

BONUS: BYTE Guide to Apple PCs

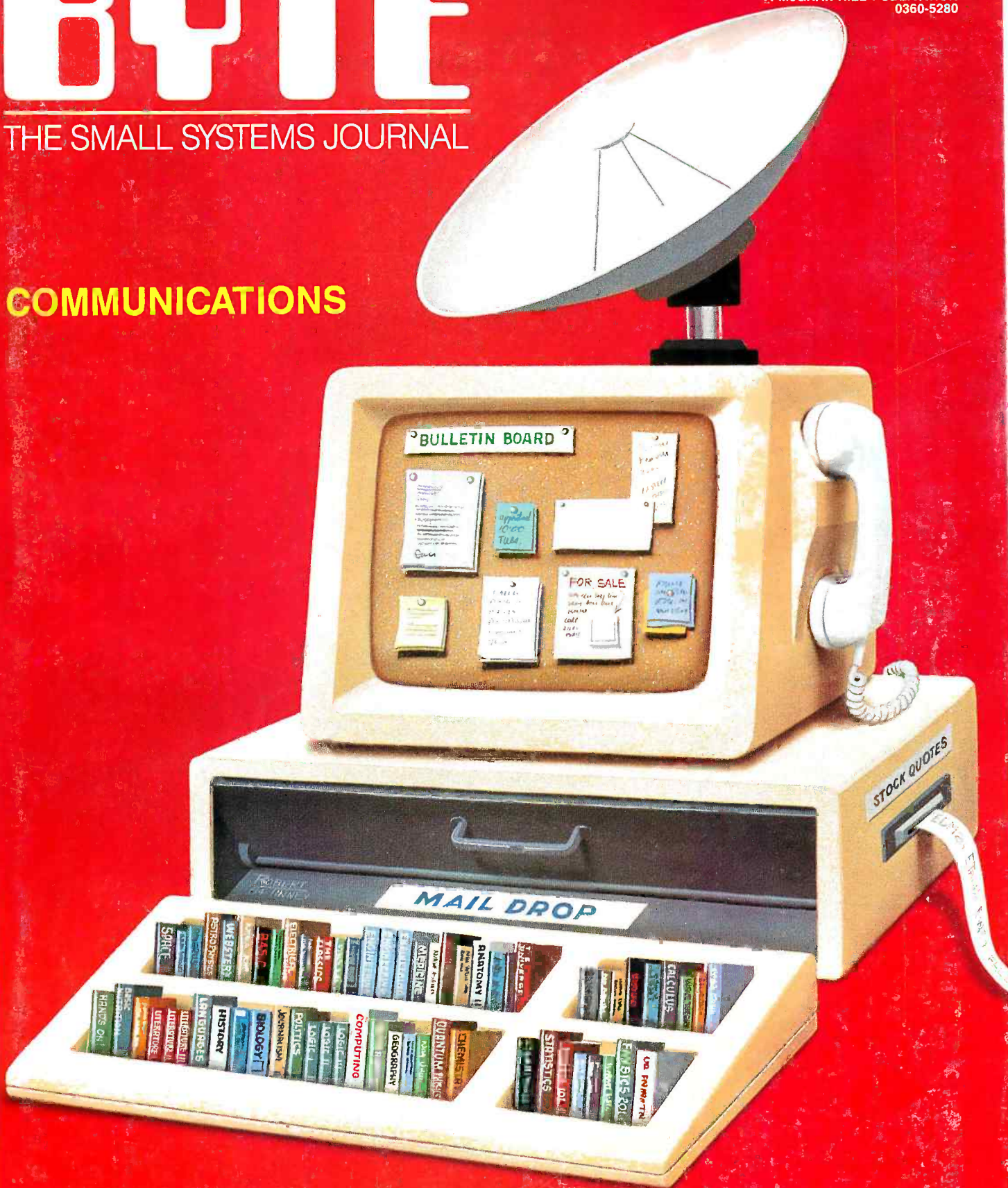
BYTE

THE SMALL SYSTEMS JOURNAL

DECEMBER 1984 VOL. 9, NO. 13

\$3.50 IN UNITED STATES
\$4.95 in CANADA / £2.10 in U.K.
A MCGRAW-HILL PUBLICATION
0360-5280

COMMUNICATIONS





Why every kid should ha

Today, there are more Apples in schools than any other computer.

Unfortunately, there are still more kids in schools than Apples.

So innocent youngsters (like your own) may have to fend off packs of bully nerds to get some time on a computer.

Which is why it makes good sense to buy them an Apple® IIc Personal Computer of their very own.

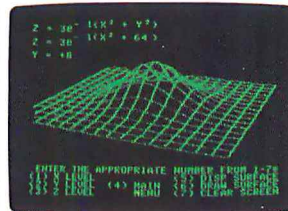
The IIc is just like the leading computer in education, the Apple IIe. Only smaller. About the size of a three-ring notebook, to be exact.

Even the price of the IIc is small — under \$1100.*

Of course, since the IIc is the legitimate offspring of the IIe, it can access the world's largest library of educational software. Everything from Stickybear Shapes™

programs in all. More than a few of which you might be interested in yourself.

For example, 3-in-1 integrated business software. Home accounting and tax



With a IIc, your kid can do something constructive after school. Like learn to write stories. Or learn to fly. Or even learn something slightly more advanced. Like multivariable calculus.

for preschoolers to SAT test preparation programs for college hopefuls.

In fact, the IIc can run over 10,000

programs. Diet and fitness programs.

Not to mention fun programs for the whole family. Like "Genetic Mapping" and



Have an Apple after school.

"Enzyme Kinetics."
 And the Apple IIc comes complete with everything you need to start computing in one box.
 Including a free 4-diskette course to teach you how — when your kids get tired of your questions.
 An RF modulator that can turn almost any TV into a monitor.
 As well as a long list of built-in features that would add about \$800 to the cost of a smaller-minded computer.
 128K of internal memory — twice

the power of the average office computer.
 A built-in disk drive that would drive up the price of a less-senior machine.
 And built-in electronics for adding accessories like a printer, a modem, an AppleMouse or an extra disk drive when the time comes.

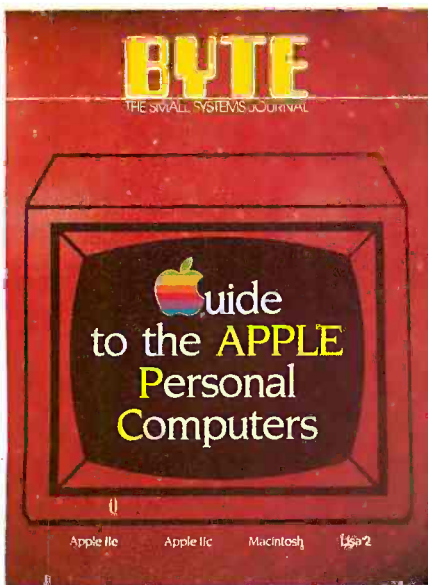


In its optional carrying case, the IIc can even run away from home.

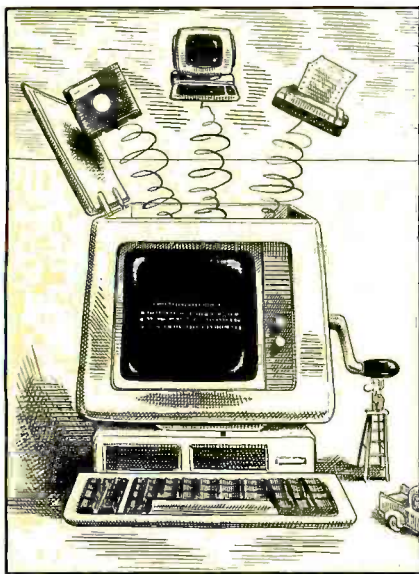
So while your children's shoe sizes and appetites continue to grow at an alarming rate, there's one thing you know can keep up with them. Their Apple IIc.
 To learn more about it, visit any authorized Apple dealer. Or talk to your own computer experts.
 As soon as they get home from school.



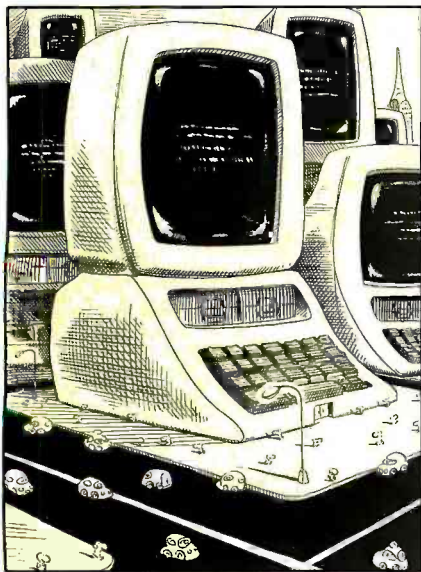
*The FTC is concerned about price-fixing. So this is only a Suggested Retail Price. You can pay more if you really want to. © 1984 Apple Computer Inc. Apple and the Apple logo are registered trademarks of Apple Computer Inc. Stickybear Shapes is a trademark of Optimim Resource. For an authorized Apple dealer nearest you call (800) 538-9696. In Canada, call (800) 268-7796 or (800) 268-7637.



The BYTE Guide to the Apple Personal Computers, a special section, begins immediately after the Reader Service page.



96



128

C·O·N·T·E·N·T·S

FEATURES

- INTRODUCTION** 96
- THE TANDY 1000** by G. Michael Vose 98
This 16-bit machine provides remarkable computing power at a surprisingly low price.
- CIARCIA'S CIRCUIT CELLAR: BUILD THE POWER I/O SYSTEM** by Steve Ciarcia . . 105
Use your computer to control ac/dc power.
- C-LANGUAGE DEVELOPMENT TOOLS** by G. Michael Vose 119
The Safe C Compiler/Profiler, the Instant-C interpreter, and the C Source Debugger are examined.
- AN INTRODUCTION TO FIBER OPTICS, PART I** by Richard S. Shuford 121
Light tamed by glass waveguides offers wide communication bandwidth.
- SOFTWARE FRAMEWORKS** by Gregg Williams 124
Software toolkits can save you programming time.

THEME: COMMUNICATIONS

- INTRODUCTION** 128
- THE EVOLUTION OF A STANDARD ETHERNET** by Edwin E. Mier 131
The technology of local networking (Ethernet-style) is well established.
- LOCAL-AREA NETWORKS FOR THE IBM PC** by J. Scott Haugdahl 147
Finding the one that best meets your needs can be quite a task.
- HIGH-SPEED DIAL-UP MODEMS** by Kim Maxwell 179
The founder of Racal-Vadic reports on the promise and peril of faster data transmission.
- WRITING COMMUNICATIONS IN BASIC** by Barry J. Arnow 187
Easy terminal emulation and file transfer can be yours to program.
- LOOKING FOR THE PERFECT PROGRAM** by David Barr and George deW. Rogers . . 199
The authors discuss criteria for selecting communications software.
- THE ON-LINE SEARCH** by Suzana Lisanti 215
Learn how to access the world's brain.

REVIEWS

- INTRODUCTION** 234
- REVIEWER'S NOTEBOOK** by Rich Malloy 237
- THE TANDY MODEL 2000** by Mark S. Jennings 239
Radio Shack's 80186-based MS-DOS computer.
- THE ZENITH Z-150 PC** by Wayne Rash Jr. 252
An IBM PC-compatible system, also available in kit form.

BYTE is published monthly by McGraw-Hill Inc. Founder: James H. McGraw (1860-1948). Executive, editorial, circulation, and advertising offices: 70 Main St., Peterborough, NH 03458, phone (603) 924-9281. Office hours: Mon-Thur 8:30 AM - 4:30 PM, Friday 8:30 AM - 1:00 PM, Eastern Time. Address subscriptions to BYTE Subscriptions, POB 590, Martinsville, NJ 08836. Postmaster: send address changes, USPS Form 3579, undeliverable copies, and fulfillment questions to BYTE Subscriptions, POB 596, Martinsville, NJ 08836. Second-class postage paid at Peterborough, NH 03458 and additional mailing offices. USPS Publication No. 528890 (ISSN 0360-5280). Postage paid at Winnipeg, Manitoba. Registration number 9321. Subscriptions are \$21 for one year, \$38 for two years, and \$55 for three years in the USA and its possessions. In Canada and Mexico, \$23 for one year, \$42 for two years, \$61 for three years. \$69 for one year air delivery to Europe, 17,100 yen for one year surface delivery to Japan, \$37 surface delivery elsewhere. Air delivery to selected areas at additional rates upon request. Single copy price is \$3.50 in the USA and its possessions, \$3.95 in Canada and Mexico, \$4.50 in Europe and \$5 elsewhere. Foreign subscriptions and sales should be remitted in United States funds drawn on a U.S. bank. Please allow six to eight weeks for delivery of first issue. Printed in the United States of America.

BYTE December

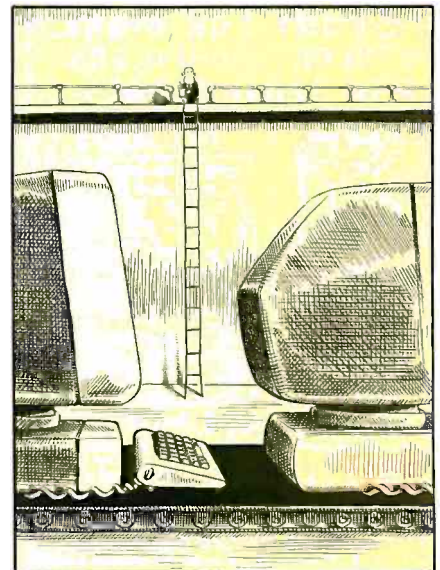
VOLUME 9, NUMBER 13, 1984

| | |
|---|-----|
| TK!SOLVER by Alan R. Miller | 263 |
| A "spreadsheet" for scientists. | |
| WORDPERFECT by Ricardo Birmele | 277 |
| A word processor for the IBM PC. | |
| THE EPSON LQ-1500 by Ken Sheldon | 293 |
| A high-resolution dot-matrix printer. | |
| REVIEW FEEDBACK | 301 |

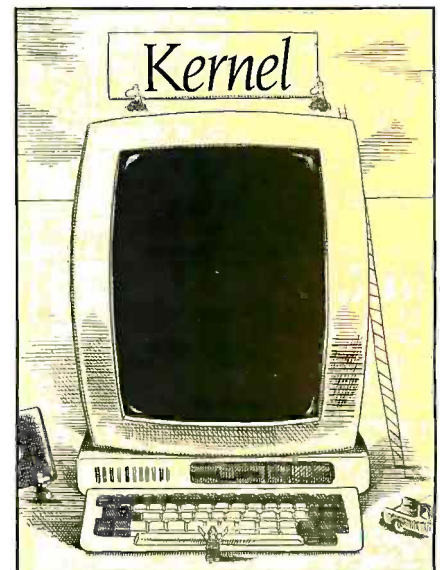
KERNEL

| | |
|---|-----|
| INTRODUCTION | 305 |
| COMPUTING AT CHAOS MANOR: HOME AGAIN by Jerry Pournelle | 307 |
| Jerry admires the HP Laserjet printer and starts a quest for a clock board while Alex Pournelle takes a look at the TI Professional Computer. | |
| CHAOS MANOR MAIL conducted by Jerry Pournelle | 335 |
| Jerry's readers write, and he replies. | |
| BYTE WEST COAST: HAPPENINGS by John Markoff and Ezra Shapiro | 343 |
| Two BYTE editors report on LAN standards, Concurrent PC-DOS, and IBM's acquisition of Rolm Corporation. | |
| BYTE U.K.: PROLOG ON MICROCOMPUTERS by Dick Pountain | 355 |
| Logical propositions replace computer-oriented instructions. | |
| BYTE JAPAN: HAND-HELD COMPUTERS AND MSX STANDARDS by William M. Raike | 365 |
| Hand-helds, the Big.APL portable, and MSX computer standards are in the news. | |
| CIRCUIT CELLAR FEEDBACK conducted by Steve Ciarcia | 375 |
| Steve answers project-related queries from readers. | |

| | | | |
|---|---------|---|-----|
| EDITORIAL: LOOKING BACK: 1984 | 6 | APPLICATION NOTE | 411 |
| MICROBYTES | 9 | BOOKS RECEIVED | 416 |
| LETTERS | 14 | UNCLASSIFIED ADS | 491 |
| FIXES AND UPDATES | 33 | BYTE'S ONGOING MONITOR BOX, BOMB RESULTS | 494 |
| WHAT'S NEW | 39, 432 | READER SERVICE | 495 |
| ASK BYTE | 48 | | |
| CLUBS & NEWSLETTERS | 59 | | |
| BOOK REVIEWS | 65 | | |
| EVENT QUEUE | 83 | | |



234

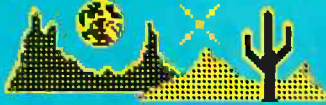


305

Address all editorial correspondence to the Editor, BYTE, POB 372, Hancock, NH 03449. Unacceptable manuscripts will be returned if accompanied by sufficient first-class postage. Not responsible for lost manuscripts or photos. Opinions expressed by the authors are not necessarily those of BYTE. Copyright © 1984 by McGraw-Hill Inc. All rights reserved. Trademark registered in the United States Patent and Trademark Office. Where necessary, permission is granted by the copyright owner for libraries and others registered with the Copyright Clearance Center (CCC) to photocopy any article herein for the flat fee of \$1.50 per copy of the article or any part thereof. Correspondence and payment should be sent directly to the CCC, 29 Congress St., Salem, MA 01970. Specify ISSN 0360-5280/83. \$1.50. Copying done for other than personal or internal reference use without the permission of McGraw-Hill Inc. is prohibited. Requests for special permission or bulk orders should be addressed to the publisher, BYTE is available in microform from University Microfilms International, 300 North Zeeb Rd., Dept. PR, Ann Arbor, MI 48106 or 18 Bedford Row, Dept. PR, London WC1R 4EJ England. Subscription questions or problems should be addressed to: BYTE Subscriber Service, POB 328, Hancock, NH 03449



MicroTime



800-MICRO 84

PC-150

ZENITH

THE BEST IBM®
COMPATIBLE

ZENITH
FREE
SERVICE



**FREE
SERVICE**
BY ZENITH
FOR 90 DAYS

PC-160

**WE SPECIALIZE IN
SYSTEM SALES AND
CAN PROVIDE BOTH
HARD AND SOFTWARE
SUPPORT FOR MOST
POPULAR COMPUTERS
AND PERIPHERALS**



**IBM
BEST
PRICES**

**ALL
MODELS
FAST
DELIVERY**

MS-DOS



**EPSON
PRINTERS
LOWEST
PRICES
ALL
MODELS**

IOMEGA



**BERNOULLI
10-20 MEG**



COMPAQ

**COLUMBIA
FRANKLIN
EAGLE**



ADD-ONS



**DIABLO
PRINTER
SPECIALS**

800-642-7684
IN ARIZONA 602-791-9030

IBM is a registered trademark of International Business Machines, Corp.

411 West Grant Road
Tucson, Arizona 85705



BYTE

EDITOR IN CHIEF

PHILIP LEMMONS
MANAGING EDITOR

GENE SMARTE
CONSULTING EDITORS
STEVE CIARCIA
JERRY POURNELLE

SENIOR TECHNICAL EDITORS
G. MICHAEL VOSE, *Themes*
GREGG WILLIAMS

TECHNICAL EDITORS
THOMAS R. CLUNE
JON R. EDWARDS
GLENN HARTWIG, *Reviews*
RICHARD KRAIEWSKI
KEN SHELDON
RICHARD S. SHUFORD
JANE MORRILL TAZELAAR
STANLEY WSZOLA

MARGARET COOK GURNEY, *Associate*
ALAN EASTON, *Drafting*
WEST COAST EDITORS

EZRA SHAPIRO, *Bureau Chief, San Francisco*
JOHN MARKOFF, *Senior Technical Editor, Palo Alto*
PHILLIP ROBINSON, *Senior Technical Editor, Palo Alto*
DONNA OSGOOD, *Associate Editor, San Francisco*
BRENDA McLAUGHLIN, *Editorial Assistant, San Francisco*

NEW YORK EDITOR
RICHARD MALLOY, *Senior Technical Editor*
MANAGING EDITOR, USER NEWS
GEORGE BOND

USER NEWS EDITORS
ANTHONY J. LOCKWOOD, *What's New*
MARK WELCH, *Microbytes*

CONTRIBUTING EDITORS
DENNIS ALLISON, *at large*
MARK DAHME, *video, operating systems*
RIK JADRNICKE, *CAD, graphics, spreadsheets*
MARK KLEIN, *communications*
ALAN MILLER, *languages and engineering*
JOHN C. NASH, *scientific computing*
DICK POUNTAIN, *U.K.*
WILLIAM M. RAIKE, *Japan*
PERRY SAIDMAN, *computers and law*
ROBERT STERNE, *computers and law*
BRUCE WEBSTER, *software*

COPY EDITORS
BUD SADLER, *Chief*
DENNIS BARKER
ELIZABETH COOPER
ANNE L. FISCHER
NANCY HAYES
LYNNE M. NADEAU
PAULA NOONAN
JOAN V. ROY
WARREN WILLIAMSON

ASSISTANTS
PEGGY DUNHAM
MARTHA HICKS
BEVERLY JACKSON
FAITH KLUNTZ, *Copyrights and Permissions*
LISA JO STEINER

ART
ROSSLYN A. FRICK, *Art Director*
NANCY RICE, *Assistant Art Director*

PRODUCTION
DAVID R. ANDERSON, *Associate Director*
DENISE CHARTRAND
MICHAEL J. LONSKY
JAN MULLER
SHERRY MCCARTHY, *Chief Typographer*
NAN FORNAL
LEN LORETTE
LEILA MATTSON
DONNA SWEENEY

Editorial and Business Office: 70 Main Street, Peterborough, New Hampshire 03458. (603) 924-9281.
West Coast Offices: McGraw-Hill, 425 Battery St., San Francisco, CA 94111. (415) 362-4600.
McGraw-Hill, 1000 Elwell Court, Palo Alto, CA 94303. (415) 964-0624
New York Office: 1221 Avenue of the Americas, New York, NY 10020. (212) 512-2000.

Officers of McGraw-Hill Publications Company: President: John G. Wrede, Executive Vice Presidents: Paul F. McPherson, Operations; Walter D. Serwalka, Finance & Services; Senior Vice President-Editorial: Ralph R. Schulz; Senior Vice President Publishers: Harry L. Brown, David J. McGrath, James R. Pierce; Gene W. Simpson, John E. Slater; Vice President Publishers: Charlton H. Calhoun III, Richard H. Larsen, John W. Patten; Vice Presidents: Kemp Anderson, Business Systems Development; Shel F. Ahen, Manufacturing; Peter I. Balestero, Human Resources; John A. Bunyan, Electronic Information Services; George R. Eisinger, Circulation; Michael K. Hehr, Controller; Eric B. Herr, Planning and Development; H. John Sweger, Jr., Marketing.

Officers of the Corporation: Harold W. McGraw Jr., Chairman; Joseph L. Dionne, President and Chief Executive Officer; Robert N. Landes, Senior Vice President and Secretary; Ralph J. Webb, Treasurer.

PUBLISHER

GENE W. SIMPSON
ASSOCIATE PUBLISHER/PRODUCTION DIRECTOR
JOHN E. HAYES
PUBLISHER'S ASSISTANT
DORIS R. GAMBLE

ADVERTISING SALES

J. PETER HUESTIS, *Sales Manager*
SANDRA FOSTER, *Administrative Assistant*

ADVERTISING

DEBORAH PORTER, *Supervisor*
MARION CARLSON
KAREN CHILLEY
LYDA CLARK
ROB HANNINGS
LISA WOZMAK
WAI CHIU LI, *Quality Control Manager*
LINDA J. SWEENEY, *Advertising/Production Coordinator*
JULIE NELSON, *Advertising/Production Coordinator*

CIRCULATION

GREGORY SPITZFADEN, *Director*
ANDREW JACKSON, *Subscriptions Manager*
CATHY A. R. DREW, *Assistant Manager*
SUSAN BOYD
PHIL DECHERT
MARY EMERSON
LOUISE MENEGUS
AGNES E. PERRY
JENNIFER PRICE
JAMES BINGHAM, *Single-Copy Sales Manager*
LINDA TURNER, *Assistant Manager*
CAROL AHO
CLAUDETTE CARSWELL
EDSON WARE

MARKETING COMMUNICATIONS

HORACE T. HOWLAND, *Director*
VICKI REYNOLDS, *Marketing Associate*
PRISCILLA ARNOLD, *Subscriptions Assistant*
STEPHANIE WARNECKY, *Graphic Arts Supervisor*
SHARON PRICE, *Graphic Arts Designer*
DOUG WEBSTER, *Director of Public Relations*
WILBUR S. WATSON, *Operations Manager, Exhibits*
MICHELE P. VERVILLE, *Research Manager*
PATRICIA AKERLEY, *Market Research Analyst*
CYNTHIA DAMATO SANDS, *Reader Service Coordinator*

ACCOUNTING

DANIEL RODRIGUES, *Business Manager/Controller*
KENNETH A. KING, *Assistant Controller*
MARILYN HAIGH
DIANE HENRY
VERN ROCKWELL
LINDA SHORT, *D/P Manager*
JOANN WALTER
VICKI WESTON, *Accounting Manager*

TRAFFIC

ANTHONY BENNETT, *Manager*
BRIAN HIGGINS

RECEPTIONISTS

L. RYAN MCCOMBS
DENISE A. PROCTOR

PERSONNEL

CHERYL A. HURD, *Office Manager*
PATRICIA BURKE, *Personnel Coordinator*

BYTE BUSINESS PHONES

GENE SIMPSON, 603-924-9957
PETE HUESTIS, 603-924-6137
HORACE HOWLAND, 603-924-3424
DOUG WEBSTER, 603-924-9027
BRAD BROWNE, 603-924-6616
DEBBIE PORTER, 603-924-6448
CIRCULATION, 800-258-5485

CROMEMCO COMPUTERS: DESIGNED TO MAKE UNIX SYSTEM V EVEN BETTER...

UNIX System V, the new standard in multiuser microcomputer operating systems, gives you high performance features along with the portability and flexibility of a standard.

Cromemco computers can make UNIX System V even better. Because our systems are designed with UNIX in mind. First of all, we offer UNIX System V with Berkeley enhancements. Then, our hardware uses advanced features like 64K of on-board cache memory and our high speed STDC controller to speed up disk operations—very important with UNIX.

More capability and expandability

We have a high-speed, 68000-based CPU that runs at 10 MHz, coupled with a memory manager that uses demand-paging and scatter loading to work *with* UNIX, not for it.

We provide room for expanding RAM to 16 megabytes—with error detection and correction—for running even the most sophisticated and advanced microcomputer programs. And the power to accommodate up to 16 users—all with plenty of memory.

But we give you even more.

A complete solution

We give you a choice in systems: the System 100 series, expandable up to 4 megabytes of RAM, and the System 300 series, expandable to 16 megabytes. A high speed 50 megabyte hard disk drive is standard on the systems. And you can expand the hard disk capacity up to 1200 megabytes using standard SMD drives. You can add floating point processing. High resolution graphics. Video digitizing and imaging. Communications through standard

protocols. Mainframe interface.

And software support is here to meet your needs. We offer major programming languages, database management systems, communications software, including SNA architecture, X.25 protocol, and Ethernet; even a program to interface to an IBM PC if you need to. And, of course, access to the broad range of standard UNIX applications programs that is growing dramatically every day.

Easy to use.

We also make our systems easier to use, because we install the operating system before we ship your computer. No complicated installation procedures. And the Berkeley enhancements give you the standard UNIX System V operating system, but with the added convenience of these widely acclaimed improvements.

Cromemco's System 100 and System 300 computers: designed to be the highest performance UNIX systems available anywhere.

Just call or visit one of our UNIX System V Official System Centers to see for yourself. They'll also give you a copy of our new publication, "What you should know before you buy a UNIX system." Or contact us directly.

We'll be glad to show you how to get a better UNIX system.

Corporate Headquarters: Cromemco, Inc., 280 Bernardo Avenue, P.O. Box 7400, Mountain View, CA 94039. (415) 969-4710. In Europe: Cromemco GmbH, 6236 Eschborn 1, Frankfurter Str. 33-35, P.O. 5267, Frankfurt Main, West Germany.



UNIX is a trademark of Bell Laboratories.
IBM is a trademark of International Business Machines Corp.

Circle 98 on inquiry card.

Cromemco[®]

DECEMBER 1984 • BYTE 5

LOOKING BACK: 1984

To hear some people tell it, the world of personal computing slowed down this year. The best way to correct that impression is to list a few of the more significant developments covered in BYTE in 1984.

COMPUTERS: There was an abundance of impressive new machines: the Macintosh; the IBM PCjr and PC AT; the Hewlett-Packard 150 and Portable; the Tandy 2000, 1200, and 1000; the Mindset; the Data General/One; the Apple IIc; the AT&T PC; the Compaq Deskpro; the Stride Micro 400 series; the TeleVideo Personal Mini and Color PC; the CompuPro 10; the Corona Mega PC; the Tektronix 4404 Artificial Intelligence System; the ITT Xtra; the NEC APC III; Seiko's wristwatch computer; and lots of 68000-based supermicros and IBM PC clones based on the 8088 or 80186 microprocessor.

SOFTWARE: Versions of UNIX and Pick for personal computers blossomed. ProDOS conquered the Apple II world. MS-DOS 3.0 arrived, and all or some of Concurrent CP/M, Concurrent DOS, and Concurrent PC-DOS may have arrived. Among languages, there were several new BASICs and Cs, Gold Hill's GCLISP, microPROLOG, various versions of Modula-2, and one of the biggest bargains in the history of personal computing, Borland's Turbo Pascal. Artificial-intelligence products gained a foothold on personal computers: Teknowledge's M.I., General Research's TIMM expert system, ExpertEase, and Level 5 Research's Insight Knowledge System (a mere \$95, and it looks quite interesting).



Environments for applications software sprang up all over the place, including IBM's own TopView and Digital Research's GEM. Thinking aids such as ThinkTank and MaxThink showed that they are of real value to personal computer users. There were friendly databases such as Infoscope, Please, 4-1-1, and Fast Facts. The long-awaited dBASE III came out, as did a major competitor, R:base 4000, and query systems such as CLOUT and In-Search. There were integrated software packages such as Symphony, Framework, and DayFlo.

Tom Jennings's Fido bulletin board and FidoNet communications system did a lot of good for a lot of people.

ASSORTED HARDWARE: Perhaps the story with the greatest impact was the decline in the price of 1200-bps modems, which gave telecommunications a boost. CMOS spread far and wide, making many machines small and cool. LCDs moved up to 25 lines by 80 columns, RAMs jumped to 256K bits, microprocessors stepped up to 32 bits, and mice became commonplace. A host of special graphics chips reached the market.

Developments in mass storage in-

cluded inexpensive optical storage devices, such as the first personal computer products based on compact audio disks, high-capacity mini hard disks, abundant microfloppies, 10-megabyte floppies, and bubble-memory cards and peripherals. In printer technology, we saw advances in dot-matrix, thermal-transfer, ink-jet, and laser printers. The HP LaserJet and its Canon mechanism brought the price of laser-printer technology down to \$3500.

TI's natural-language interface, NaturalLink, gave hints of things to come.

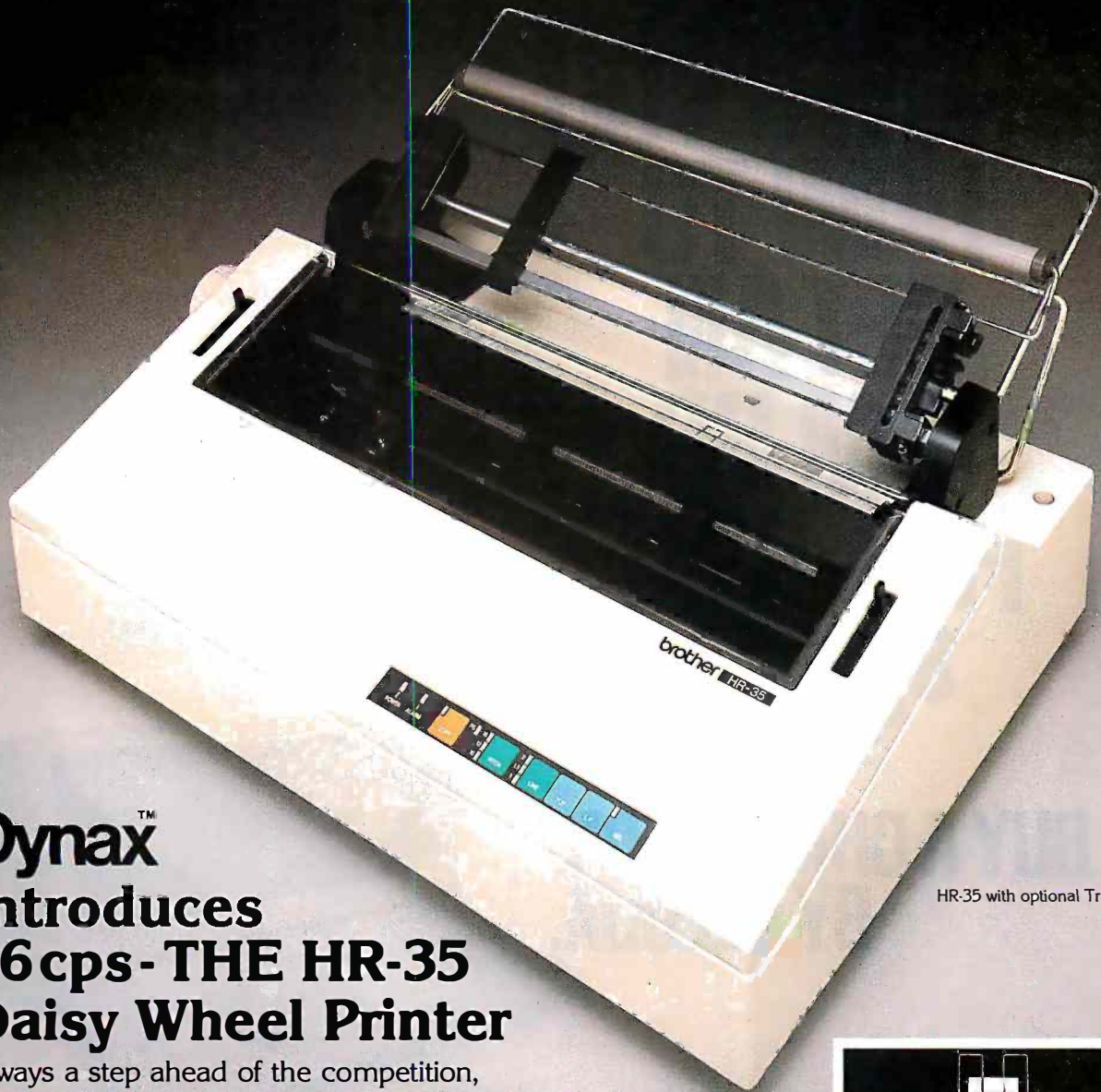
Steve Ciarcia, as usual, was a one-man industry. He gave us the schematics and explained the technology for a smart terminal, a Z8000 system that resides in an IBM PC, a scrolling alphanumeric LED display, a phonetic speech synthesizer, a musical telephone bell, an AC power monitor, an AC power controller, a sonar range finder, and a speech-recognition system.

The shakeout saddens us all. Some talented people are temporarily out of work, and some impressive new products have failed in the marketplace. But the personal computing industry makes relentless progress despite the varied fortunes of its constituents. It is no longer a rumor that Commodore will market the impressive 68000-based machine developed by Amiga. By this issue's cover date, the rumor that Atari will market the Mindset may have been confirmed. These two developments could bring impressive and powerful hardware to millions at low cost.

Be of good cheer.

—Phil Lemmons, Editor in Chief

FRONTRUNNER



DynaxTM introduces 36 cps - THE HR-35 Daisy Wheel Printer

Always a step ahead of the competition, the HR-35, with letter-quality print speed of 36cps, offers the best price/performance ratio in its class. Add the optional Tractor Feeder and Auto Cut Sheet Feeder and you have the best value on the world market today.

Dynax has always been the frontrunner. The HR-35 is the frontrunner. And it's backed by the Dynax reputation for quality and service response.

We're Confident!

HR-35 with optional Tractor Feeder



HR-35 with optional Auto Cut Sheet Feeder

Distributed by

Dynax, Inc.TM

Circle 135 on inquiry card.

Manufactured by

brother

BROTHER INDUSTRIES, LTD.
NAGOYA, JAPAN

DYNAX, INC. OFFICES

- HEADQUARTERS 6070 Rickenbacker Rd., Commerce, CA 90040 • (213) 727-1227
- NEW JERSEY One Madison St., East Rutherford, NJ 07073 • (201) 471-0100
- TEXAS 6012 Campus Circle, Suite 250, Irving, TX 75062 • (214) 257-1700

- ILLINOIS 533 West Golf Rd., Arlington Heights, IL 60005 • (312) 228-0707
- MASSACHUSETTS 400 W. Cummings Park, Suite 5300, Woburn, MA 01801 • (617) 933-8162
- N. CALIFORNIA 1255 Oakmead Parkway, Sunnyvale, CA 94086 • (408) 730-1712

SEEQUA SHOWS YOU HOW TO GET AN IBM PC FOR JUST \$1595.

BUY A CHAMELEON BY SEEQUA.



The Chameleon by Seequa does everything an IBM PC does. For about \$1000 less than an IBM.

The Chameleon lets you run popular IBM software like Lotus® 1-2-3™ and dBase II.® It has a full 83 key keyboard just like an IBM. A disk drive like the IBM. And a bright 80 × 25 character screen just like an IBM.

But it's not just the Chameleon's similarities to the IBM that should interest you. Its advantages should, too. The Chameleon also has

an 8 bit micro-processor that lets you run any of the thousands of CP/M-80® programs available. It comes complete with two of the best programs around, Perfect Writer™ and Perfect Calc.™ It's portable. And you can plug it in and start computing the moment you unwrap it.

So if you've been interested in an IBM personal computer, now you know where you can get one for \$1595. Wherever they sell Chameleons.

The Chameleon by



**SEEQUA
COMPUTER
CORPORATION**

8305 Telegraph Road
Odenton, MD 21113

Chameleon shown with optional second disk drive.

To learn more about Seequa or for the location of the Seequa dealer nearest you, call (800) 638-6066 or (301) 672-3600.

IBM is a registered trademark of International Business Machines Corporation.

Sanyo's Graphics Card for 550, Portable Color Computer

Sanyo, Moonachie, NJ, announced a \$199 graphics card for its MBC-550 computer, enabling it to run programs that directly address IBM PC graphics screens, including the Lotus 1-2-3 spreadsheet. Bundled with the card are GW-BASIC and MS-DOS 2.1.

The company also announced an IBM-compatible portable computer with a built-in color display. The MBC-775 includes two 360K-byte 5¼-inch disk drives, two full-length IBM-compatible expansion slots, a parallel printer port, and RGB and composite video outputs. It should be available in January for \$2599.

Integrated Program Has Slide-Show Feature

Xanaro Technologies Inc., Toronto, Ontario, has unveiled Ability, a \$495 integrated software program featuring a spreadsheet, word processing, a free-form database, graphics, and communications functions. Also included is Presentation!, which combines words, graphs, numbers, and music in a slide-show format. The program's user interface avoids use of MS-DOS commands, using a menu format instead. Text, spreadsheet, and graphics data can be intermixed on the screen.

Microsoft Delays Windows to Mid-1985

Microsoft announced in October that its Windows multitasking graphics operating environment would be delayed until at least June 1985. Windows was originally announced in November 1983 (see the December 1983 BYTE, page 48) and had been scheduled for release last month to manufacturers, who were to customize it for their machines.

Since Windows was announced, both IBM and Digital Research have introduced multitasking, windowing graphics environments. IBM announced TopView, which was released to software developers in September and is scheduled for general release in early 1985 with a price tag of \$149. In October, Digital Research began shipping its \$295 Concurrent PC-DOS (earlier called Concurrent CP/M-86 version 3.1 with PC-DOS emulation), which runs several MS-DOS programs simultaneously. Also in October, Digital Research announced its Macintosh-like Graphics Environment Manager for the IBM PC (see page 39), also planned for early 1985 release.

New Laser and Ink-jet Printers

Concept Technologies, Portland, OR, now offers the Concept Laser 8, a version of Canon's LBP-CX 8-page-per-minute laser printer. The \$7995 printer supports both Virtual Device Interface and Tektronix 4014 graphics input, as well as direct bit-mapped images or text information. Dataproducts, Woodland Hills, CA, unveiled a \$12,900 24-page-per-minute laser printer based on a Toshiba printer. The firm also announced seven new daisy-wheel and dot-matrix printers. Diconix, Dayton, OH, introduced the Dijit 1, an 18-page-per-minute ink-jet printer with a resolution of 300 by 300 dots per inch. The printer is available to other manufacturers for \$5000 to \$7500.

Computer Crime Bill Passes

A federal computer crime bill was included in the continuing resolution signed into law in October. Those who access classified information using a computer could be convicted of an additional felony. Other offenses are misdemeanors, including unauthorized access of a federal government computer or of data protected by the Fair Credit Reporting or Financial Privacy acts. Penalties include up to one year in prison and fines of up to \$5000 or twice the value obtained or loss created by the offense.

(continued)

Compact Disc Used for Data Storage

North American Philips Corporation has sold compact disc-mastering equipment to 3M, which will manufacture discs for use as data storage for computers. NAPC's Philips Subsystems and Peripherals Inc. division also announced that it will offer its CM 100 Compact Disc Read-Only-Memory (CD ROM) unit to other manufacturers. The CD ROM is similar to existing compact disc players from Philips, but it has enhanced error-checking and -correction features. Philips would not detail pricing but said OEMs would pay less than \$1000 for the complete drives; 3M said the 550-megabyte compact discs could be manufactured for less than \$10 each.

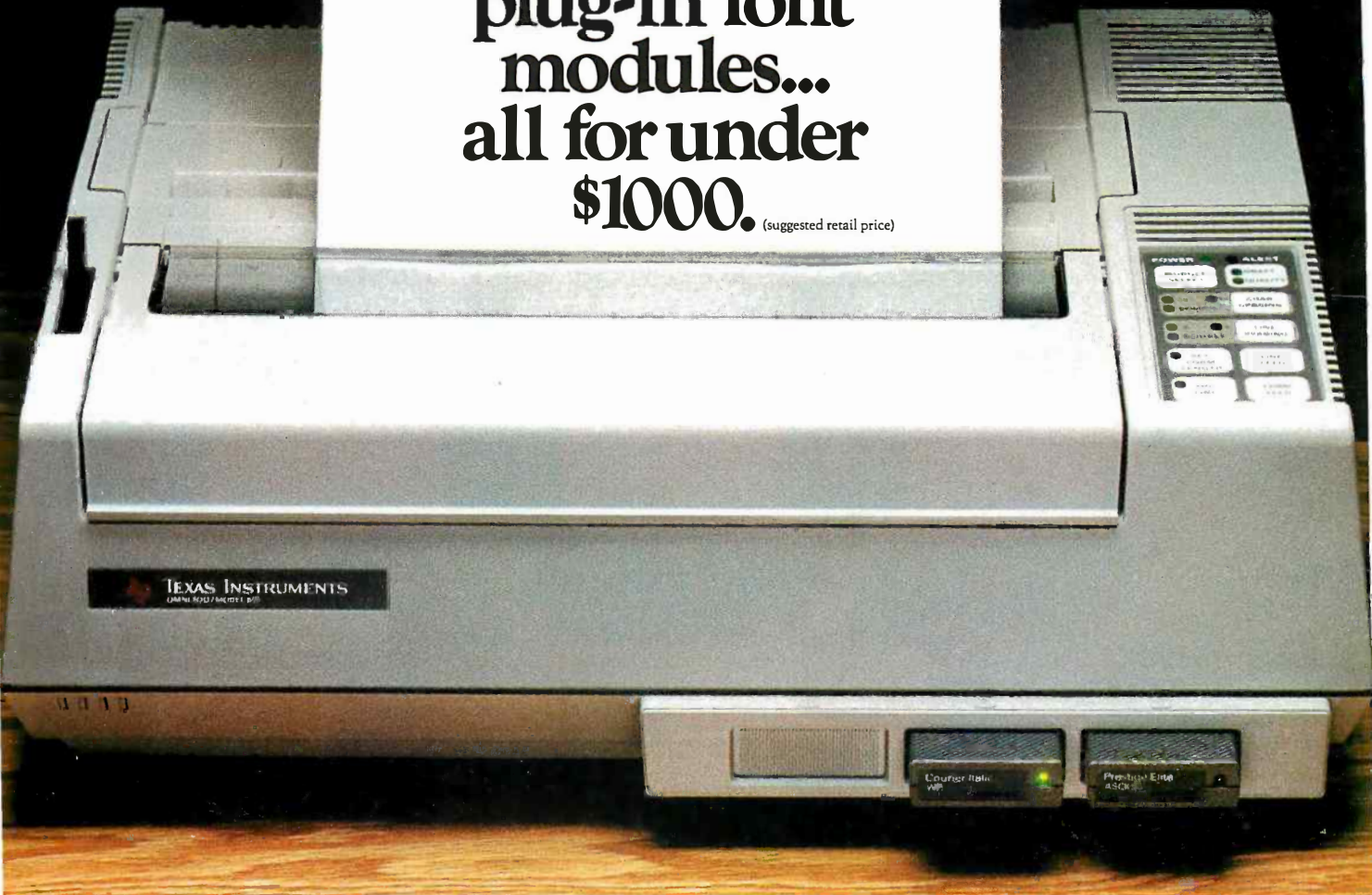
Datcopy Unveils \$4000 OCR/Digitizing System

Datcopy, Mountain View, CA, announced a \$4000 version of its Word Image Processing System. The Model 700 includes a flatbed scanner and software; previous versions, priced from \$9000, used a different type of scanner. The system can digitize images as well as recognize characters printed in 10-point Courier or 12-point Prestige Elite type; other fonts are planned.

NANOBYTES

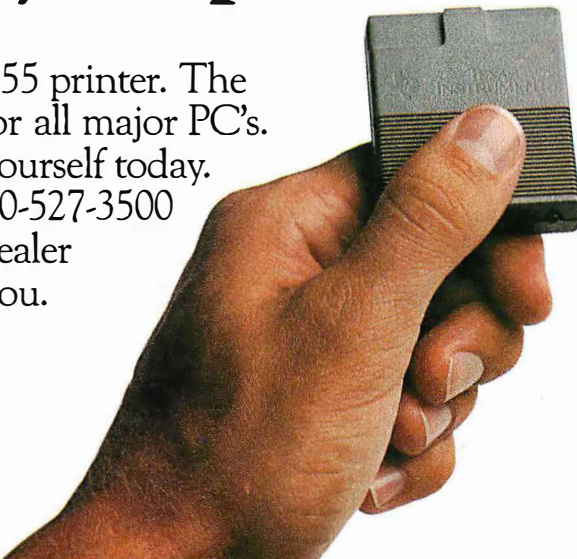
Kodak announced a line of "Instagraphic" products to create color slides of computer screens; the products will directly compete with Polaroid's Palette system. . . . **Brown Disc** announced a new lighter-weight, lower-cost plastic rigid disk to replace the aluminum medium now used in 5¼-inch hard-disk drives. . . . **Verbex**, Bedford, MA, announced the Series 4000 Voice Recognizer, a continuous speech-recognition system priced at \$4900. Matching Voice Planner software for MS-DOS computers costs \$500. Each person uses a different CMOS memory voice cartridge, which is plugged into the Voice Recognizer unit. . . . **Texas Instruments** introduced Explorer, a LISP-based artificial-intelligence workstation priced from \$52,500. . . . **IBM** introduced a Chinese-language version of its 5550 Japanese personal computer; it will also sell the IBM PC and PC XT in China. . . . **Datapoint** announced products that would link IBM PCs to its ARC local-area network. . . . **Zilog** has added ROM-less versions of its low-power Z8 microprocessors. . . . **Videotex Systems Inc.**, Dallas, TX, now offers a complete videotex system, including a 512K-byte IBM PC, 10 terminals, two modems, and software, for \$8000. . . . **Matsushita**, one of Japan's largest manufacturers, has licensed **Drexler's LaserCard**. The LaserCard stores 2 megabytes of information on a credit-card-size optical strip. Drexler is also developing a 20-megabyte version. . . . **Zenith Data Systems** sold \$99.8 million worth of its Tempest-version Z-150 microcomputer to the Defense Department. The computers are shielded to prevent electronic eavesdroppers from decoding RF signals emitted by the machines. . . . **Mindset** announced the Mindset Video Production System, a version of its personal computer designed to mix computer graphics and standard video signals from VCRs, laserdiscs, cameras, or televisions. The system will cost \$3799. . . . **Seagate** announced new hard-disk drives at COMDEX, including a 10-megabyte 3½-inch drive, a 20-megabyte half-height 5¼-inch drive, and 20-, 30-, and 40-megabyte full-height drives with an average access time of 40 milliseconds. . . . **Extended Systems**, Boise, ID, announced LaserRight, which allows three computers to share a single Hewlett-Packard LaserJet printer. The printer and a 128K-byte buffer are included for \$4495. . . . **Tandberg Data** now offers a \$1000 quarter-inch streaming-tape drive for the IBM PC. . . . **General DataComm**, Middlebury, CT, announced a \$699 1200-bps modem that it says has a lower error rate than other 1200-bps modems. . . . **Entrepo Inc.** (formerly Exetron), Sunnyvale, CA, said it had solved reliability problems that had plagued the company's wafer-tape drives for several years and that it is ready to ship an \$85 retail version of its Quick Cassette storage system for Commodore computers. . . . **Hayes** announced a 2400-bps modem, priced at \$899. The modem also supports 1200-, 600-, and 300-bps communications. . . . **IBM** is reportedly talking to Toshiba and other Japanese companies about purchasing a large quantity of 3½-inch disk drives.

**The TI 855 is
the only printer
with letter quality,
draft speed,
graphics,
plug-in font
modules...
all for under
\$1000.** (suggested retail price)



Finally, the printer for all PC needs.

The TI 855 printer. The printer for all major PC's. See for yourself today. Call 1-800-527-3500 for the dealer nearest you.




**TEXAS
INSTRUMENTS**
Creating useful products
and services for you.

dBASE III

TM



More power to you.

Remember the magic you expected when you first purchased a PC?

It's here.

dBASE III™ is the most powerful database management system ever created for 16-bit microcomputers. It pulls every ounce of energy out of your PC and puts it to work.

On top of that, it's fast and it's easy.

You've never seen anything like it.

dBASE III can handle over a billion records per file, limited only by your computer system. You can have up to ten files open, for sophisticated applications programs.

When you have two related files, information in one can be accessed based upon data in the other.

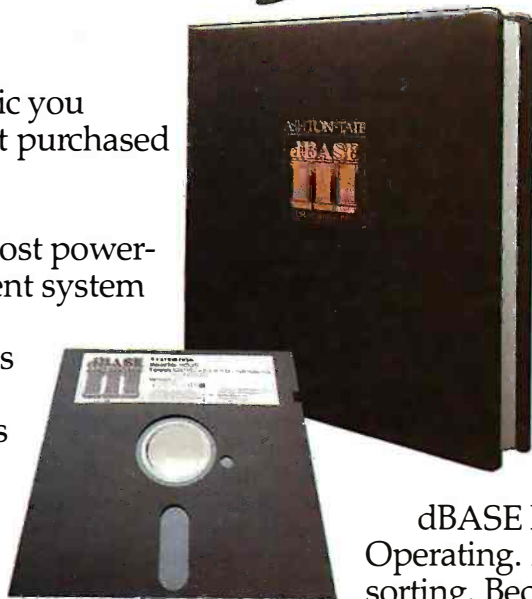
dBASE III now handles procedures, parameter passing and automatic variables. You can include up to 32 procedures in a single file. With lightning speed. Because once a file is opened, it stays open. And procedures are accessed directly.

Easier than ever.

dBASE III uses powerful yet simple commands that are the next best thing to speaking English.

If you're unsure of a command, HELP will tell you what to ask for.

If you don't know what command comes next, a command assistant does. All



you have to know is what you want it to do.

Our new tutorial/manual will have you entering and viewing data in minutes rather than reading for hours.

And to make matters easier, you get a full screen report setup for simple information access.

Faster than no time at all.

dBASE III isn't just fast. It's ultra-fast. Operating. And sorting. Even faster, is no sorting. Because dBASE III keeps your records in order, so you really don't have to sort anything. Unless you want to. Then watch out!

What about dBASE II®?

It's still the world's best database management system for 8-bit computers. And it's still the industry standard for accounting, educational, scientific, financial, business and personal applications.

Tap into our power.

For the name of your nearest authorized dBASE III dealer, contact Ashton-Tate, 10150 West Jefferson Boulevard, Culver City, CA 90230. (800) 437-4329, ext. 333. In Colorado, (303) 799-4900.

ASHTON · TATE 

© Ashton-Tate 1984. All rights reserved. dBASE III and Ashton-Tate are trademarks and dBASE II is a registered trademark of Ashton-Tate.

CHOOSING A LANGUAGE FOR STUDENTS

I am writing in regard to Fred A. Masterson's article "Languages for Students" (June, page 233). Has COMAL (Common Algorithmic Language) not yet surfaced in the United States? Here in Europe this language is the subject of growing interest among educators. It is the favored language for use in schools in Denmark, Sweden, Norway, and Ireland, and it is gathering momentum in many other countries. COMAL combines the ease of use of BASIC with the control structures of a Pascal-type language. It was first developed by a Danish educator, Borge Christensen, in the mid-1970s as a respectable "front end" to a very poor BASIC. Sophisticated COMAL interpreters are now available on a wide range of microcomputers as well as minicomputers and mainframes. The portability of the language is maintained through an international COMAL Standardization Committee, which meets at least twice a year.

What is so special about COMAL? Let's look at Mr. Masterson's four language requirements:

- *Simplicity*: COMAL's simple and coherent user interface, with interactive error messages and structure checking, retains the best features of BASIC. "Spaghetti" code is eliminated through the consistent use of block-structured statements. Not only is COMAL simply to learn, it is also easy to progress from it to other high-level languages—the beginner already has a grasp of *structure*, which BASIC often ignores or, in many cases, inhibits.
- *Power*: COMAL is a powerful language, providing the user with named procedures, parameter passing by value or reference, local and global variables, and a range of built-in functions. This allows for modular development, use of recursion, and other powerful techniques in software *development*. On the other hand, COMAL is a procedural language with limited data types and structures (int, real, string, and arrays). It is not intended to compete with functional languages such as LISP. COMAL's use of closed procedures allows

it to be easily customized to the needs of a particular application. Complex routines can be encapsulated in closed procedures in a way that is impossible in BASIC. These routines can then be invoked by name without any danger of ambiguity in the use of variable names. This allows the COMAL language to be effectively extended *by the user* for CAI, business, technical, and other applications.

- *Compatibility*: From its vantage point astride the pillars of BASIC and Pascal, COMAL prepares the novice well for a variety of future computer experiences. Its interactive nature provides a prelude for the user interfaces of most modern commercial packages; its structured flow of control prepares the student for learning more advanced languages such as C, Pascal, or Ada. In a more specific sense, the source-code compatibility that COMAL allows between a growing number of microcomputers, minicomputers, and mainframes is far in advance of most other languages.

- *Cognitive richness*: Mr. Masterson reserves this term to describe languages that process entire data structures such as arrays and lists. Such languages are indeed a "delightful surprise" to students who are used to "one thing at a time" languages. By the same token, COMAL comes as a delightful surprise to educators who have sought in vain for a language that displays the simplicity and elegance on which cognitive richness is actually based.

In a nutshell, COMAL is the answer to Mr. Masterson's final plea for "responsive, customizable languages for CAI and personal computing." If you would like more information on this "new" (i.e., 10-year-old) language and its various implementations, contact me at the Department of Computer Science, Engineering School, Trinity College, 201 Pearse St., Dublin 2, Ireland.

RODY RYAN
Dublin, Ireland

I read with interest Fred Masterson's fine article "Languages for Students." Certainly his selection criteria for a computer language for educational use hit the mark in many ways. He is exactly right in his comments concerning the cumbersome

and slow cycle of prepare-source-file/compile-source-file/link-object-file/run, which effectively prevents experimentation, exploration, and efficient learning.

It should be noted that program developers are also students: they are students of the problem they are trying to solve, and they too greatly benefit by the quick cycle of development offered by truly interactive languages like Logo and FORTH, in which on-the-spot compilation is synergistically combined with extensibility, so that new commands can be created, tested, instantly modified and improved, and then combined with earlier commands to build larger and larger modules and, ultimately, the final program.

In defining any set of criteria, however, we all are apt to overlook those with which we have no experience. For example, the only programmers who demand extensibility in a programming language are those who have worked with an extensible language. Those who lack that experience seem to be unable to grasp the power of extensibility and how much it can help a programmer.

Similarly, Mr. Masterson fails to specify what seems to me to be an essential characteristic for a programming language for students: transparency. A programming language is transparent if its implementation mechanisms are clear to the student, so that she or he can look at the internal representation of the source code and understand how it came to be and how it works. Just as the transparent plastic models of four-cycle engines can help mechanically inclined students better grasp the theory and practice of engines, so a clear and easily understood program-

(continued)

LETTERS POLICY: To be considered for publication, a letter must be typed double-spaced on one side of the paper and must include your name and address. Comments and ideas should be expressed as clearly and concisely as possible. Listings and tables may be printed along with a letter if they are short and legible.

Because BYTE receives hundreds of letters each month, not all of them can be published. Letters will not be returned to authors. Generally, it takes four months from the time BYTE receives a letter until it is published.

WHO SAYS "YOU CAN'T TAKE IT WITH YOU"?



When we at Intertec introduced our new HeadStart™ computer we said "it's the fastest, smallest, most powerful business computer in its class."

What more could we say?

How about "it's also portable."

Every HeadStart computer comes with its own easy-carrying handle. You can choose between a full size keyboard or a special compact version that snaps easily on the front of the screen. Either way, you get all the great features that make HeadStart unique. A big twelve inch screen, eight and sixteen bit processors, upgradable to one megabyte and it's networkable up to 255 users.

We named our new business computer "HeadStart" because

that's exactly what it'll give you. And because it's also portable, you can take it anywhere.

Well, almost.

For more information call us at (803) 798-9100 or write: Intertec, Dept. "HeadStart," 2300 Broad River Road, Columbia, SC 29210.



intertec™

HeadStart Standard Features:

Size: 15.75" wide, 12.75" deep, 11.30" high.

Weight: 25 lbs.

Processors: Z80A (8 bit) and 8086 (16 bit).

Memory: 128K to 1MB depending on model. All models are expandable to 1MB.

Disk Storage: 500K to 1MB (unformatted) on a 3½" Micro-Disk. RAM disk feature emulates second system drive. Optional 3½" or 5¼" external drives.

Display: 12" (diagonal) P31 phosphor, non-glare screen. 25 lines x 80 or 132 columns.

Keyboard: Detachable with 104 total keys. A portable version snaps onto the front screen for easy transportability.

Disk Operating Software: *CP/M 80 for 8 bit. **MS DOS for 16 bit. LAN DOS for multi-user 8 or 16 bit operation.

*Concurrent CP/M 86 optional.

Interfaces: One RS 449/RS 232 compatible serial port.

One Centronics compatible parallel printer port.

External data bus. Coaxial communications interface.

External disk I/O interface. Optional network print spooling interface.

Networking: Up to 255 HeadStarts may be connected via a coaxial, multi-user network into one of 2 optional data storage systems.

Optional Data Storage Systems: Two models are available. A 10MB, 5¼" system is expandable to 20MB. A 50MB, 8" system (25MB fixed, 25MB removable) is expandable to 545MB in 165MB increments.

*CP/M 80 and Concurrent CP/M 86 are registered trademarks of Digital Research.

**MS DOS is a registered trademark of Microsoft.

Don't make a move without Compucart: "The Smart Cart!"



Everyone likes a parade ... except when it's time to move the computer to another office. Compucart has twin-wheel casters to let you move your workstation with ease. It's ergonomically engineered to adjust for the user's comfort. And, Compucart is designed to enclose and secure both hardware and software with one key. Convenience, comfort, mobility and security ... in just 4 square feet of floor space ... that's a Smart Cart!

- Holds a complete PC system
- Adjusts for hardware and user
- Controls cabling and hardware
- Rolls easily
- Locks securely with one key
- Quiets the printer
- Very affordable
- High quality materials and craftsmanship
- Cools computer hardware
- Human-factor engineered (ergonomic design)
- GSA scheduled



"The Smart Cart!"

COMPU-CART®

The first ergonomically designed computer workstation.

Products of Versa Tec Corporation

60 years of craftsmanship

CALL TOLL FREE 1-800-237-9024

P.O. Box 2095, Tampa, FL 33601-2095 • IN FLORIDA CALL (813) 251-2431

ming-language implementation can increase both the confidence and understanding of the students.

Unfortunately, most programming languages are implemented as "black boxes"—source code goes in, and some sort of machine instructions come out. Not only are the workings of the compiler a mystery, but often its product as well. Even in theory, students cannot work back from the object code to derive the source code that they provided.

FORTH, on the other hand, has a simple and effective compiler that actually resides within the language—the compiler consists of FORTH commands, and they can be extended and modified just like any other FORTH commands. In addition, the product of the FORTH compiler, the indirect threaded code, is easily grasped by students so that they can look at a representation of memory and understand what is there, how it works, and even how it came to be—how the compiler works.

As for the data structures that Mr. Masterson feels are essential, it is certainly important that students be able to manipulate these structures easily. But the students will learn the characteristics and strengths of the various data structures much better if they themselves construct the commands to create and manipulate the structures. Of course, that requires that the language be extensible. Again, the idea is to avoid handing students a completed "black box" and having them simply learn the rote manipulations. Students want understanding, which requires participation.

FORTH fits the criteria that Mr. Masterson specifies, as well as bringing its own special strength in terms of the missing criterion of transparency. I find it strange that his article failed to miss this almost ideal educational programming language.

MICHAEL HAM
Santa Cruz, CA

In his letter (July, page 16), Wendell Brown raised issues that are of concern not only to high school teachers. I am attempting to design a course about computers for law students and am seriously concerned about what—if any—programming language I should use. I suspect that the safest approach may be to introduce the students to a little bit of assembly language so that they can get an understanding of how computers actually work, with registers, stacks, program counters, etc., and then introduce them to some applications programs. The major portion of

(continued)

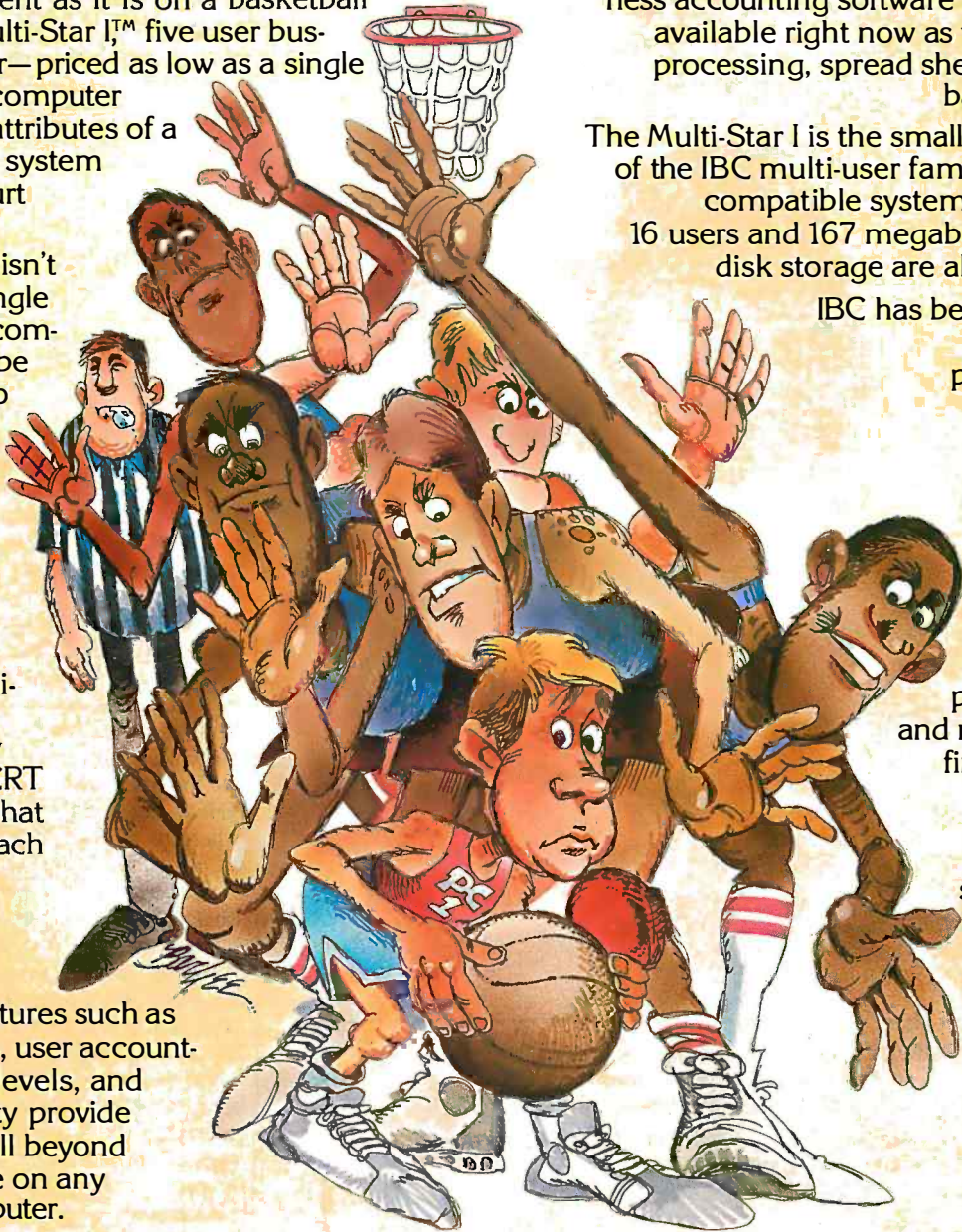
FIVE AGAINST ONE

It Hardly Seems Fair

Five against one is just as unfair in a business environment as it is on a basketball court. IBC's Multi-Star I™ five user business computer—priced as low as a single user personal computer with all of the attributes of a true multi-user system has the full court advantage.

The Multi-Star isn't just another single user personal computer that can be "Networked" to pretend you have multi-user capabilities. It is a true multi-user business system like the high priced multi-user mini-computers of old. And, a low cost "Dumb" CRT terminal is all that you need for each user.

Sophisticated multi-user software with big system features such as record locking, user accounting, privilege levels, and system security provide capabilities well beyond those available on any personal computer.



There are hundreds of multi-user business accounting software applications available right now as well as word processing, spread sheet, and data base software.

The Multi-Star I is the smallest member of the IBC multi-user family. Software compatible systems with up to 16 users and 167 megabytes of hard disk storage are also available.

IBC has been manufacturing high-performance, multi-user micro-computers since 1979.

Their reputation has been built on quality, performance, and reliability. To find out more about the multi-user business systems that is priced like a single user personal computer, please call or write:

IBC

Integrated Business Computers
21621 Nordhoff Street
Chatsworth, CA 91311
(818) 882-9007
Telex No. 215349

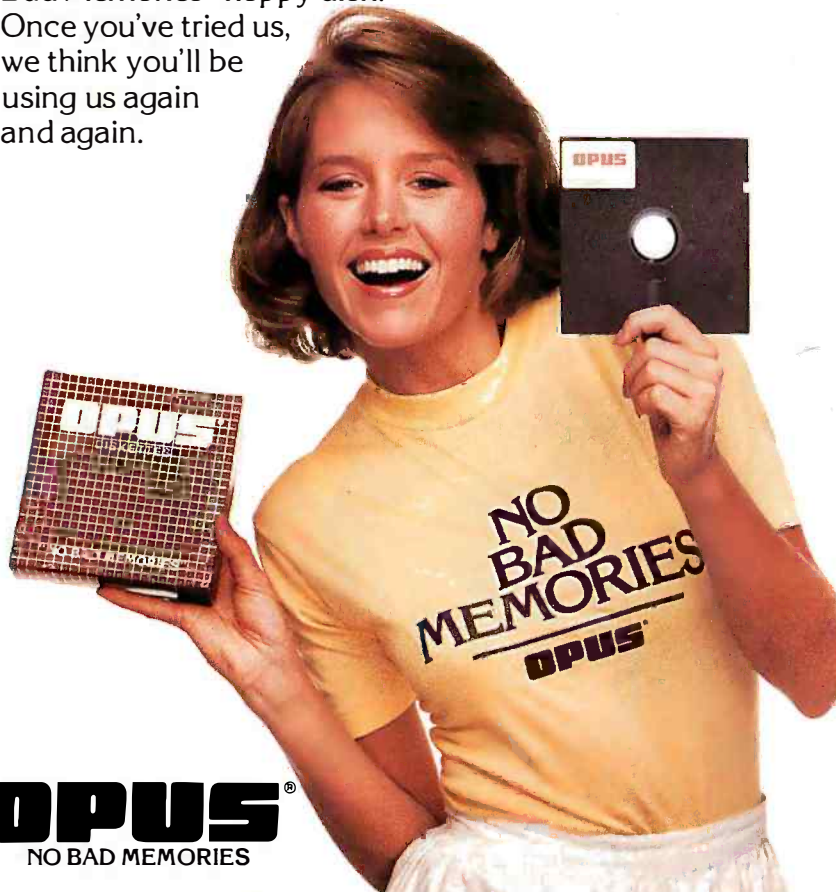
Circle 184 for Dealer inquiries. Circle 185 for End-User inquiries.

FREE UNFLOPPABLE FLOPPY

Just send us the coupon below and we'll send you one free OPUS unfloppable floppy. Plus, we'll even include a discount coupon for future purchases as well.

This is our way of getting you to try OPUS, the "No Bad Memories" floppy disk.

Once you've tried us, we think you'll be using us again and again.



OPUS[®]
NO BAD MEMORIES

SEND TO: OPUS Computer Products
Dept. BYT 1284, 150 Chicago Street
Cary, IL 60013 1-800-692-6905

B1284

PLEASE SEND ME MY FREE 5 1/4" OPUS FLOPPY. I UNDERSTAND THIS OFFER IS LIMITED TO THE FIRST 5,000 RESPONDENTS.

Name _____
Address _____
City _____ State _____ Zip _____
Phone _____
Number of floppy disks used annually _____
Brand of floppy disk most commonly used _____
Store where purchased _____
Type of computer system used _____
Home or business use _____

One free floppy per person, while they last. Facsimile coupons or copies are not redeemable.

LETTERS

such a course, with its specialized student body, could then be concerned with larger issues that are neither machine- nor language-dependent.

But if I take that approach I foresee a large problem because many students will already have had diverse experiences in programming. I am particularly worried about how to deal with students who are experts at writing "spaghetti" code in some version of BASIC. Perhaps the solution lies in introducing them to some language such as Prolog, in which the idea of a GOTO statement doesn't make any sense. In elementary and high schools the same result might be accomplished (although I am not sure because I don't know the language) by using Logo, which is available on the ubiquitous Apple II.

The problem, however, does not arise necessarily or solely from the use of BASIC. The worst spaghetti code I ever wrote was on a TI-59 calculator. And it is possible to avoid spaghetti code even if one has to use GOTO statements, although it is admittedly difficult.

CBASIC, which Mr. Brown refers to, can be used to write orderly code. As I recall, the only time it is necessary to use a GOTO in that language is in the special case of GOTO on end of file. One can avoid GOTO statements in a series of IF..THEN statements by using GOSUB statements instead. In complicated cases the GOSUB may have to set a flag that the main routine checks with another IF.. THEN statement in order to determine where to go next. The result may not be as clear to the reader as a segment of Pascal, but, on the other hand, it will not be a tangled web. I suspect that more can be taught about structured programming in BASIC than in Pascal; with the first language the student has to supply the structure, in the second the student cannot avoid it even if he or she wants to.

The problem is not only that high school students go on to take computer courses in college, but that they go on from college to law schools or theology schools or even, sometimes, the real world. Except for students who are going to become programmers or computer scientists, I should think that any introductory programming course may be a waste of time or worse. I believe that everyone should in some sense be computer-literate, but that does not mean that everyone should know how to write programs. Instead, everyone should know what computers can do—and what they can't. I really don't think that a programming course is the

(continued)

INTRODUCING AST GRAPHPAK.™

THE POWER TO BUILD ON FRAMEWORK™ AND ORCHESTRATE SYMPHONY.™



AST delivers the powerful integrated hardware you need to unlock the full capabilities of your integrated software. Including Framework, Symphony, Lotus 1-2-3™, Multiplan® and more.

GraphPak is a complete, convenient solution—two plug-in boards for the IBM® PC, XT and their compatibles. And it's packed with advanced features. Expanding memory to 640KB, GraphPak gives you the space to operate state-of-the-art programs, handle more data, and create larger spreadsheets. And it lets you take full advantage of the sophisticated graphics capabilities of your software, bringing high-resolution, bit-mapped displays to your monochrome screen.

IBM-compatible serial and parallel ports mean you can easily add a letter-quality printer and a modem to connect with services such as Dow Jones® EasyLink® and CompuServe®. Further, our built-in clock-calendar provides automatic date stamping.

Productivity-boosting SuperPak™ utilities give you SuperDrive which responds fifty times faster than a disk drive and SuperSpool which lets you input and print at the same time.

All this is yours in an easy-to-buy, easy-to-install, easy-to-use package that costs less than individual components.

Find out about AST's total solutions. See your dealer for facts on GraphPak and our complete family of multifunction boards, and communications, LAN, graphics and modem products. Or call our Customer Information Center (714) 863-1333 Ext. 5249 for your nearest dealer. AST Research Inc., 2121 Alton Avenue, Irvine, CA 92714. TWX: 753699ASTR UR.



AST

RESEARCH INC.

IBM PC and XT trademarks of International Business Machines Corporation. Symphony, Lotus and 1-2-3 trademarks of Lotus Development Corporation. Framework trademark of Ashton-Tate. Multiplan trademark of Microsoft. Dow Jones trademark of Dow Jones & Co. Inc. EasyLink copyright Western Union. CompuServe is an H&R Block Company. GraphPak and SuperPak trademarks of AST Research Inc.

Circle 6 for Dealer inquiries.
Circle 7 for End-User inquiries.

IT RUNS THO PROGRAMS AS

If you have to plan, figure, write, organize, predict or communicate, the NCR PC 4 can help you do it easier and better.

Because the NCR PC is compatible with thousands of off-the-shelf programs available through your local PC dealers.

From the best-selling 1-2-3™ by the Lotus™ people to all sorts of other programs for business, education or just plain fun.

But besides getting more software to choose from you get more computer to work with.

For instance, you can get all the

memory you need—all the way up to 640K.

An enhanced keyboard with separate cursor keys and separate numeric key pad that make it easier for you to work with spreadsheets and data base programs.

A special program called a RAM-DISK that acts as a super fast disk drive. It allows you to access information up to 15 times faster than a floppy disk.

And a rugged, compact cabinet that looks great on any desk.



© 1984 NCR Corporation
Lotus and 1-2-3 are trademarks of Lotus Development Corporation. GW-BASIC is a trademark of Microsoft Corporation.

USANDS OF EASY AS 1-2-3.

Plus extras others charge extra for.

Like built-in serial and parallel ports. Disk and video controller boards. Plus the standard operating system, GW™ BASIC and self-teaching programs to get you started.

The NCR PC is also compatible with industry standard hardware. So you can attach all kinds of fun things to it. Like a mouse, a modem, a printer, a hard disk, a graphics board, etc.

In short, the NCR PC is exactly the personal computer you'd expect

from a company that's been doing business with business for 100 years.

See your Authorized NCR Personal Computer Dealer. He'll be glad to show you how easily the NCR PC can make things easier for you.

For the name of your nearest dealer call toll-free 1-800-544-3333.*



**A BETTER PERSONAL COMPUTER.
IT'S EXACTLY WHAT YOU'D
EXPECT FROM NCR.**



*In Nebraska call 1-800-343-4300.

Circle 282 on inquiry card.

best way to learn that. In fact, I fear that there are a great many programmers who are not computer-literate. Neither BASIC nor Pascal is much help in understanding the *Entscheidungsproblem* or the Turing test, but certainly those are examples of issues that the computer-literate, as well as the computer-literati, should be able to address.

PETER D. JUNGER
Professor of Law
Cleveland, OH

The letter from Wendell Brown was a complaint about using BASIC to teach pro-

gramming in high school, and it ended with a plea for a well-structured, powerful, interpreted language for the Apple II. I am happy to direct Mr. Brown's attention to such a language.

The language is modular and incrementally compiled but it is interpreted so there is an "immediate mode" as in BASIC. It allows procedures and functions with local and global variables. Uninitialized variables are not permitted, but variables do not have to be predeclared. Names for variables and procedures can be made practically any length, resulting in self-documenting programs. The error mes-

sages are descriptive and extremely useful. It permits a wide variety of looping structures. Procedures are easily made recursive. Character strings are easily handled. For arithmetic, it has real numbers with six-digit accuracy and it also has integer arithmetic operations. Trigonometric functions, but not logarithms, are built in. Graphics include turtle graphics, coordinate graphics, color, and full control of the text screen.

As in C, the user can create a system of software utilities or a "shell" for other users. As in Pascal (but not UCSD Pascal), procedures can be passed as parameters. Combined with descriptive variable names, this feature allows for "natural language" programming. Data typing is convenient, though not as strict as Pascal; for example, one cannot take the square root of "false" as one can easily do in BASIC, but on the other hand, real numbers can easily be manipulated as character strings.

This language is widely available for the Apple, Commodore 64, Atari, and the IBM PC. It was developed rather carefully as a teaching language (as were BASIC and Pascal) and has been thoroughly tested.

The language is Logo.

Logo has a well-deserved reputation as a language that is easy for young children to work with. For this reason it has largely been overlooked at the high school level. Most people are surprised to learn that it's more than a graphics package. In fact, it is so far superior to BASIC that, in my opinion, there is no longer any rationale for teaching BASIC. For example, the whole problem of "structured programming" ceases to be an issue when you teach Logo; you write separate procedures, not programs. A long-time BASIC programmer has a hard time understanding the concept that a computer can have separate procedures in memory at the same time, accustomed as he or she is to the restricted nature of BASIC.

I taught BASIC for two years; in our school programming is a required part of the ninth-grade math class. We switched to Logo this year and it was like removing a blindfold and ankle chains. Everything is easier. I took my old list of programming projects from BASIC and added more to it. Is programming power an issue? The Commodore Logo that I use has an assembler and a sprite editor, both written in Logo. Logo is a dialect of LISP, which is the language used on the cutting edge of artificial-intelligence work. Is speed an issue? Logo is slow, as befits an interpreted language, and there is no compiler avail-

Table 1: A comparison of pointer versus subroutine threading.

| Pointer-threaded | Subroutine-threaded |
|-------------------|---------------------|
| (2 bytes in list) | CALL nnnn (3 bytes) |
| POP reg | MOV reg,[DI] |
| LODSW | INC DI |
| XCHG DI,AX | INC DI |
| JMP WORD-PTR [DI] | RET |
| 39 clock cycles | 38 clock cycles |

Listing 1: Some pointer-threaded coding examples for the 68000.

Register usage:

- A7 Interpreter Pointer
- A6 Return Stack Pointer
- A5 Data Stack Pointer

A primitive looks like this:

- "Name" Character count plus ASCII name
- Link Address Long word
- <- Jump-up address

(Machine code body)

- RTS Return from subroutine

A secondary:

- "Name" Character count plus ASCII name
- Link Address Long word
- <- Jump-up address
- MOVE.L A7,-(A6) Push interpreter pointer on return stack (2 bytes)
- LEA 8(PC),A7 Point IP to second address in threaded list (4 bytes)
- JMP Jump to first address in threaded list (2 bytes op code)
- ADR1
- ADR2 (Every address 4 bytes)
- ADR3
-
-
- ADR SEMI

The primitive SEMI controls return to the calling secondary and consists of the code:

- ```
SEMI: MOVEA.L (A6)+,A7 ;Pop interpreter pointer
 RTS ;Continue execution at next higher level
```



able yet. On the other hand, its purpose is as a learning tool, and in this spirit we do not teach driver education on a Ferrari.

JOEL TELLER  
Berkeley, CA

### ON "FASTER FORTH"

"Faster FORTH" by Ronald L. Greene (June, page 127) is a misguided attempt at optimizing pieces of FORTH without regard to their interrelationships. The poor choice of examples further clouds the comparison.

The time differentials given for pointer-threaded versus subroutine-threaded implementations are misleading for several reasons. One of the least efficient methods available for pointer threading is compared to a simple call-threading scheme. The unavoidable loss in data-stack efficiency is not explained in the article. Also, colon nesting is shown in the least favorable circumstances imaginable. It is seldom used to define a word consisting of two short primitives. It is more typically used to define words of sufficient complexity that its overhead is negligible.

The idea of keeping more than the top element of the stack in the registers is useless. FORTH uses the stack for parameter passing between routines. Its depth cannot be limited to so few elements without seriously cramping the generality of user-written words and eliminating recursive use. Any word that changes the number of elements on the stack would require not only a PUSH or a POP, but a string of register moves as well. (HS/FORTH does keep the top element of the stack in a register. This improves efficiency without long-term register shuffling losses.)

Assuming that you do need a decent stack facility, table 1 shows a more reasonable comparison of pointer versus subroutine threading. The preponderant inefficiency is in passing through the inner interpreter rather than through in-line code, so I have limited the comparison to just the RETURN-NEXT-RUN code. Since parameters from the data stack will usually be required, I included a single POP operation. A second stack operation adds 8 to 10 clock cycles to the pointer-threaded example and 20 clock cycles to the subroutine-threaded one. Where are the savings for adding half again as many bytes to our definition lists?

JIM CALLAHAN  
No address available  
(continued)

# BAY TECH'S MULTIPORT-FOLIO

**YOUR BEST SOURCE  
FOR HIGH QUALITY,  
HIGH PERFORMANCE,  
DATA COMMUNICATIONS  
PRODUCTS**

## PORT NETWORKING

Star network capable of any port-to-port connection with up to 18 ports communicating simultaneously.

## PORT MULTIPLEXING

Allows up to 8 computers to use the same data communication line simultaneously.

## PORT SWITCHING

Expands your single RS232C serial port to 4 or 8 ports. Even more ports by cascading.

## PORT CONTENTION

Adds terminals to your computer. For example: 12 terminals can contend for 6 ports on a first come, first serve basis.

## PRINTER SHARING

Enables up to 8 computers to automatically share a single printer.

**Multiport models with 5 to 18 ports, \$279 to \$1,750.**



BAY TECHNICAL ASSOCIATES

P. O. BOX 387  
BAY ST. LOUIS, MS 39520

CALL US TOLL-FREE  
**1-800-523-2702**

Telex: 910-333-1618 (BAYTECH)  
EasyLink: 6277-1271



I just read Ronald Greene's excellent article on reduction of overhead in TILs (threaded interpretive languages).

The author compares pointer-threaded and subroutine-threaded TILs and admits that the pointer-threaded implementation is superior with regard to execution time. I believe that a well-designed pointer-threaded TIL will also produce the most time-efficient code. What is the business

of a TILs inner interpreter? It has to direct program flow from one executable primitive to the other. Usually this is done by using a central-processor register as interpreter pointer (IP). The IP points to the next entry in the list of pointers to primitive or secondary routines. After completion of one routine, the next address is read, the IP is incremented by 2 or 4 bytes (depending on the address

size), and a JUMP is executed to continue execution at the new location.

If you look closely at this process, you will see that you will not need more than a RET instruction to do the job if you use the central-processor hardware stack pointer as the interpreter pointer. The processor will permanently execute returns and will be "eating" up its way along the threaded list. This works well as long as there are only primitives to execute, with the time overhead being the execution time of a single RET instruction. And this is also the most important point, since jumps from one secondary to the next are very rare compared to the jumps from primitive to primitive. Even the highest-level words of a FORTH program consist mostly of primitives like DUP or LOOP.

Secondary routines require some code to save the IP on a stack (which must be maintained by another central-processor register) and load it with the starting address of the new threaded list.

To do this efficiently you need a processor that supports multiple stacks. Listing 1 shows some coding examples for the 68000.

The memory overhead to save and set up the IP and to jump to the first address is 8 bytes, so this technique pays only if the secondaries are not too short. But the time savings are optimal, eliminating the need for the JSR (CALL) instruction and leaving only the RTS (RET) instruction.

Note that this code is completely stand-alone and does not need any special inner interpreter. One disadvantage is that you can't implement the macros proposed by Mr. Greene, but because there is so little overhead they're not as necessary.

Care must be taken if the processor uses the hardware stack pointer (which serves in our case as IP) to process interrupts, not to PUSH any information into the threaded code. In the case of the 68000 this should not be a problem since it will use the supervisor stack pointer.

ALEXANDER BURGER  
Sapporo, Japan

I cannot believe that Ronald Greene intends to imply that DUP DUP accomplishes the same thing as 2DUP. Fortunately, this apparent error does not detract from the sense of his argument, only from its credibility. Substitution of OVER OVER for DUP DUP avoids the distraction of a common slip that most beginners (like me) are painfully aware of.

DONALD GARWOOD  
Mendocino, CA  
(continued)

**YOUR PC CAN BE YOUR NEXT SMART TERMINAL.**

SmarTerm software can make your personal computer a lot more intelligent than it really is.

Our terminal emulators have the features that do the job: Full keyboard emulation. Multiple setups. TTY mode. "Smart" softkeys. Printer support. Help screens. And a friendly user manual.

Built-in text and binary file transfer is powerful and simple to use, and does not require

any special host software. SmarTerm also features automatic file transfer and two different "error-free" protocols, including XMODEM.

There's a SmarTerm emulator that matches your needs: SmarTerm 100 for emulation of DEC VT100, VT102 and VT52. This program now features 132-column display mode support, using either horizontal scrolling or special 132-column video display boards. SmarTerm 125 includes all the features of SmarTerm 100, plus VT125 ReGIS graphic support. SmarTerm 400 for emulation of Data General Dasher D100, D200 and D400.

More than 10,000 customers have discovered just how smart their PCs can be with SmarTerm. We think you'll agree. Try it for 30 days with full refund privilege.



Call today for more information.

Available through your local software dealer, or Persoft, Inc., 2740 Ski Lane, Madison, WI 53713. Phone (608) 273-6000. TELEX 759491.

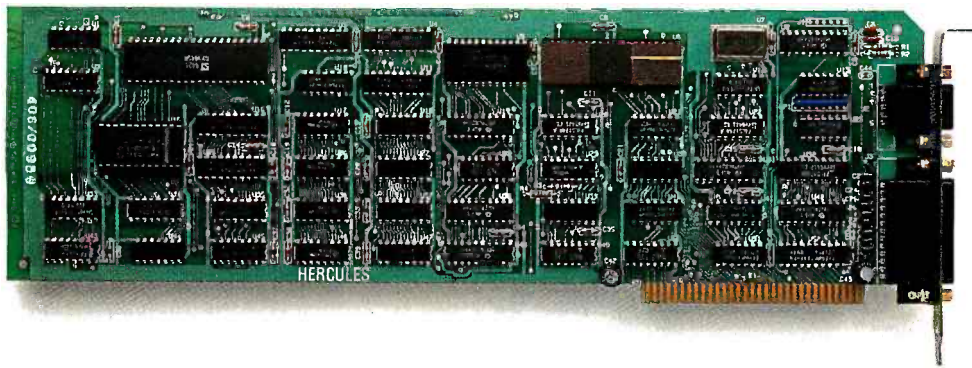
SMARTERM is a trademark of Persoft, Inc. • DEC, VT & ReGIS are trademarks of Digital Equipment Corp. • Dasher is a trademark of Data General Corp. • IBM is a registered trademark of International Business Machines Corp.

**IN A WORLD OF CHANGE, THE SMART GET SMARTER™**



See us at DEXPO, booth #4011.





# Introducing the Hercules™ Graphics Card for the technical user.

OK. We confess. The Hercules Graphics Card in the picture above isn't a special version for the technical user.

In fact, it's exactly the same as the standard Hercules Graphics Card running programs like 1-2-3™ and Symphony™ in more than 100,000 IBM® PCs.

We just wanted to make the point that the Hercules Graphics Card is not only big with business users—it's also the most popular high resolution graphics card for the technical user.

**Why? We run more software than anyone else.**

The Hercules Graphics Card is supported by more technical software than any other hi-res graphics card.

There are word processors that can produce publication quality documents with mathematical formulas.

There are programs that enable your PC to emulate a graphics terminal

and run mainframe graphics software.

There are toolkits of graphics utilities that can be linked to popular programming languages.

There are CAD programs that can provide features normally associated with \$50,000 systems.

And we supply free software with each card to do hi-res graphics with the PC's BASIC. No one else does.

**Hardware that set the high performance standard.**

When we introduced the Hercules Graphics Card in August, 1982, it set the standard for high resolution graphics on the PC.

But we didn't stop there. In the past two years, we've continually refined the original design.

Today's Graphics Card gives you two graphics pages, each with a resolution of 720h x 348v, and a parallel printer port—standard.

A 2K static RAM buffer elegantly eliminates scrolling flicker. And our exclusive safety switch helps prevent damage to your monitor.

**Convinced? Good. Now, how about a little color?**

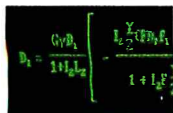
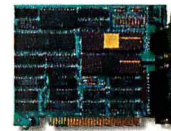
Should you want IBM compatible color graphics for your system, then the new Hercules Color Card is the smart way to go.

It gives you a parallel printer port and a size small enough to fit in one of the XT's or *Portable's* short slots.

And both Hercules cards are compatible with the new AT™ and backed by our two year warranty.

Call 800 255-5550 Ext. 408 for the name of the Hercules dealer nearest you and we'll rush you a free info kit. See why the company that made the first graphics card for the IBM PC still makes the best.

**Hercules.**  
**We're strong on graphics.**



There are word processors that can produce publication quality documents with mathematical formulas.

# Graduate school for professional software engineers is here.



## The Wang Institute of Graduate Studies

Name: \_\_\_\_\_

Business Address: \_\_\_\_\_

\_\_\_\_\_

Telephone: Home \_\_\_\_\_ Business \_\_\_\_\_

Years of Software Development Experience: \_\_\_\_\_

I am currently a  software professional

B- 12/84  student  other



For tomorrow's leading software engineers, the Wang Institute offers an unprecedented educational opportunity.

Students enrolled in our Master of Software Engineering (M.S.E.) program prepare for positions of increasing challenge and responsibility, while studying the latest technical and managerial aspects of software development.

Working in teams with other professionals, M.S.E. students learn how to plan, organize and supervise real-world software projects. With access to a large and growing collection of software tools, our students develop a thorough understanding of the entire software life-cycle. At the same time, our low student/faculty ratio of seven to one allows them to work closely with teachers who have significant industrial and academic experience.

The Wang Institute's M.S.E. program is open to all qualified software professionals. Currently more than 20 companies have sponsored M.S.E. students, who may choose either part- or full-time schedules of study. Graduate assistantships for unsponsored, full-time students are also available.

If you're ready to become one of tomorrow's leading software engineers, the Wang Institute of Graduate Studies is the place to be.

For further information, write or call Janis Ackerman, Wang Institute of Graduate Studies, School of Information Technology, Tyng Road, Tyngsboro, MA 01879 (617) 649-9731.

The Wang Institute of Graduate Studies is an independent, non-profit educational institution founded in 1979.

The article "Faster FORTH" is one-quarter right. It basically gives two methods for speeding up a FORTH language.

If you thread CALL statements instead of just addresses you will avoid numerous jumps to the inner interpreter. Short routines may also be coded in line. This saves time at the cost of memory. This method works fine until 64K bytes are reached, at which point any FORTH implementation slows down. Since threading CALL statements uses memory faster, it reaches that limit sooner. Besides, when speed is paramount, you always recode critical sections in assembly language anyway. The threaded-subroutine method is probably faster, but this article overstates the difference.

The article also recommends using four registers as a short data stack. This has two problems. It practically precludes structured programming or recursion. The programmer must keep track of the depth of the data stack at each level, losing transparency. Additionally, this short stack is slower, not faster. The 8088 is normally limited not by internal processing but by memory access time. The instruction cycle count is practically irrelevant. Since it takes 8 bytes of memory access to POP or PUSH a short stack, it is slower than an in-memory stack, which only needs 6 bytes of memory access. My experimental timing indicates the short stack is 20 percent slower.

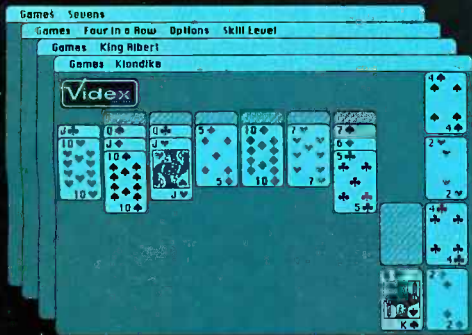
FRED SINAL  
Hampton, VA

In the search for a "Faster FORTH," Ronald Greene has several valuable suggestions. However, the section of the article concerning data stack should be completely ignored. Mr. Greene discusses a "stack" in four data registers. This setup is, first of all, not a stack. With a stack, one is able to tell whether underflow or overflow has occurred. This important capability is used by FORTH programmers during debugging and then edited out for fastest execution of valid words. I don't see how one could tell if an overflow or underflow had occurred with this register stack without adding back the code that it is meant to save.

The stack allows you to write fully re-entrant code. When writing fully recursive definitions in FORTH, the stack and named variables have radically different functions—with the stack holding *all* working variables and the named variable reserved to global functions. Mr. Greene's implementation would virtually eliminate clean-

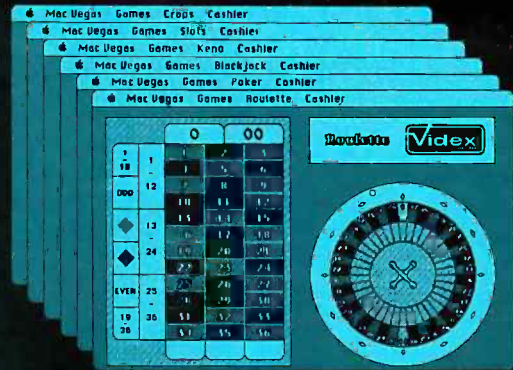
(continued)

# The MacClassics™ from Videx. Legends in Their Own Time.



**FunPak™ — \$39**

**Klondike Solitaire •  
King Albert Solitaire •  
Four in a Row • Sevens**



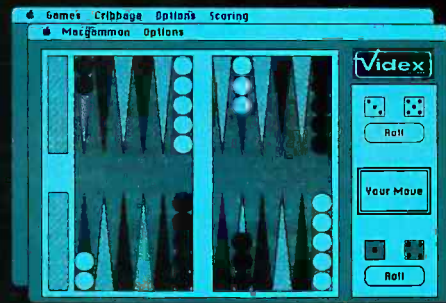
**MacVegas™ — \$59**

**Roulette • Poker • Blackjack •  
Keno • Slots • Craps**



**MacCheckers™ — \$49**

**Checkers • Reversi**



**MacGammon™ — \$49**

**Backgammon • Cribbage**

Introducing the MacClassics, a collection of familiar games designed to entertain and challenge. With Macintosh™ or a friend as an opponent, you can enjoy such classic games as solitaire, poker, checkers, backgammon, roulette, etc., and they're all more fast-paced and exciting than ever before, with a little assistance from Macintosh. MacClassics let you enjoy and explore the power of your Macintosh while you relax and have a good time.

The MacClassics are just another example of the kind of high-quality

products you've come to expect from Videx. With a solid reputation for dependable, innovative business software and hardware, Videx is consciously building that same degree of excellence into its entertainment software. Through development of Apple® and Macintosh software, Videx continues to provide the micro-computer industry with an ever-expanding line of exciting, reliable products.

Call today for more information.  
(503) 758-0521.



Innovation Backed by Support

Videx, Inc. • 1105 NE Circle Blvd. • Corvallis, OR 97330



Macintosh is a trademark of Apple Computer, Inc. Apple is a registered trademark of Apple Computer, Inc.

# NEW from BORLAND!

## TURBO TOOLBOX & TURBO TUTOR

"TURBO is much better than the Pascal IBM sells."

Jerry Pournelle,  
Byte, July 1984

"TURBO PASCAL appears to violate the laws of thermodynamics.

You won't find a comparable price/performance package anywhere. It is simply put, the best software deal to come along in a long time. If you have the slightest interest in Pascal... buy it."

Bruce Webster,  
Softalk IBM: March 1984



# BORLAND INTERNATIONAL GIFT PACK

ONLY

# \$99.95

A SAVINGS OF \$30!

What a gift for you and your friends! The extraordinary TURBO PASCAL compiler, together with the exciting new TURBO TOOLBOX and new TURBO TUTOR. All 3 manuals with disks for \$99.95.

**TURBO PASCAL** Version 2.0 (reg. \$49.95). The now classic program development environment still includes the FREE MICROCALC SPREAD SHEET. Commented source code on disk

- Optional 8087 support available for a small additional charge

**NEW! TURBO TOOLBOX** (reg. \$49.95). A set of three fundamental utilities that work in conjunction with TURBO PASCAL. Includes:

- TURBO-ISAM FILES USING B+ TREES. Commented source code on disk
- QUIKSORT ON DISK. Commented source code on disk
- GINST (General Installation Program)

Provides those programs written in TURBO PASCAL with a terminal installation module just like TURBO'S!

- NOW INCLUDES FREE SAMPLE DATABASE... right on the disk! Just compile it, and it's ready to go to work for you. It's a great example of how to use TURBO TOOLBOX and, at the same time, it's a working piece of software you can use right away!

**NEW! TURBO TUTOR** (reg. \$29.95). Teaches step by step how to use the TURBO PASCAL development environment—an ideal introduction for basic programmers. Commented source code for all program examples on disk.

**30 DAY MONEY BACK GUARANTEE** These offers good through Feb. 1, 1985

For VISA and MASTERCARD order call toll free: **1-(800)-255-8008 1-(800)-742-1133**  
(Lines open 24 hrs., 7 days a week) Dealer and Distributor inquiries welcome (408) 438-8400

**CHOOSE ONE** (please add \$5.00 for handling and shipping U.S. orders)

|                                              |                 |                 |                                        |                |
|----------------------------------------------|-----------------|-----------------|----------------------------------------|----------------|
| <input type="checkbox"/> All Three-Gift Pack | \$ 99.95 + 5.00 | <b>SPECIAL!</b> | <input type="checkbox"/> Turbo Toolbox | \$49.95 + 5.00 |
| <input type="checkbox"/> All Three & 8087    | 139.95 + 5.00   | <b>SPECIAL!</b> | <input type="checkbox"/> Turbo Tutor   | 29.95 + 5.00   |
| <input type="checkbox"/> Turbo Pascal 2.0    | 49.95 + 5.00    |                 | <input type="checkbox"/> Turbo 8087    | 89.95 + 5.00   |

Check \_\_\_\_\_ Money Order \_\_\_\_\_ VISA \_\_\_\_\_ MasterCard \_\_\_\_\_

Card #: \_\_\_\_\_ Exp. date: \_\_\_\_\_ Shipped UPS

My system is: 8 bit  16 bit

Operating System: CP/M 80  CP/M 86  MS DOS  PC DOS

Computer: \_\_\_\_\_ Disk Format: \_\_\_\_\_

Please be sure model number & format are correct.

NAME: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

CITY/STATE/ZIP: \_\_\_\_\_

TELEPHONE: \_\_\_\_\_

California residents add 6% sales tax. Outside U.S.A. add \$15.00 (if outside of U.S.A. payment must be by bank draft payable in the U.S. and in U.S. dollars). Sorry, no C.O.D. or Purchase Orders. H15



4113 Scotts Valley Drive  
Scotts Valley, California 95066  
TELEX: 172373







# HIGH PERFORMANCE 11 MEGABYTE HARD DISK FOR ONLY \$159<sup>00</sup>?

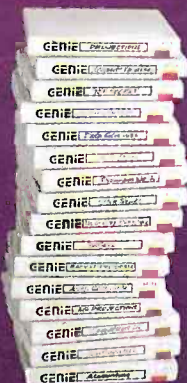


## INTRODUCING GENIE'S NEW 22 MEGABYTE FIXED/REMOVABLE 5.25" WINCHESTER

Genie brings you tomorrow's technology today, with a 22 megabyte high performance fixed/removable Winchester disk drive made to expand into the future. Because one half of Genie's ingenious 11+11 (22 megabyte) system is removable. And best of all, each 11 megabyte Winchester cartridge costs just \$159.00.

### Start Out with 22 Megabytes End Up with a Billion

While other hard disk systems limit you to their maximum fixed capacity, Genie's 11+11 gives you virtually unlimited primary storage, along with the built-in option of using an extra cartridge to quickly back up your data. Then pull it out and lock it up. That's the beauty of a removable cartridge system. You can take your confidential data with you. And you can also plug it right back in for instant on-line use.



### 22 Megabytes of High Performance.

Twice as fast as the IBM XT, Genie's new 11+11 outperforms most other 5.25" hard disk systems with an access time of only 40 ms. And with a conservatively rated 8,000 hour cartridge data life, Genie's 11+11 offers more than four times the life expectancy of other 8" high density "floppy" cartridges. It also has built-in data-protect features, such as automatic retracting heads on power down.

### Plug It into Your Computer Today

Designed to be absolutely transparent with the IBM PC, PC-3270, XT, AT, and other IBM-compatibles, Genie's 11+11 is network-ready, and can be up and running rings around all other systems in just a few minutes. All you have to do is plug it in. You can boot directly from the disk, and we even pre-format the cartridges for you.

Before you lock yourself into a fixed capacity hard disk drive, take a look at ours. From low cost-per-megabyte to high performance and back-up, Genie's 11+11 (22 megabyte) Winchester system represents tomorrow's technology. But you can have it today.

Genie's line of removable Winchester systems start at just \$1,995.00. Find out more. See the Genie 11+11 at participating Computerland, Entre and other dealers, or give us a call for the name of your nearest Genie dealer.



Genie systems are also compatible with Apple IIe, Macintosh, Lisa, TI Professional and S-100 computers.

## GENIE TECHNOLOGIES

31117 Via Colinas, Westlake Village, CA 91362  
818/991-6210 • TX 658233

Mr. Sinal makes a good point regarding execution speed. The fact that sometimes the time required to fetch an instruction is larger than the execution time is too often overlooked by amateurs such as myself. Nevertheless, I believe his conclusion is incorrect because it does not take into account the way a register stack is used. Consider the arithmetic operations, for example. With an in-memory stack the two or three operands are typically popped to registers where the arithmetic is done,

and the result is then pushed back to the stack, for a total of three to four PUSH/POP operations. With the short stack that I proposed the operands are already in the arithmetic operation (with perhaps an XCHG necessary if the AX register is called for). In this case one or two PUSH/POP operations is more typical.

The letter by Mr. Callahan contains a number of relatively minor points regarding my comparison between subroutine threading and the pointer

threading suggested by Loeliger. Since the major point of his and Mr. Burger's letters is that there is a much more efficient way of threading pointer code than that illustrated by Loeliger, my replies to these particular comments would be moot. Let me just say that I believe my overall evaluation of subroutine-threaded code in comparison to threaded code, which uses an inner interpreter, is fair. It was based primarily upon actual benchmark comparisons between my subroutine-threaded version of FORTH with a short stack and the IBM PC version of FORTH Level II distributed by FORTH Technology. To the best of my knowledge, it is among the fastest FORTHS available for the IBM PC. The comparisons I made were an attempt to explain qualitatively why subroutine threading was faster in terms of a readily available implementation of pointer-threaded code (Loeliger's book).

I found Mr. Burger's letter and the last part of Mr. Callahan's letter most interesting because they sketch a technique of pointer threading that does not require an inner interpreter. The technique is not widely known, judging from the speed of the FORTH compiler/interpreters on the market. It has almost all of the advantages of subroutine-threaded code but few of the disadvantages. It is also possible to partially implement macro coding (as I discussed in my article) to define primitives at the user level.

The technique suggested by Messrs. Burger and Callahan (tight threading) does not use an inner interpreter in the usual sense of the word. Burger's version of tight threading is the more efficient of the two, and is also most closely related to subroutine threading, so I'll concentrate on it. Ignoring secondaries for the moment, in the usual implementation of FORTH, when a primitive finishes executing, a jump is made to a short routine called the inner interpreter. This routine performs some housekeeping and then causes a jump to the next primitive. Subroutine threading uses a CALL/RET pair to complete these two jumps, and uses the hardware of the processor stack to handle the housekeeping. With tight threading, on the other hand, there is a single jump from the end of one primitive to the beginning of the next, thus saving one time-consuming jump. The necessary housekeeping is done at the end of the primitive, just before the jump to the next primitive. Like subroutine threading, Burger uses the stack hardware for housekeeping so the only overhead necessary (to complete the jump) is a RET statement.

As I mentioned earlier, the tight-threading technique can be adapted to partially utilize macro coding. One way of doing this would be to define a second compiler (perhaps "C") that would copy executable code, rather than a list of addresses, into the word being defined. A word so defined would be a user-created primitive and would not have the additional overhead of a secondary, nor the overhead of the RET statements of each of its constituents.

RONALD L. GREENE  
New Orleans, LA ■

## Winchester power for your PC



The proven Winchester subsystem drives for your IBM or compatible PC. 10, 15, 25, or 33 megabytes of big system storage in a DiskSystem® you simply plug into your system and it's ready to use. At prices that make the speed and storage of a Winchester practical. Only \$1495 for a 10 megabyte DiskSystem, \$1795 for 15 megabytes, \$2245 for 25 megabytes, or \$2795 for 33 megabytes. DiskSystems can be bootable from the Winchester. See your dealer today for DiskSystem power for your PC.



**Interface Inc.**

21101 Osborne Street  
Canoga Park, CA 91304  
(818) 341-7914 • Telex: 662949

### Dealer Inquiries Invited

DiskSystems is a copyright of Interface Inc. IBM is a registered trademark of IBM Corporation. Prices are suggested retail and are subject to change without notice.

## UPDATES

### UNIX Benchmarks Brought Up to Date

David F. Hinnant, whose article "Benchmarking UNIX Systems" appeared in the August BYTE (page 132), laments that "for some reason the most impressive benchmarking results always seem to arrive after the publication deadline. Such is the case with the SCI-1000. The product configuration far outperforms the preproduction version in most respects."

The most notable performance increase was found with the multiuser-simulation benchmark. The results for the multitasking UNIX benchmark with a variable number of background processes were presented in table 3 (page 407). The new data for the SCI-1000 running UNIX System III is shown here in table A.

The new results place the SCI-1000 in the number six position, ahead of the Altos 986 and the TRS-80 Model 16B, both of which ran versions of XENIX. Mr. Hinnant anticipated this result due to the fact that the SCI-1000 is based on the 80186 microprocessor. Other benchmarks displayed a similar increase in performance. Substitute the data in table B here for that listed for the SCI-1000 in table 1 (page 135).

Curiously, the new times for the disk write and read (listings 5a and 5b, page 404) are somewhat slower than those

Table A: The multitasking UNIX benchmark with a variable number of background processes produced these results on the production version of the SCI-1000. The data is the elapsed (i.e., real) times for the benchmark to complete its cycle.

| UNIX Version | AVERAGE ELAPSED TIME IN SECONDS |     |      |      |      |      |
|--------------|---------------------------------|-----|------|------|------|------|
|              | Number of Concurrent Processes  |     |      |      |      |      |
| System III   | 1                               | 2   | 3    | 4    | 5    | 6    |
|              | 5.5                             | 8.9 | 12.3 | 16.9 | 21.9 | 28.1 |

Table B: The other UNIX benchmarks given in the August BYTE produced these results on the production version of the SCI-1000 running UNIX System III.

| TIME IN SECONDS |      |        |                |      |        |                  |      |        |          |      |        |
|-----------------|------|--------|----------------|------|--------|------------------|------|--------|----------|------|--------|
| 1. Pipe         |      |        | 2. System Call |      |        | 3. Function Call |      |        | 4. Sieve |      |        |
| real            | user | system | real           | user | system | real             | user | system | real     | user | system |
| 7.7             | 0.0  | 3.3    | 24.3           | 0.9  | 23.1   | 1.2              |      |        | 4.1      | 3.6  | 0.1    |
| 5a. Disk Write  |      |        | 5b. Disk Read  |      |        | 6a. Shell        |      |        | 7. Loop  |      |        |
| real            |      |        | real           |      |        | real             | user | system | real     | user | system |
| 5.0             |      |        | 13.9           |      |        | 4.9              | 0.0  | 2.8    | 14.1     | 13.6 | 0.1    |

achieved with the preproduction version. However, the slower speed doesn't seem to affect the overall performance of the system: e.g., the shell test (listing 6a, page 406) executes in substantially less time.

"With a price of around \$10,000," concludes Mr. Hinnant, "the price/perfor-

mance ratio for the SCI-1000 is competitive with the Altos 586 or Altos 986." He adds that because the same company produced the UNIX port for the PC/IX and the kernel for the SCI-1000, it should be easy to create application programs for an IBM PC running PC/IX on the SCI-1000.

### Benchmarks Run Well on Lisa 2/10

Wilf Sullivan from Carleton University in Ottawa ran David Hinnant's UNIX benchmarks on a pair of Apple Lisa 2/10s. In some cases, the results were considerably better than those obtained by Mr. Hinnant, who ran his benchmarks on a 1-megabyte Lisa. (See "Benchmarking UNIX Systems," August, page 132.)

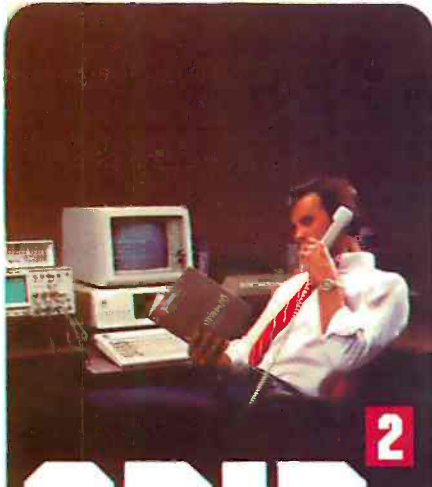
The benchmarks were run on 1- and 0.5-megabyte Lisa 2/10s using Microsoft's XENIX. The results for the Pipe, System Call, Function Call, and Sieve benchmarks are comparable to those obtained by Mr. Hinnant. However, the Disk Read, Disk Write, and Shell benchmarks are faster. (The data for the Shell test on the

1-megabyte Lisa 2/10 is unavailable.) With respect to multitasking performance, the 1-megabyte Lisa, according to Mr. Sullivan's survey, should rank among the top seven machines when rated on the fastest execution of a real-time task. Those results are shown in tables C and D.

*(continued)*

Table C: The UNIX benchmark results on a 0.5-megabyte Apple Lisa 2/10 running XENIX.

| AVERAGE ELAPSED TIME IN SECONDS |  |               |  |                             |      |        |                                 |        |
|---------------------------------|--|---------------|--|-----------------------------|------|--------|---------------------------------|--------|
| 5a. Disk Write                  |  | 5b. Disk Read |  | 6a. Shell (tree-run sample) |      |        | 6b. Multitasking UNIX Benchmark |        |
|                                 |  |               |  | real                        | user | system | Number of Concurrent Processes  | real   |
| 13.5                            |  | 24.5          |  | 12.3                        | 0.5  | 4.3    | 3                               | 51.5   |
|                                 |  |               |  |                             |      |        | 6                               | 2:02.2 |



# GPIB

**IBM PC, PCjr  
& COMPATIBLES**  
**DEC UNIBUS, Q-BUS  
& RAINBOW 100**  
**MULTIBUS, VMEbus  
STD & S-100**

Full IEEE-488 functionality, with the most comprehensive language and operating system coverage in the industry. It takes experience to make IEEE-488 systems work with nearly 4000 devices available from more than 500 different manufacturers, and experience is what enables National Instruments to take the GPIB to the second power and beyond.



**2** Your personal guarantee of unsurpassed customer support and satisfaction. CALL 1-800-531-GPIB for instant access to 100+ man-years of GPIB experience.

**NATIONAL INSTRUMENTS**  
12109 Technology Blvd.  
Austin, TX 78727  
1-800-531-5066 512/250-9119  
Telex: 756737 NAT INST AUS

IBM and PCjr are trademarks of International Business Machines. MULTI-BUS is a trademark of Intel. DEC, UNIBUS, Q-BUS, and Rainbow 100 are trademarks of Digital Equipment Corporation.

## FIXES AND UPDATES

Table D: The UNIX benchmark results on a 1-megabyte Apple Lisa 2/10 running XENIX. (Please note that data for the Shell benchmark is unavailable.)

| AVERAGE ELAPSED TIME IN SECONDS |               |                                 |      |
|---------------------------------|---------------|---------------------------------|------|
| 5a. Disk Write                  | 5b. Disk Read | 6b. Multitasking UNIX Benchmark |      |
|                                 |               | Number of                       |      |
|                                 |               | Concurrent Processes            | real |
| 13.7                            | 23.7          | 3                               | 26.0 |
|                                 |               | 6                               | 48.9 |

### Chip Choice Explained

Professor Marvin L. De Jong was surprised that Richard C. Hallgren used an AD7570 A/D converter in his automated data-acquisition system. (See "Putting the Apple II Work, Part I: The Hardware," April, page 152.) He felt that the AD571 would remove much of the complexity of the circuitry involved. However, he notes that the chips are similar, except that the AD571 has 10 fewer pins, a shorter conversion time, and an internal clock.

Mr. Hallgren replied that he chose the AD7570 over the AD571 because of the

speed he wanted to achieve. He felt that his best approach would be to parallel the converters. This would allow them to convert their respective input signals simultaneously, eliminating time that would otherwise have been wasted by multiplexing the input signals to the input of a single converter. Since the output of the AD7570 is three-state buffered, all three outputs could be wired to the Apple's data bus and then successfully read in by the machine-language routine. The AD571 would require the addition of three-state buffers if it were used in this manner.

## BYTE'S BUGS

### Aliasing Error Foils Analysis

Rob Spencer found an aliasing error in his cluster-analysis program. (See "Cluster Analysis," September, page 129.)

"Though the program worked dozens of times of my NEC PC8001 and also on a friend's Apple II+," writes Mr. Spencer, "it didn't work . . . when I brought it over to a Macintosh."

The bug appears only in certain dialects of BASIC. Although the variables DM and DMIN are meant to be the same, as they are in Apple II and NEC BASIC, they do not function correctly with BASICs that use the whole variable name, including Microsoft BASIC for the Mac.

Please substitute DMIN for DM in lines 470 and 690 in listing I (page 423).

### New Numbers on Database Specifications

Some errors crept into the table in "A Database Catalog" (October, page 227). The Sensible Solution from O'Hanlon Computer Systems Inc. (Bellevue, Washington) allows a maximum of 1000 fields per record, 17 million records per file, and 16 files open at once. Also, it can be used in a multiuser system. FilePro 16 from the Small Computer Company Inc. (New York, New York) allows a maximum of 16 million records per file.

### Say It Right

The introduction to the October Features section (page 107) was struck by production gremlins, who altered the meaning of the last sentence in the first paragraph. The sentence should read: "Alas, the AT keyboard cannot be used with prior-model Personal Computers."

### Memory Lapse

We misstated the memory capacity of the Menos I Robot Control System in the September What's New section (page 472). The total memory space available on the main circuit board and slots can be expanded to 102K bytes. On the motherboard alone, ROM and RAM capacities are expandable to 16K bytes.

### Faulty Caption Corrected

A figure caption in the Software Review "LISP for the IBM Personal Computer" inaccurately refers to a listing. (See July, page 281.) The caption for figure 1 (page 286) should have stated that the tree shown represents the list ((JOHN AND JORDAN) HACK (C AND LISP)). The figure shown has no relationship to listing 1.

Our thanks to John Diamant, who co-authored the article with Jordan Bortz, for spotting the error. ■

# Make your dumb terminal run circles around more expensive equipment



Turn your dumb terminal into a 9600 bps, full-duplex asynchronous genius, using the dial-up telephone network and two new products from UDS.

Start with a UDS 9600 A/B, the modem that makes dial-up 9600 bps communication a reality. Then add an EC100 — a remarkable new UDS product that converts the synchronous, half-duplex line signal to asynchronous full-duplex for presentation to your terminal. As a bonus, the EC100 also performs error correction for any synchronous modem, limiting message errors to one every several years.

Save on equipment investment and line charges by putting your terminals on a faster track. For details, phone 800/633-2252, ext. 356. Universal Data Systems, 5000 Bradford Drive, Huntsville, AL 35805. Telephone 205/837-8100; TWX 810-726-2100.



 Universal Data Systems

 **MOTOROLA INC.**  
Information Systems Group

Circle 375 on inquiry card.

UDS modems are offered nationally by leading distributors. Call the nearest UDS office for distributor listings in your area.  
DISTRICT OFFICES: Atlanta, GA, 404/998-2715 • Aurora, CO, 303/368-9000 • Bellevue, WA, 206/455-4429 • Blue Bell, PA, 215/643-2336 • Boston, MA, 617/875-8868  
Columbus, OH, 614/895-3025 • East Brunswick, NJ, 201/238-1515 • Glenview, IL, 312/998-8180 • Houston, TX, 713/988-5506 • Huntsville, AL, 205/837-8100  
Mesa, AZ, 602/820-6611 • Minnetonka, MN, 612/938-9230 • Mountain View, CA, 415/969-3323 • Richardson, TX, 214/680-0002 • Silver Spring, MD, 301/942-8558  
Tampa, FL, 813/684-0615 • Thousand Oaks, CA, 805/496-3777 • Tustin, CA, 714/669-8001 • Willowdale, Ont, Can, 416/495-0008 • Ypsilanti, MI, 313/483-2682  
Created by Dayner/Hall, Inc., Winter Park, FL



# PROJECT MAN NEVER GET OUT

"What do you mean, the printer's on vacation!"

"Those prima donnas in development say the prototype will be a month late."

"Concrete just went up 20%!"

"The boss wants to make it blue."

If you're managing any kind of project today, you've got your hands full. Whether it's bringing a new product to market. Picking the best telephone system. Constructing an office building.

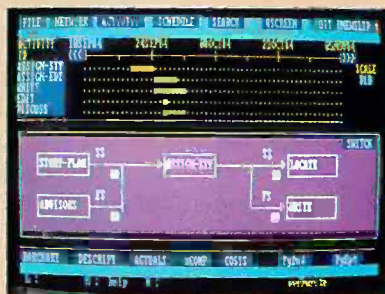
Planning a convention. Or doing the annual report.

No matter what, someone important expects you to finish on time.

And on budget. And if that doesn't seem humanly possible, you're right.

That's why you need QWIKNET:® a remarkable new bit of software magic for your IBM\* PC.

With QWIKNET, and its optical mouse, you can push-button your way to figuring the time, money, and resources



*A picture of the project plan.*

# AGEMENT WILL OF HAND AGAIN.

you need to complete a project. And when changes threaten your best-laid plans, QWIKNET analyzes the effects on your deadlines and budget. Then it helps you make the necessary adjustments to keep on track.

QWIKNET is an idea that could only have come from PSDI. We created the world's most respected family of project management software for mainframes and minis: PROJECT/2®. And 16 years of experience have given QWIKNET more savvy, more power, and more usable features than any other product.

Features like easy, pop-down

menus. Window management. CPM analysis. Network graphics. And a report writer.

For the name of your nearest QWIKNET dealer, or a free copy

of the "Project Management Primer," call us at 617-661-1444.

With QWIKNET, project management won't be a project any more.



## QWIKNET®

PC Project Management Software

From **PSDI**

**IF IT ISN'T ONE  
OF THOSE BRAND-  
NEW C. ITOH 7500  
PRINTERS THAT COSTS  
A MERE PITTANCE...  
FORGET IT.**

A new C. Itoh isn't exactly a stocking stuffer. But as printers go, the new ProWriter™ 7500 dot matrix goes for very little money.

Yet, it's C. Itoh quality through and through. A gift fit for a king. Tested. Proven. So doggone reliable it will be around for many a Christmas to come.

It gives you IBM® PC compatibility, and it's perfect for your basic printing needs.

The 7500 delivers 105 characters per second, 54 lines per minute throughput. It has bi-directional printing, graphics, and a 2-Kbyte buffer.

It has a very low profile design, only 4.3 inches high. And it is extremely quiet and lightweight, less than 14 pounds, making it ideal for office or home.

Like all C. Itoh printers, the 7500 comes with a full 12-month warranty, backed by over 400 Authorized Service Centers coast to coast.

C. Itoh and your C. Itoh dealer wish you and your PC the best Christmas ever. (And you can print that.)

C. Itoh printers since 1973, from a \$60 billion world-wide company that began making better products over 125 years ago.

For more information, just call toll free 1-800-423-0300. In Massachusetts, call 1-617-769-8770. Or write C. Itoh Digital Products, Inc., 19750 South Vermont Avenue, Suite 220, Torrance, CA 90502.



© 1984 News Group Chicago, Inc.

**C. Itoh**  
DIGITAL PRODUCTS

Circle 50 for Dealer inquiries. Circle 51 for End-User inquiries.



™ ProWriter is a Trademark of C. Itoh Digital Products, Inc.  
© IBM is a Registered Trademark of International Business Machines Corp.  
© 1984 C. Itoh Digital Products, Inc.



## NEC Unveils Notebook Computer

The NEC PC-8401A is a seven-pound notebook computer with a 16-line by 80-character liquid-crystal display. Also included are a 300-bps modem, parallel and serial ports, a Z80 processor, and 64K bytes of RAM, of which 32K bytes is always available for any application software.

A built-in expansion slot can be used to attach an optional 1200-bps modem, a CRT adapter to connect a standard monitor, or a 32K-byte RAM cartridge. A data recorder and one or two 3½-inch floppy-disk drives can also be added.

The system has 80K bytes of ROM, featuring MicroPro's WordStar-To-Go and Calc-To-Go, NEC's Personal Filer, telecommunications software, and the CP/M 2.2 operating system. BASIC is not included with the system.

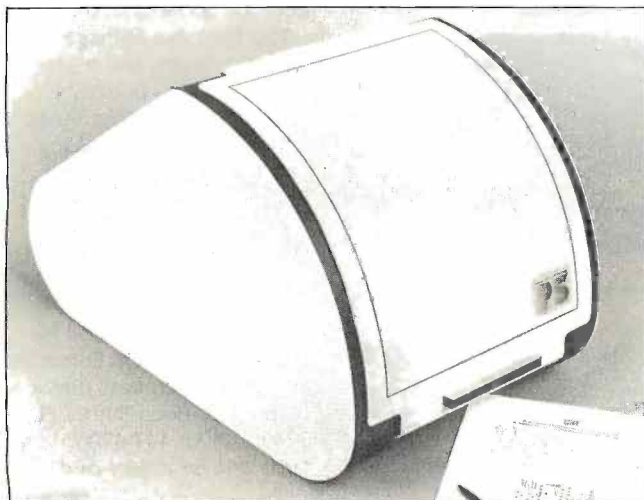
According to NEC, the



PC-8401A will be available this month for \$995. For further information, contact NEC Home Electronics Inc.,

Suite 10, 700 Nicholas Blvd., Elk Grove Village, IL 60007, (312) 228-5900. Circle 551 on inquiry card.

## Desktop Scanner Can Digitize Images and Read Documents



Electronic Information Technology's Personal Scanner (EIT-PS) is an automatic graphic digitizer and text-input device. It can either perform optical character recognition or digitize images.

EIT-PS consists of the desktop scanner, a cable, and a half-size card for the IBM PC. It costs \$2487. Versions for Apple computers are planned for early 1985. Contact Electronic Information Technology Inc., 373 Route 46 W, Fairfield, NJ 07006, (201) 227-1447. Circle 552 on inquiry card.

## Graphics Environment Manager

Digital Research's Graphics Environment Manager (GEM) is a single-tasking graphics user interface for MS-DOS computers. The operating environment has features similar to those found on Apple's Macintosh, such as pull-down menus, icons, and variable-size windows, and includes color graphics.

GEM operates as an extension to the MS-DOS operating system. Makers of MS-DOS computers must adapt the graphics portion of their operating system for each machine. The manufacturers pay a one-time fee for unlimited rights to distribute GEM with their MS-DOS computers.

Digital Research also announced three presentation graphics packages that will operate under GEM. GEM Wordchart can be used for text presentations using a number of type styles and formats. Pictures can be drawn with GEM Draw software, which adds the GEM user interface to the DR Draw program. GEM Presentation Master bundles GEM Draw, GEM Wordchart, and DR Graph with the Polaroid Palette image recorder.

According to the company, these programs should be available for MS-DOS in early 1985; a version that will run under DR's Concurrent PC-DOS is also planned. For further details, contact Digital Research Inc., 60 Garden Court, POB DRI, Monterey, CA 93942, (408) 649-3896.

Circle 553 on inquiry card.

*(continued)*

## Relational Database Requires No Programming

Cornerstone is a relational database for the IBM PC that allows you to add fields, incorporate data from other Cornerstone files, and check the validity of entered data from an easy-to-use menu-based interface. Billed by Infocom as "the sophisticated database system for the non-programmer," Cornerstone lets you enter data into separate database files in a loose structure that can easily be changed later.

The database size is limited by the capacity of the disk. Storage of 8,000,000 characters per file with 120 files per database is possible. Cornerstone commands are typed in by the user or can be selected from a menu; the menu can be deleted for experienced users. Fields can contain from 1 to 255 values. All



text fields are of variable length, and files can be stored on any field. Data is automatically checked during input.

Cornerstone includes a

context-sensitive help function that provides information given by the user when defining the file. This information explains the function of a key or command in the

context of the file being used.

An interactive report writer lets you quickly define the layout of a report on the video display. Using that layout, you can print selected records from a file or save the layout for later use.

Cornerstone can read pfs:File and dBASE II files and can exchange data with Lotus 1-2-3, WordStar, and other word processors and spreadsheets.

Cornerstone runs on the IBM PC family and compatible computers; PC-DOS 2.0 or later, at least 256K bytes of memory (512K bytes is recommended), and two disk drives are required. Infocom plans to release Cornerstone in February for \$495. Contact Infocom, 55 Wheeler St., Cambridge, MA 02138, (617) 492-1031. Circle 554 on inquiry card.

## QX-16 Features Valdocs 2

Epson's QX-16 includes dual 8088 and Z80 microprocessors, 256K bytes of RAM expandable to 512K, 640- by 400-pixel graphics, and the MS-DOS, CP/M, and Valdocs operating systems. Two 5¼-inch disk drives store 360K bytes of data in MS-DOS format or 720K bytes in CP/M.

Bundled with the QX-16 (and the QX-10) is an enhanced version of Rising Star Industries' Valdocs operating system. Valdocs 2 is faster than the original and has an expert mode so that experienced users won't be frustrated by the normal menu-driven format.

The Epson QX-16 will cost less than \$3000. For details, contact Epson America, Computer Products Division, 2780 Lomita Blvd., Torrance, CA 90505, (213) 539-9140. Circle 555 on inquiry card.

## IBM Announces Productivity Software

IBM has introduced the Business Management Series and the Personal Decision Series, two lines of integrated software for the IBM PC. Also available from IBM are attachments for these packages to enable file transfers to IBM System/36, 370, 4300, 303X,

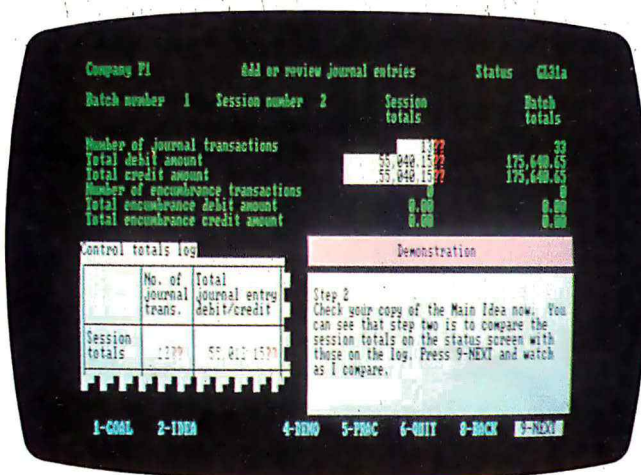
and 308X computers using the MVS and VM operating systems.

The Personal Decision Series comprises five application programs, with Data Edition, a database manager priced at \$250, as the required central module. The related packages are

Reports+ Edition, a \$150 report generator; Graphs Edition, a \$200 graphics program; Words Edition, a \$150 word processor; Plans Edition, a \$150 spreadsheet program with graphics; and the \$300 Plans+ Edition, an advanced version of Plans. Training modules are available for \$60 and \$70.

The Business Management Series consists of General Ledger, Accounts Payable, Accounts Receivable, Payroll, Order Entry and Invoicing, and Inventory Accounting Editions for \$695 each. Training programs for each module are \$95 each.

IBM expected most of the products to be released by this month; Plans+ will be available in March. For more information, contact IBM, POB 1328, Boca Raton, FL 33432, (800) 447-4700. Circle 556 on inquiry card.



(continued)

Available for the IBM PC, AT, XT, jr,\* and true compatibles

# GOT YOUR SIDEKICK™ YET?

## The Super Organizer

Whenever you're using your computer . . . from start to finish of your session Sidekick™ will be there . . . ready to serve. And it's as lightning-fast and compact as only Borland knows how to make it.

There's a notepad that has a full-screen editor that can time and date stamp your notes, and then save them to disk. You can even pull information into the notepad directly from the screen of your "underlying" software.

Suppose you're working in Lotus and the phone suddenly rings. Give your Sidekick a call and it pops right up over Lotus with the notepad you need. Or an appointment calendar . . . one you can never misplace.

What if you need to do a quick calculation? A keystroke instantly brings up the calculator. And the results of your calculations can even be transferred to your "underlying" software.

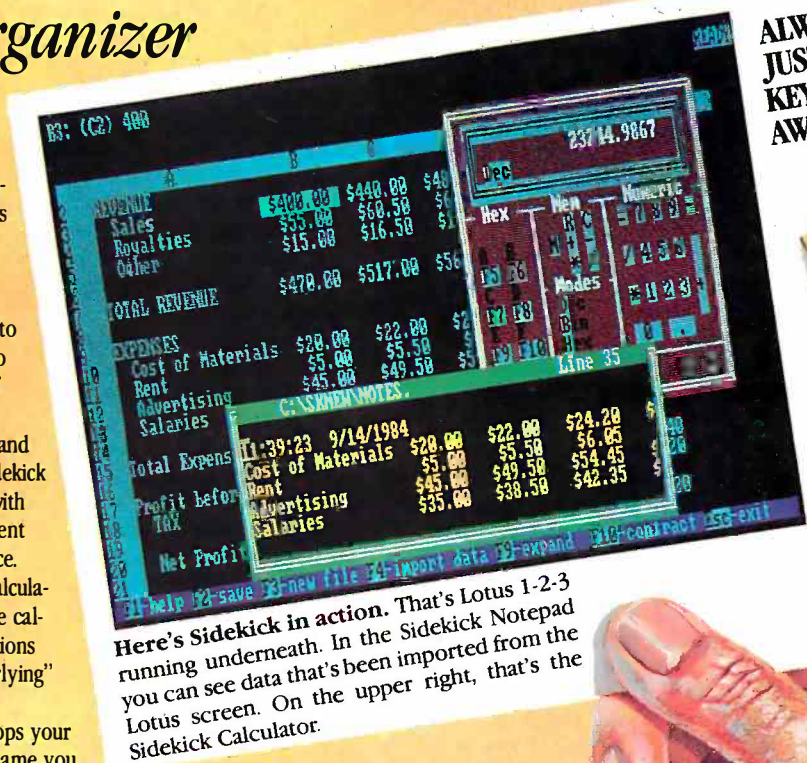
Need to make a phone call? Up pops your personal phone directory. Type in the name you want . . . and Sidekick jumps right to the phone number. Another keystroke, and the phone is automatically dialed for you.\*\*

There's lots more, too. You can move the Sidekick windows anywhere on the screen you like. And you can have as many on screen at a time as you need. There's even an on-line help window for each of Sidekick's features.

We designed it because we needed it. If you've ever been writing a report and needed to do a quick calculation,

**"IF YOU USE A PC,  
GET SIDEKICK. YOU'LL SOON  
BECOME DEPENDENT ON IT."**

Jerry Pournelle, BYTE



ALWAYS  
JUST A  
KEYSTROKE  
AWAY . . .

*Here's what  
you've been  
looking for!*

INTRODUCTORY OFFER

**\$49.95**  
Copy Protected Version

Here's Sidekick in action. That's Lotus 1-2-3 running underneath. In the Sidekick Notepad you can see data that's been imported from the Lotus screen. On the upper right, that's the Sidekick Calculator.

or jot down a note, then you need Sidekick, too.

\*\*Only with Hayes Smartmodem and compatibles.

**WHETHER YOU'RE RUNNING  
LOTUS, WORDSTAR, dBASE OR WHATEVER . . .**

**JUST A KEYSTROKE  
AND A SIDEKICK WINDOW  
OPENS . . .**

- A CALCULATOR
- A NOTEPAD
- AN APPOINTMENT CALENDAR
- AN AUTO DIALER
- A PHONE DIRECTORY
- AN ASCII TABLE

**YOU CAN ORDER YOUR COPY OF SIDEKICK™ TODAY!**

For VISA and MasterCard orders call Toll Free **1-800-255-8008** in California **1-800-742-1133**

(lines open 24 hours, 7 days a week) Dealer Distributor Inquiries Welcome 408-438-8400

**SIDEKICK™ \$49.95**  
Non-copy protected  
Version: \$79.95  
(Plus \$5.00 shipping and handling.)

Check  Money Order

VISA  MasterCard

Card # \_\_\_\_\_

Expiration Date \_\_\_\_\_

Please be sure your computer is an IBM PC, AT, XT, jr., or true compatible!

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY/STATE/ZIP \_\_\_\_\_

TELEPHONE \_\_\_\_\_

California residents add 6% sales tax. Outside U.S.A. add \$15.00. (If outside of U.S.A. payment must be by bank draft payable in the U.S. and in U.S. dollars.) Sorry, no C.O.D. or Purchase Orders.

S H15

Circle 43 on inquiry card.



**BORLAND**  
INTERNATIONAL

Borland International  
4113 Scotts Valley Drive  
Scotts Valley, California 95066  
TELEX: 172373

\*PC jr. runs non-copy protected version only.

## Osborne Introduces Vixen, Emerges from Chapter 11



Osborne Computer Corporation, which expected to emerge from Chapter 11 protection by this month, introduced the Vixen portable computer. The Vixen features a 7-inch amber display, two 390K-byte disk drives, 64K bytes of RAM, a 4-MHz Z80A microprocessor, and parallel and RS-232C serial ports. Bundled with the system are the CP/M 2.2 operating system, WordStar 3.3, SuperCalc 2, MBASIC, and Desolation, a game program. Also included are Osboard soft-

ware, for drawing graphics, Media Master, to transfer information to MS-DOS format disks, and Turnkey, to change some system features.

The Osborne Vixen is priced at \$1298. Optionally, an external 10-megabyte hard disk may be added to the Vixen; with an interface card, the hard disk is \$1498. For more information, contact Osborne Computer Corp., 42680 Christy St., Fremont, CA 94538. (415) 490-6885.

Circle 557 on inquiry card.

## Quadram Adds Software Line

Quadram's new Quadsoft software line includes word-processing and database-management programs for the IBM PC and compatibles, as well as add-on products for Lotus 1-2-3 and Symphony. All are based on products developed by XO Software and Select Information Systems.

Freestyle, an outline-based word processor, has drawing capabilities and a spelling checker. Its "outline zoom" lets you organize many pages of text in an outline format on a single screen. Freestyle costs \$295 and requires MS-DOS 2.0, 192K bytes of RAM, and two double-sided disk drives.

A retrieval system, 4-1-1 creates a word database or index of documents composed with word processors, such as WordStar. 4-1-1 is \$149 and requires 256K bytes.

The Executive Organizer uses icons to select note pad, alarm clock, calendar, phone directory, and calculator functions. It also serves as an environment to execute, print, or erase other files. The Executive Organizer is \$99 and re-

quires 256K bytes of RAM. Also released were Select Write: Word Processing 101, a \$99 menu-driven word processor; Bilingual, a \$395 Spanish/English word processor; and a line of Expert Writing Guides (\$50 each).

The Data Base Manager is a menu-driven database-management system that can be linked to many spreadsheets and word processors. It costs \$295 and requires only a 128K-byte IBM PC with at least 360K-byte disk capacity.

For users of Lotus 1-2-3, the Key to Data Management, \$99, provides additional menus and options to make functions easier to implement. Symphony users can buy a \$129 Report Generator and a \$119 Starter Kit that contains sample templates.

Other new items are the Investment Strategist, for \$295, the Tax Strategist, also \$295, and the Deadline Manager, a project-management system for \$149.

Contact Quadram Corp., Quadsoft Division, 4355 International Blvd., Norcross, GA 30093, (404) 564-1975. Circle 558 on inquiry card.

## TeleVideo Personal Mini Links PCs, Workstations



The Personal Mini PM/4T is a four-user version of TeleVideo's multiuser IBM PC-compatible computer. The PM/4T features 80186 and Z80A microprocessors, a 20-megabyte hard disk, a floppy-disk drive, and a 20-megabyte tape-cassette drive. TeleVideo's InfoShare operating system for the Personal Mini can run many multiuser programs or execute most single-user MS-DOS and PC-DOS programs.

The PM/4T can be linked to four personal computers or workstations, including IBM PCs or compatibles or

TeleVideo's PM Workstation. Two RS-232C serial ports, four RS-422 serial ports for workstations, and one parallel printer port are provided.

The TeleVideo PM/4T will cost under \$6000; a 16-user version is about \$9000. A \$99 interface card is required to connect each personal computer to the system; PM Workstations cost \$1995 each. Contact TeleVideo Systems Inc., 550 East Brokaw Rd., San Jose, CA 95112, (408) 971-0255. Circle 559 on inquiry card.

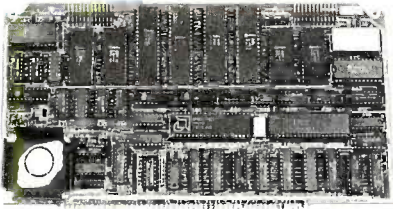
(continued)



## INPUT/OUTPUT TECHNOLOGY, INC.

25327 Avenue Stanford, Unit 113, Valencia, CA 91355 (805) 257-1000

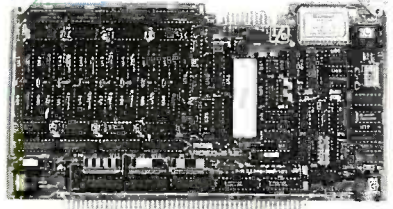
### Uncompromising Additions to your S-100/IEEE-696 BUS



#### DUAL GPIB-488 INTERFACE BOARD

A Stand-Alone, Independently Controlled Dual Channel IEEE-488 I/O Processor. Interface Activity Modes for Controller-in-Charge, Controller Assigned or Terminal Bus Slave, and all Interface Functions are handled transparent to Host System CPU through an on-board CPU and DMA controller. User Friendly operation.

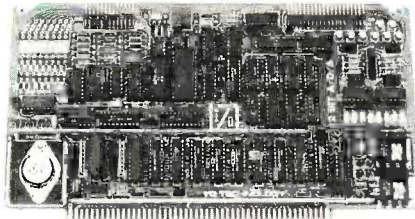
A&T, P/N 52748-800-102



#### RGB COLOR GRAPHICS BOARD

Programmable resolution up to 512 x 512 pixels with 4 local video planes and on-board graphics processor. Color mapper allows 16 colors from a palette of 4096. Light pen input. Plus more ...

A&T, P/N 52748-300-101

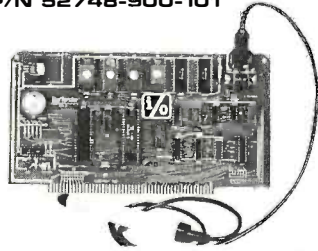


#### 12-BIT A-D-A CONVERTER BOARD

**8 Channel A-D:** 12 microsec. Conversion, 50KHz Sample Rate, Programmable Gains, Offset and Diff./Single Modes.

**8 Channel D-A:** 2 microsec. Settling, Bipolar V or Unipolar I Output. Programmable Reference Levels, Dual-Ported Channel Refresh RAM. **16/8-Bit Data Transfers** via I/O or Memory Mapped

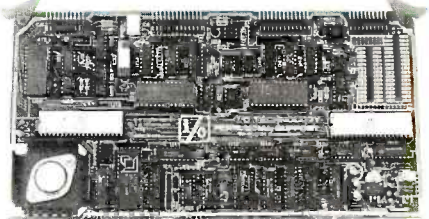
A&T, P/N 52748-900-101



#### BAR CODE PROCESSOR BOARD

The BarTender is a stand-alone I/O Processor that reads and prints most common Bar Codes. Includes bi-directional reading, wand interface, clock/calendar with battery. Extensive documentation and software.

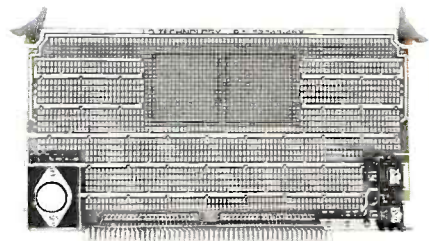
A&T, 52748-500-101 Without Wand  
A&T, 52748-500-201 With Wand



#### PERIPHERAL SUPPORT BOARD

Two Serial SYNC/ASYNCR Ports with RS-232, TTL or Current Loop Outputs, three 8-Bit Parallel Ports, three Timers, Real Time Clock/Calendar and Response Programmable Interrupt Controller. Small Proto Area with +5 and ±12v.

A&T, P/N 52748-150-101



#### MULTI-PURPOSE PROTOTYPING KIT

Industrial Quality with Plated-Thru holes for Wire-Wrap or Solder projects. Complete with +5, ±12v Regulators, Bus Bar, Filter Capacitors, and Manual.

P/N 52748-450 Circle 193 on inquiry card.

ALSO AVAILABLE: MULTI-FUNCTION I/O BOARD, SMART PROTOTYPING KIT, 128Kx8/64Kx16 STATIC RAM MODULE

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

## Graphics Products for Image Capture and Enhancement

**A**T&T Consumer Products announced three graphics products for the AT&T 6300 or IBM PC: a high-resolution color graphics card, an image capture card, and a NAPLPS videotex decoder card.

The Video Display Adapter has two color graphics modes: a 256- by 256-pixel mode displaying 256 colors from a palette of 32,768 colors and a "high spatial-resolution mode" showing 512 by 256 pixels in 8 colors with two intensity levels per color. The card can be used to display 80-column text on an analog RGB monitor; a composite output is also provided.

The Image Capture Board is a high-resolution frame grabber and buffer that can



capture, digitize, and display images from a composite video signal source. The card captures images with a resolution of 256 by 256

pixels in 32,768 colors, storing the image in 128K bytes of RAM.

The Personal Computer NAPLPS Decoder can be

used with any AT&T or IBM-compatible computer to display color images encoded in the North American Presentation Level Protocol Syntax (NAPLPS). The card can also be used to emulate AT&T's Sceptre terminal.

These products can be purchased only by other manufacturers. The Video Display Adapter will be available by mid-1985 for about \$500. The Image Capture Board, scheduled for a December release, will cost about \$1000. The NAPLPS card, available now, is about \$600. For further information, contact AT&T Consumer Products, 5 Wood Hollow Road, Parsippany, NJ 07054, (201) 581-3000.

Circle 560 on inquiry card.

## Security System Includes Speech Synthesizer and Software

**T**he Peace of Mind Master Controller is a complete home security system for use with the IBM Personal Computer. The controller is a standard IBM PC expansion card with 16 inputs for sensors or wireless receivers, 8 relay outputs for alarms or speakers, and control ports for up to 16 lights or electrical appliances. Also included is a speech-generation system with 300 words on disk.

The system can be connected to a number of optional devices. Planned for January release is the Communicator board with an auto-dial/auto-answer 300/1200-bps modem that can make unattended voice or data phone calls. Other devices include a universal power supply, infrared wireless transceivers, smoke and glass break detectors, and medical alerts.

The expansion card costs \$695 and comes with security software as well as bun-

dled word processing, spreadsheet, and database programs. The firm estimates that a typical hard-wired system will cost \$900,

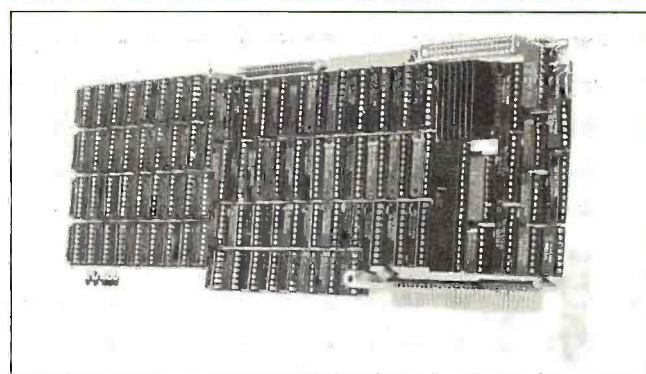
while a system using a wireless transmitter and receiver will cost from \$1200 to \$1500. Contact Gestalt Technology, Suite 4, 874 Henry

Street, Arnold, CA 95223, (800) 235-6646 ext. 599; in California, (800) 235-6647 ext. 599 or (209) 795-3157. Circle 561 on inquiry card.

## Expansion Card Adds 80286 Processor to IBM PC

**T**he PC-286 is a coprocessor card for the IBM PC that replaces the PC's 8088 processor with a 4-, 6-, or 8-MHz Intel 80286. The card also includes 256 to 640K bytes of memory and a socket for an optional 80287 math coprocessor. An optional 512K-byte piggyback card can be added.

A 40-pin connector from the expansion card is plugged into the 8088 socket after the processor is removed; the 80286 then controls the PC bus. An on-board EPROM allows the system firmware to be copied into the 80286 local memory to provide faster program execution. All available software and expansion



cards should operate normally with the PC-286. Under software control, the 80286's hardware protection, virtual memory support, and 16-megabyte address space can be used.

The PC-286 card with a

4-MHz 80286 and 256K bytes of RAM costs \$2395. Contact Seattle Telecom & Data Inc., 2637 151st Place NE, Redmond, WA 98052, (206) 883-8440.

Circle 562 on inquiry card.

(continued on page 432)

---

Executives' Review & Guide to

# SMARTWARE™

For Personal Computer Success

ONEDOLLAR

VOLUME M1

---

---

|                                                                             |   |
|-----------------------------------------------------------------------------|---|
| Database flexibility and power . . .                                        | 2 |
| Easy to use Revelation™ front end                                           | 3 |
| Mainframe data to your PC . . . and back                                    | 4 |
| Graphics that improve your 1-2-3™ presentation                              | 5 |
| Word processing makes major advances<br>Your ideas remembered and retrieved | 6 |
| Your PC can run like an XT<br>Backup that's more — real flexible storage    | 7 |
| Software selection for results                                              | 8 |

---

## Full Strength, Big League, No Holds Barred Database. . .

### REVELATION™

IBM PC/XT/AT and 3270PC

\$950

Revelation is the most significant DBMS product to appear on the IBM Personal Computer series! It has incredible depth and power, and yet us ordinary persons can use and understand it. You just cannot outgrow the system. The limits of Revelation are determined by the power of the PC or AT, not the software.

What do you get? This is a full relational system, not just an application. In addition to complete relational DBMS file creation and management, Revelation includes a full Basic Compiler called R/Basic, PC-to-PC and PC-to-mainframe communications utilities (R/Net), text editor (R/Edit), full selective copy function (R/Copy), an applications code generator (R/Design) that allows you to build and use custom data entry screens and reports with a minimum of effort, and a English-like report writer and general purpose retrieval language that can be used for both repetitive and ad hoc reporting or inquiry (R/List). The R/Maker applications generator and Menu system is also available for Revelation that creates a menu-oriented easy to learn environment for us less experienced users.

Where did Revelation come from? There are two operating systems that have been fighting the last 10 years for market share in the mini and mainframe world, UNIX™ and the PICK/OS™. Revelation is a highly extended emulation of the Pick/OS that runs under standard MS-DOS. Revelation was designed to implement business systems that can be maintained by business people, not programmers.

How does it work? First, Revelation expects you to change your mind, so you don't have to define your entire database schema at the start (we leave our "schema" in the garage). You use the data dictionary to add fields or relationships without redefining or reloading or touching the data! That's it. . . virtual fields (computed or joined on the fly) are available without creating a separate working file. You can even use this feature to access one record at a time—onscreen dynamic joins. Users of most other databases just broke into tears of joy.

Next, Revelation variable length files containing variable length records (items), each record containing a variable number of variable length fields (attributes), each field containing a variable number of variable length values, and each value containing a variable number of variable length sub-values. Say that three times fast. An example—you could have a personnel file with one field named "Children" where you record the names of each of the employees' children. Easy to do, just define the field as Multi-Valued in the dictionary and you can have *any number of entries in that field.*

You have to picture Revelation records as multi-dimensional. (There are seven dimensions, but normally you would only use three.) This concept of dimensions is real useful in business applications where you have multiple transactions (or line items) per master record. Invoices could be single records with each line item stored as a group of multi-valued fields that are associated to other fields (quantity, description price, units, extended price, etc.). Obviously this capability saves enormous amounts of disk space and simplifies your database design. There is no limit to the number of entries except that the entire record cannot exceed 65,000 characters. The files can be any size, except the entire system including all files and programs can't exceed the address space of 2.4 billion characters (if your disk is larger than that, please call us immediately).

All this is great, but is it usable? What you really need is a way to access only the data you want. Revelation has a dynamic report writer that makes it extremely easy to display or print reports. You use simple sentences like "SORT INVOICES BY CUSTOMERS WITH AMOUNT.DUE > '0' AND WITH DATE.DUE < '1/15/84' DISPLAY THE COMPANY.NAME AMOUNT.DUE INVOICE.NUMBER 'PHONE'". You would immediately get a report in customer order on your screen or on your printer that your credit department could start calling from. Not only do you get the report, but you can request that the R/Basic source code that created the report to be generated and saved for change later. . . a code generator at no extra charge!

R/Basic? R/Basic is the powerful user programming language integrated with the Revelation Database environment. You don't need to use R/Basic for standard or easy data management functions, but it is there when you begin to exceed the capabilities of the standard systems. With it you can program almost any application. It is a highly structured language that contains all the features of languages like C, Pascal, or PL/I.

Revelation completely supports the 8087 co-processor in the IBM. The 8087 can be used extensively by the Database and R/Basic to maximize the speed of the system. We recommend that you get an 8087 for maximum benefit.

If you (like us) don't want to program, Revelation has a menu and screen building system included. You do not have to learn a complex procedural language. If you want complete hand holding, see our discussion on R/Maker. Unlimited flexibility and the ability to move your files up to mini or mainframe computers makes Revelation totally without equal. We recommend Revelation for everyone who will outgrow their file handling system and is willing to spend 8 hours learning a product that they will never outgrow.



*(Revelation continued)*

**Applications:** In the beginning you create a mail list...then you use the same data to create your customer list...which becomes your accounts receivable file and your reference list and part of the data becomes your general ledger and your balance sheet and then grows into a complete business management system which you run on your hard disk which then you integrate into your local area network which grows into your national management information system which becomes the kernel for your international Euro-America management system...if you get the feeling that there is no end in sight, then you are beginning to understand the power of Revelation.

**Capacity:** Records: Limited only by disk capacity, addresses up to 2.4 Billion Bytes. Record Size: Maximum of 65,000 characters each. Fields: Maximum of 65,000 per record. Variables: Maximum of 65,000. Files: Limited only by disk capacity.

**Requires:** IBM PC/XT/AT, Columbia, Compaq, and many other compatibles. 8087 or 80287 optional and fully supported. MS-DOS or PC-DOS, 1.1, 2.x and above. 320K Bytes of main memory. 512K recommended. Requires 2 320K floppy disks or compatible hard disk.

## NETWORK REVELATION

|                                     |         |
|-------------------------------------|---------|
| Four User                           | \$1,495 |
| Eight User                          | \$2,995 |
| Twelve or more                      | \$4,995 |
| Upgrade from single user Revelation | Call    |

You need a driveway for your data, then there is Revelation—for a freeway we have Network Revelation. The best database will be available in January as a **networking, multi-user DBMS with record locking and resource sharing.** Files can be in your local PC, remote PCs, or even on a minicomputer.

Network Revelation allows files to be shared and data relationships to be established across machine boundaries. Consolidations of data from many-to-one for reports become easy. All the resources of the machines in the net become available for the database to use. Frame locking provides complete data security, with all the normal user rights and checks. What if your database is too large for the normal PC network capabilities, or if you really need a transaction oriented environment? From the freeway to the friendly skies...we have a solution. Call us for complete information.

## Revelation PLUS Ease of Development and Use...

### R/Maker™

Requires Revelation DBMS

\$175

When ordered with Revelation...

\$45

What could R/Maker do that Revelation can't? R/Maker takes you through the first 6 days of creating your application with Revelation so you can rest on the 7th (and it makes all 7 days happen in 4 hours!).

R/Maker is an **interactive menu and screen creation/update system.** It supplements and magnifies Revelation's power and completely interfaces with almost all Revelation features. You can start out with R/Maker and completely create your applications using it. R/Maker screens were designed by a graduate of the "Pong" and "Invaders" school of computer users. The fields appear in a window and you point to the fields you want on your screen. The screen is automatically created (no programming), and then you can push and shove fields and labels around like a video game to get the screen the way you want it.

With the R/Maker interface you can create systems, execute batch commands, update files, run reports, call other menus, make your own custom menus, run DOS commands or other programs such as 1-2-3 from a R/Maker menu. Besides doing all these functions, you can stack an unlimited number of program steps in a given menu choice so reports and processes happen automatically. R/Maker menus implement **complete security** so you can limit access of programs, menus and functions to those authorized. Applications and aids that take months to create are already done for you.

Want to use your favorite spreadsheet or word processor with Revelation? No problem, R/Maker includes a feature to load database information to a text file compatible with the Lotus 1-2-3™ import files. You can selectively load records from Revelation to 1-2-3™. You can use R/Maker to create files for use in your word processor.

There just is not enough space to tell you of all the capabilities that R/Maker gives you. **Order R/Maker along with Revelation and get a special price and our full guarantee.**

**Requirements:** Same as Revelation.

# Mainframe Data to Use on Your PC...and PC Data to your Mainframe!!!

## SPREADLINK™

IBM PC/XT/AT, PCjr, 3270PC

\$149

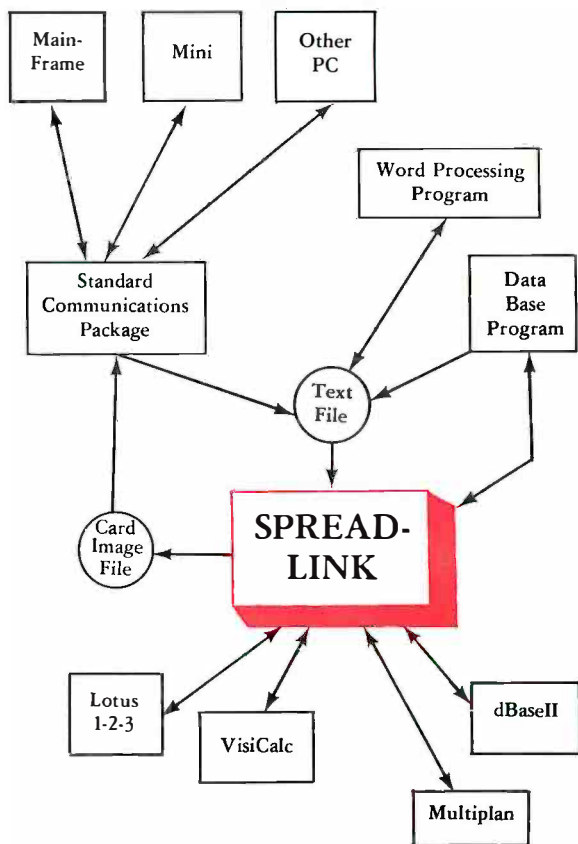
Instead of entering data by hand from external sources into your spreadsheets or databases, Spreadlink reformats your data and allows you to load your information directly into 1-2-3, VisiCalc, MultiPlan, dBase II, and many other packages, and then can convert the files back into fixed length data files (card images) to transmit back up to your mainframe. Your files can be from mainframes, commercial databases, minicomputers, other personal computers, or any application packages that create ASCII standard text files (such as word processors).

You get to preview your data, edit rows and columns with Spreadlink, and then Spreadlink automatically converts it into the right format for your application. Since Spreadlink lets you save your edit format as a command file, you can automate your reports for the next time. Spreadlink allows any mix of labels and values without any special formatting or separators... it also adjusts to column variations caused by stacking several dissimilar reports in one file. We use Spreadlink to move data from our Mini to our controller's PC for monthly reports... and it only took our controller 15 minutes to learn and start using.

### Features:

- Converts standard ASCII text files to native files for Lotus 1-2-3, VisiCalc, Multiplan, dBase II, and DIF.
- Converts files from 1-2-3, VCalc, MPlan, dBase II or any other packages that have DIF capability back into fixed format data files that can be uploaded for use by mainframe programs.
- Screen preview of your data allows you to edit out unwanted rows or columns of data. Convert only the data you need, or just take it all automatically.
- File size is only limited by the disk space available.
- No pre-editing or programming required. Reports do not need to be in columns and rows, and all occurrences of repetitive headings can be suppressed.
- Requires no installation or adaptation on the host computer end.
- Requires 128K memory, one disk drive, version 1.1, 2.x or 3.x of MS-DOS.

**Applications:** Download the last years financials from your IBM 3033. Using Spreadlink, load them to your 1-2-3 model for analysis to determine next years plan. Take expense figures out of a memo in a word processor text file and use it as input to your expense tracking model. Take the new data created and convert it into mainframe format. Communicate the data back up. Using your mainframe report writer, update the annual plan. All the personal computer operations are completely automated, no technical knowledge required.



© 1984 Smartware

# True Presentation Quality Color Graphics...

## Graphwriter™

IBM PC & XT, most compatibles

|                                       |                |
|---------------------------------------|----------------|
| Basic Set                             | <b>\$395</b>   |
| Extension Set                         | <b>\$395</b>   |
| Combination Set (Basic and Extension) | <b>\$595</b>   |
| Polaroid Palette with Combination Set | <b>\$1,995</b> |

Do you ever do really important presentations? You have probably noticed that the graphics provided in spreadsheets are just not flexible or distinctive enough. Graphwriter produces the type of slides, charts, and graphs that you have seen cost thousands of dollars. It has a built-in artist that helps you create graphics that are boardroom quality every time. It is also extremely easy to use. This is the perfect companion to your spreadsheet!

Graphwriter is planned for use by business. You can tell that the authors have spoken frequently to users. The package is planned for executives or others that are not users of computers. You can use a relatively untrained person as your central graphics department, hand out the forms in the package, and service the entire organization. You can make significant changes to the style, layout, size and orientation of all the charts. The final charts may be produced in almost any size with automatic recomposition of the chart to account for the final dimensions chosen by the user. Everything is adjustable, with nothing locked in place. Yet, the pre-done formats provide a quality chart with no user intervention other than data input. You can preview everything onscreen, and batch processing is provided for output so you can setup your plotter or printer once and run many charts at a time.

Is it hard to use? No, and you can move spreadsheet data as DIF or SYLK files directly in, or enter the data in the fill the blank data entry screens. High quality output

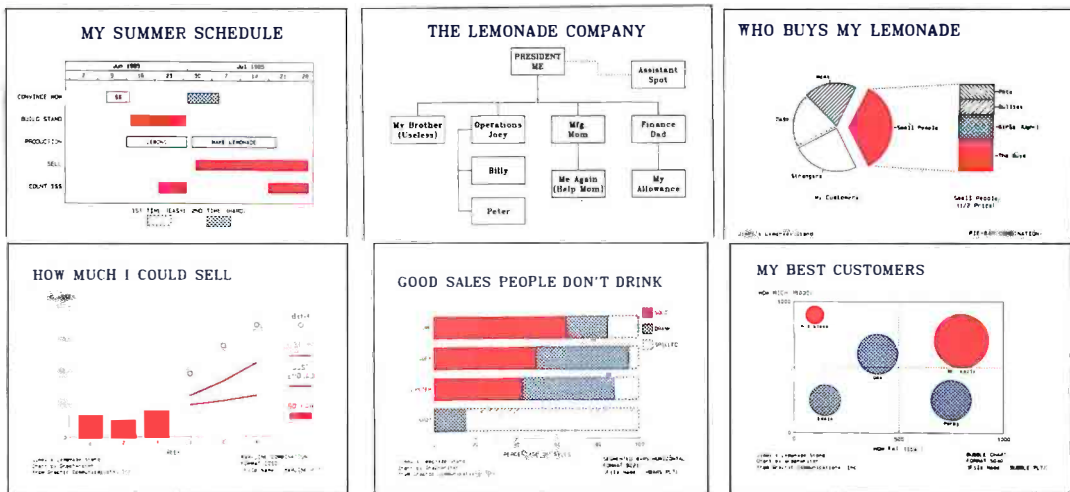
on a wide variety of plotters and printers, low level of effort on your part for the input side. This is the graphics package that every organization needs... you know, you could set up an interesting service business with Graphwriter. We have tested them all, and this is the graphics champ.

### Features:

- Basic Set has 11 Formats: Column Charts; Bar Charts; Segmented Bars, vertical and horizontal; Clustered Bars, vertical and horizontal; Pie Chart with 1-4 pies on a plot; Line Charts; Scatter Plot (regression); Bar-Line Combination; Text/Word Charts.
- Extension Set has 12 Formats: Gantt Chart; Organization Chart; Bubble Chart; Table Chart; Pie-Bar Combination; Surface Line Chart; Line-Table Chart; Double Stacked Bars; Grouped Bars; Range Chart (bars); Paired Bars; Horizontal Bars with inset labels.
- Provides 8 different character fonts. Supports multiple graphs on page, fast plotting for rough drafts, totally flexible chart composition including special options for overhead projection and 35mm slides formats.
- Does pen sorting for use with plotters, allows you to use unlimited colors. With Polaroid Palette provides up to 13 colors on slide from choice of 72 colors.

**Requires:** IBM PC, XT, AT, or clone with MS-DOS 2.x or above. Needs 192K (256K with Palette), 2 double-sided disk drives. Can be used with IBM monochrome monitor for plotter output only. With color/graphics board supports plotters, dot matrix printers, Palette.

**Supports:** Pen Plotters: IBM XY749; HP 7220, 7470A(opt. 001), 7475, 7550; Mansman Tally Pixy; Calcomp M84; Sweet-P™ Six-Shooter. Polaroid Palette: The Polaroid Palette attaches to a serial port and makes slides or prints directly. Call for more information on this accessory. Dot Matrix Printers: IBM Graphics printer; Epson MX, RX, FX; Okidata 82, 83, 92 and 93 w/graphic proms.



## Hard Disk Management and Security System for your files.

4-1-1™

IBM PC/XT/AT with hard disk or Kodak \$149

How many documents do you have stored away on your hard disk? Can you find a specific proposal or letter quickly... or is it one of those never ending searches for truth, justice, and the "one I wrote last week?" 4-1-1 is the answer! It is a full-text information retrieval system. You can quickly access all information created by any popular word processing package (or any package that creates text files—that includes documents loaded from public data bases or your mainframe.) You can find any document within two seconds no matter how many files are on your disks! And as your hard disk fills up, you can archive files to floppies and keep a complete index of where they are.

4-1-1 indexes every important word in every document and places it in a special database for later retrieval. Sounds like it should take lots of disk space, but you select how much total space 4-1-1 can use and it automatically drops the high frequency words. All you have to do is remember some of the words or content of the document and you can locate it. Not enough? You can find documents by date, by combinations of words and dates, by logical AND/OR using words or ranges of dates and even use wild cards (\* and ? just like DOS.). 4-1-1 lets you ask questions like "give me a list of all the letters I wrote to people named Brown and Smith or Elroy that I mentioned the property on Lake Street in and wrote between January and July of this year.

Does this miracle take a lot of effort on your part? No, and it is really easy to use. All the indexing can be done in batches and can also run as a background task. As if all this isn't enough, 4-1-1 is also an archival system. When you transfer files from your hard disk to floppy, 4-1-1 keeps track of which files are on which floppy. You needn't trash up your hard disk with all last month's headaches. This is all integrated with the rest of the system, so you can keep many years worth of data indexed! To finish you off, 4-1-1 not only makes your documents accessible, they also included a two key Public Key Encryption System to encode your documents so that only authorized persons can read them.

4-1-1 has enormous benefits for all of us in today's business environment. As your number of files grows, your capability to retrieve in two seconds becomes more important, ability to archive old files is required, and the locking away of company secrets becomes a necessity. This is one of the most important new products we have seen. 4-1-1 addresses the weaknesses created by the strengths of computers in your business.

**Requires:** 256K memory, MS-DOS 2.x or above, hard disk.

**Applications:** Your legal office has been selected to defend a major client from a government anti-trust case. Since the client has all their correspondence on 4-1-1, you are able to show every document requested in minutes. You can research the companies files for every memo, proposal, letter sent to others in the industry. Using FreeStyle, you prepare a brief stating your findings, and have representative sections printed in context in the brief. The government is shown they have no basis, and the case is dropped.

You have been doing major research for months using Dialog and other public databases. Every file that you download, you use 4-1-1 to index and archive to floppies. Since this is original research, you encrypt every file with 4-1-1 to prevent industrial theft. Using Freestyle, you are able to show your flowcharts on the pages with the documentation drawn from your research. At print time, everything is merged properly and then indexed with 4-1-1.

## Beyond Word Processing... A Complete Set of Writing Tools!

FREESTYLE™

IBM JR, PC, XT, AT, compatibles \$295

Right in the middle, we mean 25 pages down and no where to go, you decide to completely reorganize you entire business plan, paragraph by paragraph! With other word processors you would go through real pain—not with Freestyle! You'd just "Zoom" out to the document "Outline," change the outline order and the document text moves. It's a totally new cut at word processing.

This is an integrated set of tools for working with words. Integral with the Freestyle Word Processor are: Draw (line drawings right on the screen); Outline (a master outline that controls the entire document); Mail List Merge; Superspell; the Teach Tutorial (online and interactive). Don't forget the "Attach" feature that lets you attach or insert other files at time of printing, and on screen bold and underline, math and engineering symbols, foreign and Greek characters. Full "boilerplate" and glossary libraries to speed your document creation. We haven't mentioned the online Expert Writing Guides. To speed up your filling and finding, it has a direct link to 4-1-1. And to top it off, you have hundreds of online help screens. We just don't have room to tell you all the unique features.

Great features, but how is it to use? Fast ("real time" justification at 160 words per minute)... and it works with you the way you like to write. You can start by making an outline, and then "zoom" to each area and fill in with text, or attach another file there for printing, or you can just start typing. You can put a diagram in the middle of the page; boxes, charts, graphs, arrows, or symbols. As you finish a section, you can have the Superspell check your words immediately. If you forget how to use any feature, you can have the online "Teach Tutorial" show you how again. There is nothing to get in the way of your creativity.

This is a sophisticated writing tool that goes beyond simple word processing... we feel that this is the perfect package for offices, anyone that does heavy document preparation and assembly, or any word intensive professional. It also is a good choice for beginners in word processing, and one that you won't outgrow!

**Requires:** IBM PC, PCJr., XT or AT with MS-DOS 2.x or above, 192K memory, 2 drives. Full hard disk support. Networkable.

© 1984 Smartware

*Your PC Acts Like an XT,  
But the Warranty is Better!*

## TeamMate 1000 Series Winchester Subsystems

|                                                 |                |
|-------------------------------------------------|----------------|
| 10MB Internal System                            | <b>\$1,495</b> |
| 10MB External System                            | <b>\$2,095</b> |
| 10MB/3.3 Kodak                                  | <b>\$2,795</b> |
| 32MB External System                            | <b>\$3,395</b> |
| IBM Autoboot ROM<br>(only required on older PC) | <b>\$50</b>    |

Have a PC, want an XT? Wish you could run DOS 2.0 packages that require a hard disk? Have we found a good answer for you! The TeamMate Systems operate under DOS 2.0, install in just minutes and are 100% compatible... no software drivers, no patches to the system, your PC works just like an XT. This means compatibility with all hardware peripherals and software that work with the XT. Moreover, it means that you can upgrade any PC and many IBM compatible computers to an "XT Look-alike." After you install the controller card your PC boots from the hard disk just like an XT (if you have an early 64K motherboard PC you will need the new ROM). TeamMate has been around since 1979 making disk controllers for computer manufacturers, and they know how to make the products right.

We don't know which combination is the best! Either a Kodak superfloppy combined with the 10Mb in its own cabinet, or the 32MB external and a Kodak internal in your system. Either way, you get the maximum flexibility and utility. Use the Kodak to hold large software systems, backup the hard disk with just 4 disks, or for archiving with software like 4-1-1.

The internal hard disk system is a special low-power model that really uses less power than a floppy drive. You don't need an external power supply. All the drive systems come complete, nothing else to buy. They all feature ECC assured error free storage and have the TeamMate proprietary chip set that gives unsurpassed reliability. They also are all FCC Class B approved and U.L. listed. All TeamMate products carry a 6 month full replacement warranty, and they will ship a swap-out unit within 24 hours during the first 90 days!

*You Get 2.78MBytes Formatted  
Storage on a Diskette!*

## TeamMate Kodak® 3.3MByte Half-Height 5¼" Disk Drive Systems

|                                                      |                |
|------------------------------------------------------|----------------|
| For IBM PC, XT, or compatibles                       |                |
| Kodak 3.3MB Internal                                 | <b>\$895</b>   |
| Kodak 3.3MB External                                 | <b>\$1,295</b> |
| Kodak Double 3.3/3.3MB External                      | <b>\$1,995</b> |
| Kodak Diskettes, pack of 5                           | <b>\$75</b>    |
| Four Drive Daisy Chain Cable                         | <b>\$50</b>    |
| <b>XT Special,<br/>Kodak and one ½ high Teac Kit</b> | <b>\$1,095</b> |

This is the low cost alternative to a Winchester disk, and it makes a great hard disk backup. The Kodak drive has 3.3 megabytes of unformatted storage, 2.78MB after formatting (over twice that of the AT floppy drive). It provides the ruggedness of floppy technology with the accuracy and capacity of a hard disk.

The Kodak is a half high drive, and TeamMate has provided their special short controller card that will fit a PC, XT or IBM Portable and replaces your standard floppy controller. You can read standard 360KB IBM diskettes, so you really get double duty from these drives. Unlike tape drives, the Kodak drive is an active direct access storage device. The units read and write twice as fast as a normal diskette. With their sturdy design, they are perfect for adverse conditions. Since you can remove the disk and carry it just like any other diskette, it fits into your existing storage systems.

There are lots of ways to use this drive. You can add a 10MB hard disk later to the external Kodak. Owing to the smaller power supply in the IBM PC, we do not recommend adding both a ½ high hard disk and the Kodak internal to a PC. It's OK to put almost any combination in an XT. You can replace the PC power supply with an XT supply if you want—call us for a price on the replacement. Our Smartware XT Kit includes everything you will need to replace your full-size floppy drive with a half-height standard floppy and the Kodak... probably the best of all worlds combination.

This drive carries the same 6 month warranty as the other TeamMate products, and the Kodak logo. You know who is responsible for this one!

## SMARTWARE, INC.

Smartware / 'smart - , waar / 1: The entire set of software that is selected and tested to work together. 2: Integrated software for office automation. 3: National software service company specializing in the corporate market place.

## “When the Wind Blows, Even Turkeys Can Fly!”

(Martin Dean, Chairman of Select Information Systems)

Have you noticed all the Turkeys falling out of the sky recently? There are thousands of packages available for your personal computer, but you cannot browse through software the way you could a book. How can you be assured that those big birds aren't going to fall on you? Are you going to get the software you need, not just a "good deal"?

The Smartware staff spends man-years surveying, testing, and selecting the products that we recommend to you. Our experts are here to support you and answer those questions that always come up. Most important to you, we are users, not authors. Your success, not the software's, is our concern.

## Can Success Be Guaranteed? Yes!

We have examined most the business software and many of the accessories for the IBM Personal Computer Series in the market. We picked only the best. That's why we can give your company the best guarantees, two of them.

First, in addition to the manufacturer's normal warranty we provide a **30 Day Full Replacement Product** guarantee. If the products do not perform to manufacturer's specifications you may return the item for full replacement during the first 30 days after you receive the product. Second, Smartware's **Satisfaction Guarantee**. You must be *totally satisfied* with your purchase. If not, you may return it for full refund within 30 days . . . no questions asked! When you order from Smartware, you order success. We guarantee it. (These guarantees apply only to products featured and recommended by Smartware in this set of reviews and in our current 42 page set of Reviews—call for your copy today.)

## Smartware Corporate Volume Purchase Plan

Smartware has been supplying corporate, institutional, and government customers with their mini-computer and micro-computer software needs since 1981. Our over 5,000 Volume Purchase Plan customers include the Fortune 500, major accountancy firms, the military, and even the Houses of Congress.

The Smartware Corporate Volume Purchase Plan lets you buy all your software and accessories at greatly reduced prices (based on your volume), and receive the support you require. We also let your employees buy for their own use at the same low prices and count their sales toward your volume.

The key benefits to your company and yourself are:

1. Both employee and company benefit from automatic price improvements. All products are included. Even software not recommended by Smartware can be provided on the plan.
2. **Product Research.** We support your special requests. A staff researcher/analyst is assigned to each corporate account to locate products you need—large or small.
3. **Purchasing control.** Our higher volume customers receive company personal computer demographics profiles on a yearly or quarterly basis. Call for details on our *Smartware Corporate Services*.
4. **Exclusive Customer Identity.** You are an individual to us. All our clients are assigned a unique ID number and we maintain a complete profile of every user on our online database. We track your orders, your requests, and your calls to assure you of the best personal service available.

### 42 page Review & Guide

For a free copy of our 42 page  
*Software Review and Guide*  
return the enclosed card.  
If the card is gone,  
call or write us  
and ask for our latest  
*Review & Guide*

SMARTWARE™

557 Howard Street  
San Francisco, California 94105  
(415) 974-1500  
Order Line: 1-800-SMARTWARE

© 1984 Smartware

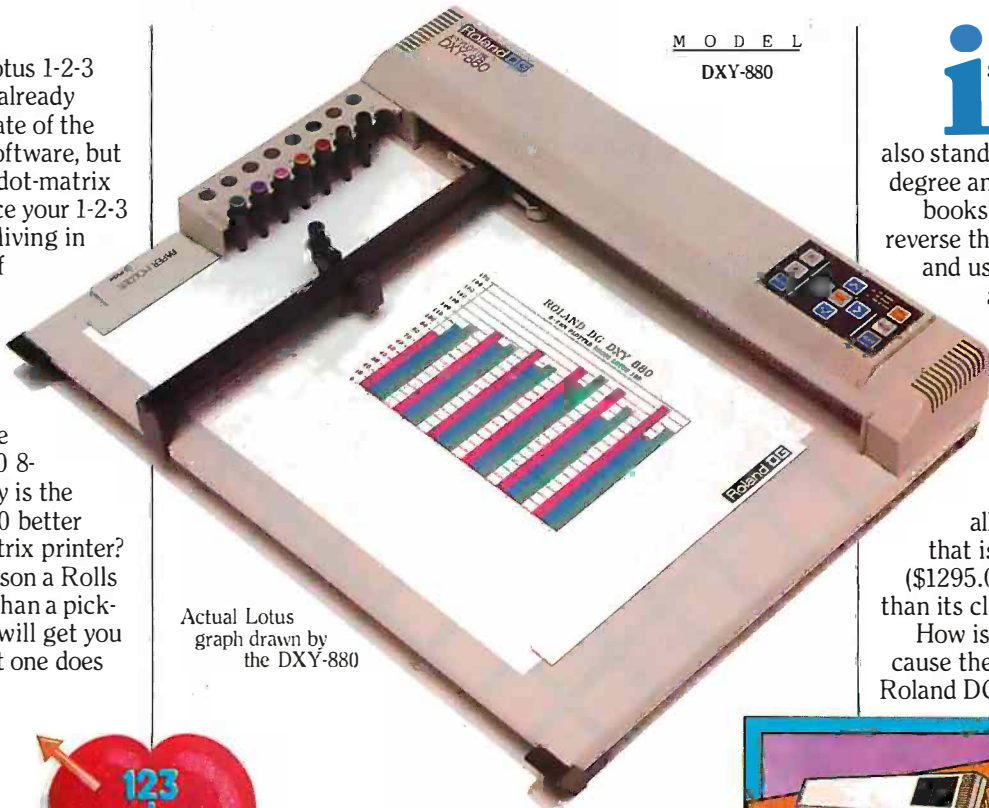
# Make 1-2-3 Look Like 1-2-3½

**i**f you're a Lotus 1-2-3 user, you're already using the state of the art in business software, but if you're using a dot-matrix printer to produce your 1-2-3 graphics, you're living in the Stone-Age of computer graphics.

Produce outstanding 1-2-3 business graphics with the Roland DXY-880 8-Pen Plotter. Why is the Roland DXY-880 better than any dot-matrix printer? For the same reason a Rolls Royce is better than a pick-up truck—both will get you to the dance, but one does it with so much more style.

The Roland DXY-880 produces high-quality business graphics in eight different colors on standard 8½" x 11" or 11" x 17" paper, and draws with a lightning quickness and accuracy that can't be matched by any artist. And because the DXY-880 emulates the Hewlett-Packard graphics language, it has at its disposal hundreds of business graphics and CAD/CAM software packages.

If you do a lot of group presentations, you'll like the fact you can easily produce instant overhead projection graphics just by using acetate instead of paper.

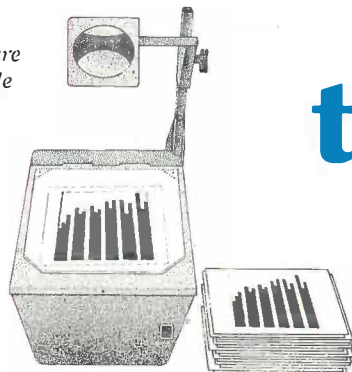


MODEL  
DXY-880

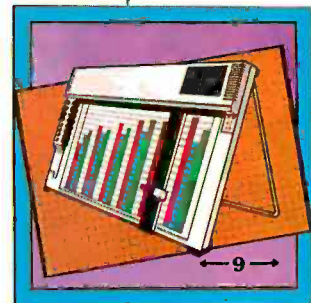
Actual Lotus  
graph drawn by  
the DXY-880



**L**otus 1-2-3 and Roland DXY are very compatible



**d**raw your graphics on acetate for instant projection presentation



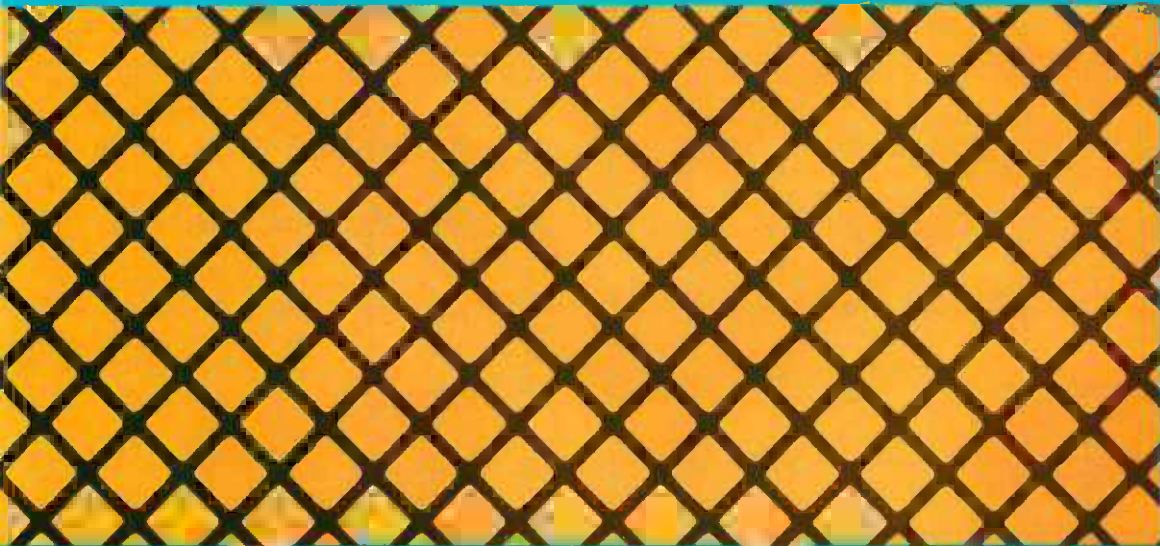
**t**he DXY can even work on a 9 inch shelf.

**i**s limited desk-top space a problem? The DXY-880 also stands up to run at a 60 degree angle—perfect for a bookshelf. You can even reverse the plotting process and use the DXY-880 as an input device by activating the built-in multi-speed digitizer. And the best part of all, is that the DXY-880 does all of this for a price that is unbelievably low (\$1295.00—hundreds less than its closest competitor). How is this possible? Because the DXY-880 is from Roland DG—the new kid on

the computer peripherals block (who's out to make a name for itself by packing innovation, performance, and low-price into every product). Don't settle for 1-2-3 when you can have 1-2-3½ with a DXY-880 Plotter from Roland DG. Ask for it at fine computer dealers everywhere. Roland DG, 7200 Dominion Circle, Los Angeles, CA 90040 (213) 685 5141.

Lotus and 1-2-3 are trademarks of Lotus Development Corporation. Hewlett Packard is a trademark of Hewlett Packard. Roland and Roland DG are trademarks of Roland Corporation.

**Roland DG**



## **HELP THEM READ BETWEEN THE LINES.**

To make a powerful presentation, you should sit in the back row.

Because when you put yourself in the place of your audience, you see that what's simple to you, isn't to them. To help people follow your thinking, you need strong, clear graphics.

You need Graphwriter. The graphics software that brings you closer to that guy in the back row. Graphwriter puts more easy-to-customize charts at your fingertips than any other graphics package.

It designs, labels, and previews your chart on the screen, automatically. If you like it, plot it. If not, fix it. In seconds.

You don't have to bend over backwards to reach your audience. Reach for the software built to bring them to you. Before your next presentation, get your hands on Graphwriter at ComputerLand, Entre, or your local computer store. Or call 617-890-8778.



**FORMATS**

text/word  
vertical column  
stacked column  
clustered column  
horizontal bar  
stacked bar  
clustered bar  
pies (1-4)  
proportional pies  
line  
scatter plots  
bar-line combination  
Gantt  
organization  
bubble  
table  
pie-bar combination  
surface line  
stacked line  
line-table  
double stacked bars  
range  
paired bars  
3D horizontal bar

**FLEXIBILITY**

text justification  
variable font sizes  
variable font colors  
22 font styles  
adjustable bar widths  
pie rotation/placement  
unequal line lengths  
8 line types  
5 frame options  
8 fill patterns  
axes labels (\$,% ,x)  
log/semilog scaling  
multiple curve fits  
floating comments  
vertical page plotting  
multiple plots per page

**EASY-TO-USE**

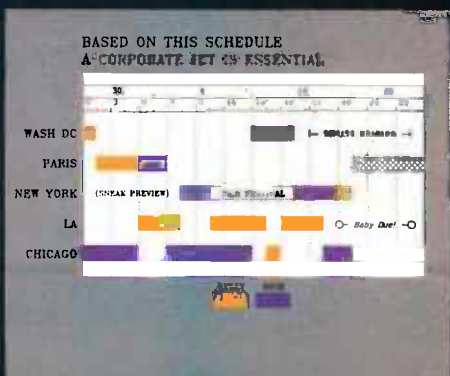
pre-designed formats  
chartbook  
input forms  
1-2-3® DIF® access  
Multiplan® file access  
on-screen help messages  
chart preview  
"built-in artist"  
batch processing  
chart/template storage

**OUTPUT OPTIONS**

paper  
transparency  
35mm slides  
Polaroid Palette™

**COMPUTERS**

IBM PC, XT and AT®  
DEC Rainbow®  
Tandy 2000®  
HP 150®  
NEC APC®  
Burroughs ET2000®  
Fortune Systems®



# Graphwriter®

**THE ART OF PERSUASION.™**

Circle 169 on inquiry card.

Graphic Communications Inc.  
Waltham, Massachusetts 02254  
617-890-8778

## Conducted by Steve Ciarcia

### INTERFACING

Dear Steve,

I built your September 1981 speech-synthesizer project for my 6800-based self-built computer, but I can't get it to work properly. The problem is, of course, interfacing.

I connected the  $\bar{A}/R$  line to  $\bar{I}RQ$ , the STB line to  $R/\bar{W}$ , and the  $\bar{E}NABLE$  line to  $\bar{B}OARD\ SELECT$ . On power-up, the board lets out a single phoneme and holds it. I ran my program, and the board fell silent with the computer waiting for a return from interrupt. Where have I gone wrong?

Let me fill in some details. I am using the 74121 pulse extender. The board is

connected to a parallel I/O port located at 7000 hexadecimal. I know that the LM386 audio amp works and that data can be fed to the SC-01 chip. The following story illustrates that.

When I first wired the board, I connected  $\bar{E}NABLE$  to GND,  $\bar{A}/R$  to  $\bar{I}RQ$ , and STB to  $R/\bar{W}$ . Powering up and typing on the keyboard without running my program produced a variety of sounds. Running the program silenced the board.

I thought maybe it was the STB,  $\bar{A}/R$ , or  $\bar{E}NABLE$  line, so I rewired it so that I could try all possible combinations (for example,  $R/\bar{W}$  to STB and  $\bar{S}T\bar{B}$ ) but with no success. With the board wired as I mentioned at the start of my letter, I get only a "WAAA..." at power-up.

The driver program is simple. I load some text at 8000 hexadecimal. The program sets up that funny-looking ricochet reset, loads the first data byte and sends it to 7000 hexadecimal, and then waits forever with the computer silent. Running the program ends the "WAAA..." (sounds rather Zen, doesn't it?).

GARY ODOM  
Tokyo, Japan

*Your method of interfacing the Sweet Talker to your 6800 computer has several problems. Let's first consider the hardware.*

*The SC-01 chip is a "slow" device. The data lines must be held stable for at least*

*(continued)*

Listing 1: A driver for the speech synthesizer.

```

1 NAM SPEECH
2 * UNTESTED TEXT-TO-SPEECH DRIVER
3 *
4 9000 ORG $9000
5 8000 TEXT EQU $8000 TEXT STARTS HERE
6 F000 SPEAK EQU $F000 PIA PORT
7 C000 MDOS EQU $C000
8
9 9000 7F F0 01 START CLR SPEAK+1
10 9003 86 FF LDA A #$FF
11 9005 B7 F0 00 STA A SPEAK ALL PIA BITS OUTPUT
12 9008 86 2E LDA A #$2E
13 900A B7 F0 01 STA A SPEAK+1 CA1 + EDGE, AUTO STROBE
14 900D 86 3F LDA A #$3F STOP SC-01
15 900F B7 F0 00 STA A SPEAK
16 9012 CE 80 00 LDX #TEXT
17 9015 7D F0 01 NEXT TST SPEAK+1 BUSY?
18 9018 2A FB BPL NEXT
19 901A A6 00 LDA A 0, X
20 901C 08 INX POINT TO NEXT BYTE
21 901D B7 F0 00 STA A SPEAK
22 9020 B6 F0 00 LDA A SPEAK CLEAR PIA FLAG
23 9023 81 3F CMP A #$3F
24 9025 26 EE BNE NEXT END OF STRING?
25 9027 7E C0 00 JMP MDOS
26
27 8000 ORG TEXT
28 8000 54 FCC 'TEST STRING GOES HERE'
29 8015 3F FCB $3F
30
31 END START
NO ERROR(S) DETECTED
LAST ASSEMBLED ADDRESS: 8015
TRANSFER ADDRESS: 9000

SYMBOL TABLE:
MDOS C000 NEXT 9015 SPEAK F000 START 9000 TEXT 8000

```

# A BUREAUCRAT'S GUIDE TO WORD PROCESSING

Now, if it were you or I and we wanted a word processing program for our IBM-type PC, we'd probably stop off at our local computer store and simply diddle with a few.

You and I, however, are not the U.S. Department of Agriculture. (Nor any of its permutations of subsystems like the Economic Research Service, National Resources Economics Division, Data Services Center, etc., etc.)

So when the USDA told ERS to tell NRED and DSC to look into a truckload of w.p. programs for all their PCs, the last thing they wanted was simple diddling. Their dedicated Wangs and Lexitrans were far too few to handle their

needs, their IBM® PCs weren't compatible with them anyway, and nobody really, quantifiably, knew from word processing with a personal computer.

Definitely not a diddling-mode condition.

As they put it in *The Exchange*, an internally distributed publication of the Department of Agriculture: "A needs assessment showed that, in the long-term, a word processing system is needed that can increase word processing capability and also be compatible with ERS' Long Range Information Management goals."

Well. "Needs assessment" led swiftly to "procurement action," which galloped into an "objective review" of the eight top-rated PC programs on the market (as compiled by *The Ratings Book* published by *Software Digest*), along with Wordstar® and Display Write 2, because they had some around.

Thus armed with the names, the final evaluators (a team of secretaries from NRED who would be the primary users of the PC software) became armed with each of the programs, along with checklists to record such things as ease of use, advanced features, and similarity to their existing dedicated equipment.

The first to be eliminated from the prospect list were Office Writer™

and Samna™ since they're copy-protected and couldn't be transferred to hard disks.

Next, IBM's Display Write 2: because it's "not compatible with other software used in ERS (like Lotus 1-2-3™, dBASE II®, etc.)," and it's "full of confusing menu options and cryptic error messages." Al revoir IBM.

Then, three more, for a variety of reasons.

Which left the following:

Volkswriter® Deluxe™

MultiMate™

Leading Edge™


Volkswriter Deluxe? "Too complicated and confusing." Not "easy to learn or use."

MultiMate? Not bad. It actually tied the winner in a few categories.

The winner being the one that won 82% of the votes in the Ease of Use/Ease of Learning categories. The one about which they said, "The ability to store deleted text and automatic document backup features were both highly desirable." The one they thought they'd quickly "be able to use . . . for their day-to-day word processing tasks."

The whole process took some three months of work by people in DSC to support the NRED in its work with the ERS and DSC to make the world a better place for the USDA.

But the results were well worth the wait. Because at last they've solved their word-processing problems . . .

"With Leading Edge!"  LEADING EDGE™

**THIS WAS THE WINNER:  
LEADING EDGE™  
LEADING EDGE WORD PROCESSING**

## THESE ARE THE PACKAGES THE COMMITTEE EVALUATED:



## THESE WERE THE FINALISTS:



LEADING EDGE PRODUCTS, INC.  
LEADING EDGE SOFTWARE DIVISION, 21 HIGHLAND CIRCLE, NEEDHAM, MA 02194. TEL. 800-343-3436. (617) 449-4655  
HELP HOTLINE 800-523-HELP

IBM is a registered trademark of International Business Machines.

# MidWest Micro-Peripherals

Save with Confidence

Let us earn your trust as we have that of others, such as:  
 Goodyear • General Motors • US Navy • Bell Labs  
 Conrail • Texas A&M University • General Electric  
 General Dynamics

|                                                                            | LIST      | Our Price   |        |
|----------------------------------------------------------------------------|-----------|-------------|--------|
| <b>PRINTERS</b>                                                            |           |             |        |
| Star Gemini 10X (120 CPS)                                                  | \$399     | \$259       |        |
| Star Gemini 15X                                                            | 549       | 369         |        |
| Star Delta 10 (160CPS)                                                     | 549       | 389         |        |
| Star Delta 15 (160CPS)                                                     | 705       | 499         |        |
| Star Radix 10                                                              | 849       | 539         |        |
| Star Radix 15 (200CPS)                                                     | 995       | 639         |        |
| EPSON RX 80 (100 CPS)                                                      | 399       | 249         |        |
| Epson RX-80F/T (100CPS)                                                    | 499       | 299         |        |
| Epson FX 80 (160CPS)                                                       | 689       | 429         |        |
| Epson LQ 1500 (200 CPS)                                                    | 1495      | 1099        |        |
| Okidata 92P (80 Col., 160 CPS)                                             | 599       | 389         |        |
| Okidata 82A (80 Col., 120 CPS)                                             | 349       | 319         |        |
| Okidata 93P (136 Col., 160 CPS)                                            | 999       | 599         |        |
| Okidata Pacemark 2350P, 2410P                                              |           | SCALLS      |        |
| Toshiba 1340P (54 CPS)                                                     | 985       | 769         |        |
| Toshiba 1351P (100CPS)                                                     | 1855      | 1299        |        |
| Smith Corona, Complete Line                                                |           | SCALLS      |        |
| <b>DAISYWHEEL PRINTERS</b>                                                 |           |             |        |
| Silver Reed EXP 400                                                        | 399       | 289         |        |
| Silver Reed EXP 500 (16 CPS)                                               | 599       | 359         |        |
| Silver Reed EXP 550 (18 CPS)                                               | 699       | 439         |        |
| Silver Reed EXP 770 (36 CPS)                                               | 1295      | 829         |        |
| Brother HR-15 (13 CPS)                                                     | 599       | 399         |        |
| Brother HR-25 (23 CPS)                                                     | 895       | 669         |        |
| Juki 6100 (18 CPS, Bi-dir)                                                 | 599       | 429         |        |
| Diablo 620                                                                 | 1095      | 899         |        |
| Diablo 630 (40 CPS)                                                        | 2499      | 1699        |        |
| Daisywriter 2000 (40 CPS)                                                  | 1495      | 859         |        |
| <b>IBM PC SYSTEMS</b>                                                      |           |             |        |
| PC's and PCXT's                                                            |           |             |        |
| <b>Complete Systems</b>                                                    |           |             |        |
| <b>Call and Save!</b>                                                      |           |             |        |
| <b>DISK DRIVES FOR IBM PC OR XT</b>                                        |           |             |        |
| All Drives Pretested with Complete Instructions.                           |           |             |        |
| Panasonic Half Heights                                                     |           |             |        |
| Panasonic Dual Drive Kit (Complete hardware, instructions & full warranty) | 499       | 299         |        |
| Teac Half Heights                                                          | 299       | 169         |        |
| Teac 2 Drive Kit - Complete                                                | 499       | 339         |        |
| Tandon 100-2 (IBM Standard)                                                | 399       | 179         |        |
| Maynard-10 Meg. Internal Drive                                             | 1395      | 998         |        |
| Tallgrass Drives w/Tape Backup                                             |           | SCALLS      |        |
| <b>MODEMS</b>                                                              |           |             |        |
| Smartmodem 300                                                             | 289       | 219         |        |
| Micromodem 11e                                                             | 299       | 239         |        |
| Smartmodem 1200                                                            | 699       | 469         |        |
| Smartmodem 1200B w/IBM Software                                            | 599       | 399         |        |
| Smartcom 11                                                                |           | SCALLS      |        |
| <b>MONITORS</b>                                                            |           |             |        |
| Amdek 310-A                                                                | 230       | 169         |        |
| Amdek Color II                                                             | 559       | 429         |        |
| <b>EXPANSION CARDS</b>                                                     |           |             |        |
| AST                                                                        |           |             |        |
| Six Pac Plus, 64K S/P/C+S/W Complete AST Line                              | 395       | 269         |        |
|                                                                            |           | SCALLS      |        |
| QUADRAM                                                                    |           |             |        |
| Quadboard, w/64K, Expandable 384K Complete Quadram Line                    | 295       | SCALLS      |        |
| HERCULES                                                                   |           |             |        |
| Graphics Card                                                              | 449       | 339         |        |
| Tecmar Graphics Master                                                     | 695       | 499         |        |
| Memory chip kit-64K 150ns-9 chips                                          | 99        | 54          |        |
| <b>SOFTWARE</b>                                                            |           |             |        |
| Lotus 1-2-3                                                                | Symphony  | Hundreds of | SCALLS |
| dBase III                                                                  | Multimate | Titles!     | and    |
| Quickcode                                                                  | PFS       |             | SAVES  |
| <b>VERBATIM DATA LIFE DISKETTE SALE</b>                                    |           |             |        |
| SS/DD                                                                      | 10-90     | 100-Up      |        |
| DS/DD                                                                      | 1.99      | 1.79        |        |
|                                                                            | 2.99      | 2.69        |        |



**OUR PRICE COMMITMENT**  
 Midwest will try in good faith to beat any nationally advertised price.  
 Prices subject to change and type errors

Free use of Visa, Mastercard  
**Call Today!**  
**1-800-423-8215**  
 In Ohio 1-800-321-7731  
**Information - Ordering**  
**CUSTOMER SERVICE (513) 663-5488**

We accept VISA, MASTERCARD - NO SURCHARGE! AMEX, certified checks, money orders & COD's

**MidWest Micro-Peripherals**  
 (Division of Intel, Inc.)  
 135 South Springfield St  
 St. Paris, Ohio 43072  
**AD #B-109**

## ASK BYTE

450 nanoseconds before the rising edge of the strobe. From the notes on your schematic and the lack of any port initialization in your software, I assume that you connected the data lines directly to the I/O bus lines. These lines are stable for only about 500 nanoseconds, which is too close to the minimum SC-01 setup time.

The ENABLE line, which you connected to BOARD SELECT, is used only to enable the 74LS244 buffer. The SC-01 is enabled any time STB is active. In your case, this occurs on any processor write instruction.

The A/R line is active as long as the SC-01 is busy. With A/R connected directly to the TRQ line, a long string of interrupts will be generated for every phoneme.

All the hardware problems can be solved by connecting the Sweet Talker to a parallel port, such as on a 6821 Peripheral Interface Adapter (PIA) chip. The port will hold the data stable, toggle the STB line, enable only the BOARD SELECT, and condition the A/R line for interrupts.

Your method of ricochet interrupts will not work in this situation. An interrupt service routine must disable the device that holds the TRQ line low. This is not possible with the A/R line connected to TRQ. As soon as the RTI instruction pulls the condition code register from the stack, the processor will interrupt again (actually, it completes one instruction). Since the SC-01 holds A/R low for several milliseconds, your program will be interrupted thousands of times.

If the SC-01 is buffered by a PIA, you can clear the TRQ line by reading the data register of the PIA. This will allow your RTI to return to the main program without another interrupt.

There is little need to use interrupts for the Sweet Talker. A simple test of the PIA status, followed by a branch back, if positive, is all the handshaking that is required. The printer driver in listing 1 could be adapted for your use.—Steve

in a box in the closet. Since I'm using a very slow Silver Reed 550 printer, I find myself in need of either a printer buffer or another eight hours a day. It seems to me that a genius like yourself could come up with a simple way to convert that Sinclair with its 16K-byte memory pack into a cheap printer buffer. If nothing else, maybe you could put someone on to the idea. I imagine the solution will require a reprogrammed ROM at the very least.

I'm interested in obtaining a buffer as quickly and cheaply as possible. If someone makes a couple of million dollars from this brilliant idea, please give them my name and address and ask them to send me a kit.

JOHN C. CONNELL JR.  
 FPO Miami, FL

It is possible to convert your Sinclair to a printer buffer, but it would not be too economical or convenient. An add-on board to create an I/O port would be required, and some software, preferably in the form of a ROM, would be needed to control it. Since this add-on board would get quite elaborate, it would be a simple matter to add a dedicated micro-processor chip, so why use the Sinclair?

A better choice would be to use one of the commercial printer buffers.—Steve

## ELECTRICAL SOFTWARE

Dear Steve,

I am a freelance electrical estimator. I've recently purchased a Columbia VP computer and an Okidata 92 printer and would like to use them to prepare estimates for electrical work. As yet, I have not found any software for electrical estimating. Do you know of any?

GEORGE D. MURRAY SR.  
 Baltimore, MD

A look through the January 1984 issue of LIST revealed the following programs for electrical estimating:

Electrical Computation by  
 Electrical Electric Corporation  
 POB 157  
 Townsend, MA 01474  
 (617) 597-2708

Electrical Comp-U-Tation by  
 Designs IV  
 405 Main St., Suite 201  
 Worcester, MA 01608  
 (617) 755-1183

## BUFFERS

Dear Steve,

Like many other neophyte microcomputer users, I started out with a Sinclair before investing major dollars in something I might not like. The bug bit, and I'm madly computing away with a Kaypro 2 while my little old Sinclair sits

(continued)

# Hard Disk, Soft Shell

## The Complete Hard Disk Solutions

For Desktop & Portable PC's 10 Megabytes \$794, Or 20 Meg \$1288.

We have the whole package you need to add a hard disk to your IBM PC or compatible. Our half-height 10 and 20 megabyte drives have the lowest current draw in the industry. Unlike most aftermarket hard disks ours can "boot" direct from the hard disk. No software patches, or drivers to install just a copy of IBM PC DOS 2.0 or 2.1.

**Idirfully Easy** with the popular Idir menu driven "visual shell" software. It replaces complicated DOS commands with menus that allow you to just point at what you want to do. Help files explain DOS commands and give you on-line advice when you need it. Idir takes the wonder out of the tree structured subdirectories so useful in organizing a hard disk.

**Hard Problems** like excessive current draw and heat have until now been unsolved problems with aftermarket hard disks. Most drives draw lots of power. If your PC has many expansion boards in it, power to run a hard disk is probably not available. Hard disks have also been easily damaged by vibration and movement. And of course the problem any non-IBM product must face, compatibility with the IBM PC. We have tackled all these problems and come up with the best solutions available at any price.

**Cool & In Control** with half-height drives so efficient they draw the same amount of power as a floppy disk drive. This means a minimum of heat inside your PC with more power available for expansion boards. The controller uses LSI technology to provide fewer components, drawing less power, and giving significantly improved performance over the IBM XT.

**The Portable Plus** is 10 or 20 megabytes to go. In fact, the drives we use have been selected by several computer makers for use in their portable computers. Their plated recording media helps withstand vibration, and allows the drive to be used at any angle.



**Total Compatibility** is a necessity. Our hard disks have the ability to boot directly from the hard disk. Check around, very few aftermarket systems can. In fact, all you need is a copy of DOS 2.0 or 2.1 and you are ready to go, no software drivers to install, or DEBUG patches to apply.

**Why Buy From Us?** It's simple really. Better value, and no hassles. You see, the price advertised is the whole price. No extra for freight, credit cards, COD fees, or insurance. Perhaps the best part is if you have a question you deal direct with Qubie'. We have the knowledge and ability to

help you quickly. And, if you do have a hardware problem during the warranty period it is fixed or replaced within 48 hours!

**No Risk.** Don't be afraid to save. Our manual is written so even the novice can successfully install his own system. And remember, if for any reason you are not happy within 30 days of purchase you may return it for a full refund, and we'll pay the freight back! Get our competition to make the same offer, and find out which system is best. We know which one you will choose.

**System Requirements:** Any IBM PC with 64k RAM and PC DOS 2.0 or later. Compatible owners call for application information.

**PC10:** Includes 10 Megabyte drive, controller, cables, installation instructions, Idir software, and 1 year warranty. **\$794.**

**PC20:** Same as above with 20 Megabyte drive. **\$1288.**

**Options:** Auxiliary power supply, for those with computers already full of power hungry expansion boards. #PCPWR \$88.

Half-height bezel (specify computer), #HHBZL \$15.

**DEALER AND QUANTITY PURCHASE INQUIRIES INVITED**

### Order Today, Shipped Tomorrow!

Price includes UPS surface freight and insurance. Add \$12 for two day air service. For fastest delivery send certified check or credit card. Personal checks take 18 days to clear. Calif. residents add 6% sales tax. Corporations and Institutions call for purchase order details.

**(800) 821-4479**

Toll Free Outside California

**(805) 987-9741**

Inside California

**QUBIE'**

4809 Calle Alto  
Camarillo, CA 93010

Tempo House, 15 Falcon Road,  
London SW11, United Kingdom

9/62 Blackshaw, Mortdale  
2223 N.S.W., Australia



**Idir Directory System Included**

Circle 322 on inquiry card.



# The 'C' for the Macintosh

## AZTEC C68K-C ..... \$499

commercial software development system

• Full Version 7 'C' Compiler • Fast and Compact Code • Linker (overlay) • Resource Editor • No Royalties • Source Editor • Compatible with AZTEC 'C' for PC DOS, CP/M-86, CP/M-80, APPLE II, TRS-80, COMMODORE 64 • 68000 Macro Assembler • Extensive Run Time Support • Utilities • Shell Environment • Requires 128K MACINTOSH • Compatible with LISA MACWORKS and 512 MACINTOSH • Full access to MACINTOSH TOOLBOX (ROM & OS)

## AZTEC C68K-P ..... \$199

personal software development system

## AZTEC C68K TOOLS ..... \$249

(make, grep, diff, Z editor)

## MAC CROSS COMPILER

HOSTS & TARGETS  
LISA, PC DOS, MS DOS,  
CP/M-80, APPLE II, VAX,  
PDP 11 .....



# MANX

TO ORDER OR FOR INFORMATION  
CALL OR WRITE:

MANX SOFTWARE SYSTEMS  
Box 55  
Shrewsbury, NJ 07701  
TX 4995812



**CALL:**  
**800-221-0440**  
**201-780-4004 (NJ)**

NJ RESIDENTS ADD 6% SALES TAX

TRS-80 IS A TRADEMARK OF TANDY CORP. MACINTOSH IS A TRADEMARK OF APPLE.  
CP/M-86 & CP/M-80 ARE TRADEMARKS OF DIGITAL RESEARCH. PC DOS IS A TRADEMARK OF IBM

*Unfortunately, these programs operate under the CP/M operating system and are not directly compatible with your system. Write these vendors to see if a version is available for your computer.—Steve*

## SPEECH SYNTHESIS

Dear Steve,

In your March 1984 Circuit Cellar article, "Build a Third-Generation Phonetic Speech Synthesizer," you mentioned a report by the Naval Research Laboratory. Its title was "Automatic Translation of English Text to Phonetics by Means of Letter to Sound Rules." Where can I get a copy of this report?

MARK FORTIN  
Boston, MA

*Copies of this report may be obtained from the National Technical Information Service. The order number is AD-A021929, and the prepaid price is \$13. Contact Sales Department, National Technical Information Service, 5285 Port Royal Rd., Springfield, VA 22161. Orders are usually filled in two to four weeks.—Steve*

## THE 68000 CHIP

Dear Steve,

I am a junior in high school who is very interested in computers. (I plan to make a career of it.)

I have read articles about the new MC68000 from Motorola. With high-end micros being introduced that use this chip, I am convinced that it will be one of the forerunners in the new wave of 16-bit machines.

I am interested in building a system using the 68000, but I have heard of only two available: the MC68000 Educational Computer Board from Motorola and the VU68K single-board computer kit. The one from Motorola seems to be a more complete system.

Could you please tell me about any other evaluation boards or computer kits that use the 68000 and what you think of them? I would greatly appreciate it. (Also, could a 68000-based system be configured to use the S-100 bus?)

DAVID FOGLESONG  
Kasilof, AK

*The 68000 should be an important microprocessor chip for a number of*  
*(continued)*



**C COMPILERS FOR  
PC DOS MS DOS CP/M-86 CP/M-80 APPLE II, IIe, IIc  
COMMODORE 64 RADIO SHACK and MACINTOSH**



**AZTEC C86**

**NEW RELEASE**

Optimized "C" compiler for PC DOS, MS DOS & CP/M-86  
PC DOS, UNIX I/O, math, screen, graphics libraries  
8086 assembler, linker & librarian, overlays  
/PRO—library source, debug, ROM, MASM & RMAC, 8087, large model

**NEW C COMPILERS  
AZTEC C68K for MACINTOSH  
VAX cross compilers**



**AZTEC C II**

**NEW RELEASE**

Optimized "C" compiler for CP/M, TRSDOS & LDOS  
assembler, linker & librarian, overlays, utilities  
UNIX I/O, math & compact libraries  
/PRO—library source, ROM, M80 & RMAC

**AZTEC C65**

"C" compiler for APPLE DOS 3.3, ProDOS or COMMODORE 64  
VED editor, SHELL, UNIX & math libraries  
/PRO—library source, ROM, overlays



**C TOOLS & AIDS**

Z editor (like Vi), C TUTOR compiler, PHACT database,  
C GRAFX, UNI-TOOLS I, QUICK C, BABY BLUE for PC  
to CP/M cross, QUADLINK for PC to APPLE cross



**CROSS COMPILERS**

Compile & link on HOST—test on TARGET machine  
HOSTS: UNIX, PC DOS, CP/M-86, CP/M-80, VENIX, PCIX, APPLE  
TARGETS: PC DOS, CP/M-86, CP/M-80, APPLE, RADIO SHACK,  
COMMODORE 64, other hosts and targets available



**PRICES**

**AZTEC C86 C COMPILER**

|                  |     |
|------------------|-----|
| PC DOS MSDOS     | 249 |
| CP/M-86          | 249 |
| BOTH             | 399 |
| C86/PRO          | 499 |
| /PRO UPGRADE     | 250 |
| Z (VI EDITOR)    | 125 |
| C TUTOR COMPILER | 99  |
| PHACT DATABASE   | 299 |
| C GRAFX          | 99  |
| SUPERDRAW        | 299 |
| UNI-TOOLS I      | 99  |
| QUICK C          | 125 |

**AZTEC C II C COMPILER**

|                    |     |
|--------------------|-----|
| CP/M               | 199 |
| CII/PRO            | 349 |
| /PRO UPGRADE       | 150 |
| TRS 80 MODEL 3     | 149 |
| TRS 80 MODEL 4     | 199 |
| TRS 80 PRO (3 & 4) | 299 |

**AZTEC C65 C COMPILER**

|               |      |
|---------------|------|
| APPLE DOS 3.3 | 199  |
| PRODOS        | CALL |
| E EDITOR      | 99   |

**AZTEC C CROSS COMPILERS**

|              |      |
|--------------|------|
| PDP-11 HOST  | 2000 |
| PC DOS HOST  | 750  |
| CP/M-86 HOST | 750  |
| CP/M-80 HOST | 750  |
| APPLE HOST   | 750  |
| VAX HOST     | CALL |
| MACINTOSH    | CALL |

**TARGETS**

|              |
|--------------|
| PC DOS       |
| CP/M-86      |
| CP/M-80      |
| APPLE        |
| RADIO SHACK  |
| COMMODORE 64 |
| MACINTOSH    |

TRS 80 RADIO SHACK TRS DOS is a trademark of TANDY.  
APPLE DOS MACINTOSH is a trademark of APPLE.

**MANX SOFTWARE SYSTEMS**  
Box 55  
Shrewsbury, NJ 07701  
TELEX: 4995812



**TO ORDER OR FOR INFORMATION:  
CALL: 800-221-0440 (outside NJ)  
201-780-4004 (NJ)**

Australia: Blue Sky Industries — 2A Blakesley St. — Chatswood NSW 2067 — Australia 61-2419-5579  
England: TAMSYS LTD — Pilgrim House — 2-6 William St. — Windsor, Berkshire SL4 1BA — England — Telephone Windsor 56747

Shipping: per compiler next day USA \$20, 2 days USA \$6, 2 days worldwide \$75, Canada \$10, airmail outside USA & Canada \$20

UNIX is a trademark of Bell Labs. CP/M, CP/M-80 and CP/M-86 are trademarks of DRI. PC DOS is a trademark of IBM. MS DOS is a trademark of MICROSOFT.  
N.J. residents add 6% sales tax.

**Achieve laboratory automation at low cost**—connect a DAISI™ (Data Acquisition and Instrument Systems Interface) to your Apple® II or IIe Computer.

**DAISI peripheral devices...**

- Interface with Apple II and Apple IIe Computers and their lookalikes
- Work with all popular language systems
- Come with cable, instructional diskette and comprehensive manual

DAISI and Apple work together as a single system to measure, monitor, time, analyze, control and record a wide variety of research and testing functions.

DAISI peripherals plug easily into any Apple expansion slot, ready to be used in chromatography, environmental data collection, evoked response, gas analysis, spectroscopy, signal processing, solar heating, mechanical measurement, structural testing, and many more functional applications.

The AI13 analog-to-digital converter reads instruments and sensors and has its own external unit for easy cable access.

# DISCOVER NEW HORIZONS IN LABORATORY AUTOMATION AND KEEP YOUR COSTS DOWN TO EARTH

**Here's a rundown on the DAISI Peripherals:**

- AI13 12-Bit Analog Input Interface.....\$550**
- 16 input channels
  - 20 microseconds conversion time
- DI09 Digital Interface with Timers.....\$330**
- timing and interrupt capability
  - direct connection to BCD digits, switches, relays
- AO03 8-Bit Analog Output Interface .....\$195-\$437**
- up to 8 independent channels
  - range and offset adjustable
- AI02 8-Bit Analog Input Interface.....\$299**
- 16 input channels
  - 70 microseconds conversion time
- Plus the SC14 system for front-end signal conditioning and amplification, the UI16 isolation system for AC or DC power input or output, and more . . .

**AND NOW . . . AMPRIS™**

An easy add-on to Applesoft® BASIC.

With AMPRIS you can:

- Read and store analog and digital inputs
- Send out analog and digital outputs
- Set, read and control the DI09 counters
- Set, read and control the DI09 shift registers
- Make full use of the DI09 interrupt capability

Using AMPRIS is as easy as inserting an ampersand (&) command where you would normally insert an Applesoft command. For more information about the complete line of DAISI peripheral devices and the full spectrum of their applications, write or phone:



**Interactive Structures, Inc.**  
 146 Montgomery Avenue  
 Bala Cynwyd, PA 19004  
 Telephone: (215) 667-1743

(Designed and manufactured in the USA)

years to come. It is now being used in several computers, including the Apple Lisa and Macintosh and the Radio Shack TRS-80 Model 16 (optionally on the Model 12). Others currently available include the Sage II, Hewlett-Packard HP 16, the Fortune 32:16, and the Wicat System 150. You can find addresses to obtain information on these in ads in *BYTE* and other magazines.

Interfacing the 68000 to the S-100 bus presents no special problems, except for the money involved. The easiest way to do this is probably to buy one of the 68000 S-100 boards made by CompuPro or Dual Systems Corp.

A 68000 training system is also available, the Micro 68000ECB Microcomputer Trainer from Computer System Associates Inc., 7562 Trade St., San Diego, CA 92129. I haven't seen this product, so I can't comment on it, except that the data given in the ad looks like it has features to enable you to learn to use the 68000 and to expand the system into a usable computer.—Steve ■

Between Circuit Cellar Feedback, personal questions, and Ask *BYTE*, I receive hundreds of letters each month. As you might have noticed, at the end of Ask *BYTE* I have listed my own paid staff. We answer many more letters than you see published, and it often takes a lot of research.

If you would like to share the knowledge you have on microcomputer hardware with other *BYTE* readers, joining the Circuit Cellar/Ask *BYTE* staff would give you the opportunity. We're looking for additional researchers to answer letters and gather Circuit Cellar project material.

If you're interested, let us hear from you. Send a short letter describing your areas of interest and qualifications to Steve Ciarcia, POB 582, Glastonbury, CT 06033.

IN ASK *BYTE*, Steve Ciarcia answers questions on any area of microcomputing. The most representative questions received each month will be answered and published. Do you have a nagging problem? Send your inquiry to

Ask *BYTE*  
 c/o Steve Ciarcia  
 POB 582  
 Glastonbury, CT 06033

Due to the high volume of inquiries, personal replies cannot be given. All letters and photographs become the property of Steve Ciarcia and cannot be returned. Be sure to include "Ask *BYTE*" in the address.

The Ask *BYTE* staff includes manager Harv Weiner and researchers Bill Curlew, Larry Bregoli, Dick Sawyer, and Jeannette Dojan.



# NEW PRODUCT NEWS FROM TELETEK

**Systemmaster II.** Responding to market demand for speed and increased versatility, Teletek is proud to announce the availability of the next generation in 8-bit technology — the new Systemmaster III! The Systemmaster II will offer two CPU options, either a Z80B running at 6 MHz or a Z80H running at 8 MHz, 128K of parity checked RAM, two RS232 serial ports with on-board drivers (no paddle boards required), two parallel ports, or optional SCSI or IEEE-488 port. The WD floppy disk controller will *simultaneously* handle 8" and 5 1/4" drives. A Zilog Z-80 DMA controller will provide instant communications over the bus between master and slave. Add to the DMA capability a true dedicated interrupt controller for both on-board and bus functions, and the result is unprecedented performance.

Systemmaster II will run under CP/M 3.0 or TurboDOS 1.3, and fully utilize the bank switching features of these operating systems.

## TELETEK

4600 Pell Drive  
Sacramento, CA 95838  
(916) 920-4600  
Telex #4991834  
Answer back — Teletek

Circle 367 on inquiry card.

**SBC 86/87.** As the name indicates, Teletek's new 16-bit slave board has an Intel 8086 CPU with an 8087 math co-processor option. This new board will provide either 128K or 512K of parity checked RAM. Two serial ports are provided with individually programmable baud rates. One Centronics-compatible parallel port is provided. When teamed up with Systemmaster II under TurboDOS 1.3, this 5MHz or 8MHz multi-user, multi-processing, combination cannot be beat in speed or feature flexibility!

**Teletek Z-150 MB.** Teletek is the first to offer a RAM expansion board designed specifically for the Z-150/Z-160 from Zenith. The Teletek Z-150 MB is expandable from 64K to 384K. Bring your Z-150 up to its full potential by adding 320K of parity checked RAM (or your IBM PC, Columbia, Compaq, Corona, Eagle, or Seequa to their full potential). The Teletek Z-150 MB optionally provides a game port for use when your portable goes home or a clock/calendar with battery backup!

Evaluate the Systemmaster II, SBC 86/87 or Teletek Z-150 MB for 30 days under Teletek's Evaluation Program. A

money-back guarantee is provided if not completely satisfied! All Teletek products carry a 3-year warranty.

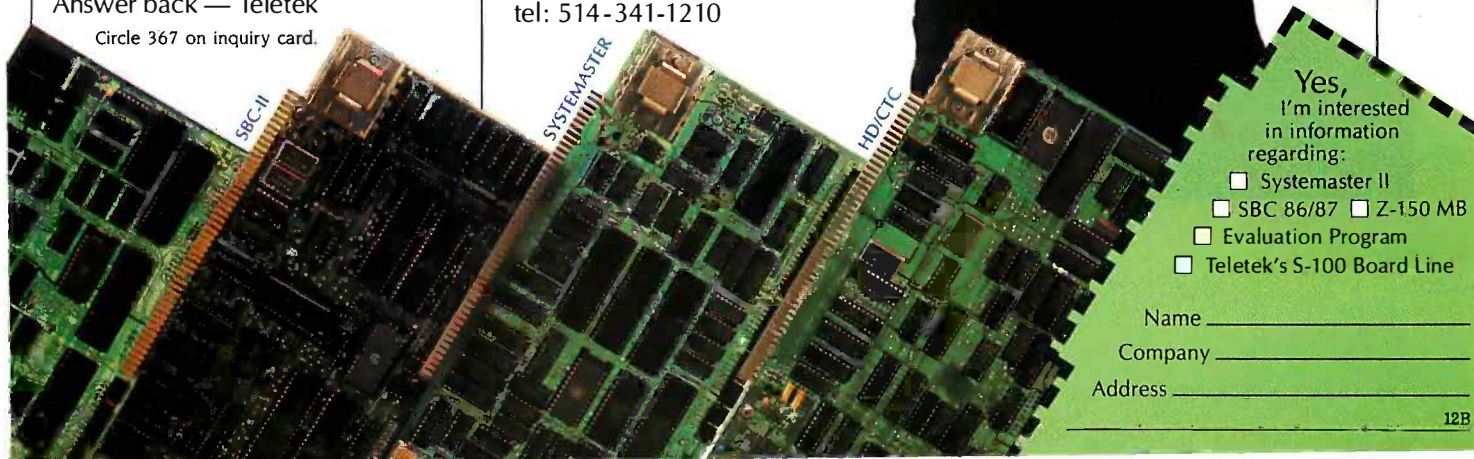
(Specifications subject to change without notice.)

### In Europe:

Kode Limited  
Station Road  
Calne, Wiltshire  
SN11 0JR England  
tel: 0249-813771  
telex: 449335

### In Canada:

MAE Microsystems  
8255 Mountain Sights, Ste.150  
Montreal, Quebec  
H4P1W1 Canada  
tel: 514-341-1210



Yes,  
I'm interested  
in information  
regarding:

- Systemmaster II
- SBC 86/87  Z-150 MB
- Evaluation Program
- Teletek's S-100 Board Line

Name \_\_\_\_\_

Company \_\_\_\_\_

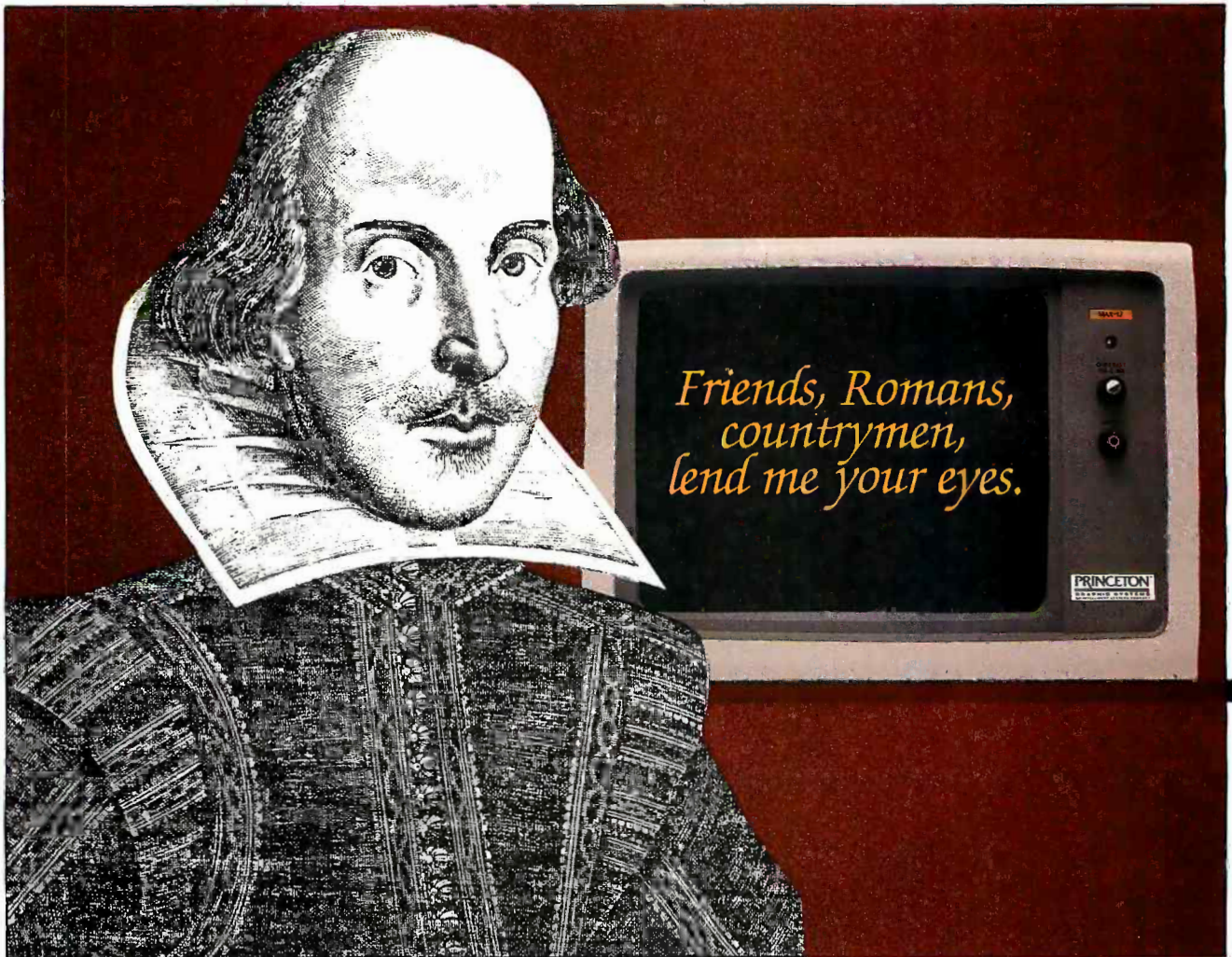
Address \_\_\_\_\_

# Great Ideas look even better on a Princeton monitor

Your Great Ideas deserve the best image you can give them. But, just as a music system's performance depends on the speakers, your computer system is limited by the quality of your monitor.

Monitor performance can be measured. That's something you should know about.

In other words, your Great Ideas should be seen, not blurred.



W. Shakespeare composing Great Ideas on a Princeton Monitor

## Things you should know about monitors

**Resolution** The quality of a color monitor's image is directly related to its resolution. The greater the number of dots available within a given area for displaying an image the greater the resolution.

● **The PRINCETON SR-12** monitor features an extraordinary 640x480 (non-interlaced) resolution. The result is an extremely high quality, flickerless image with text that approaches monochrome quality. When used in conjunction with the PRINCETON Scan-Doubler card, the SR-12 runs from a standard IBM or equivalent color card, maintaining complete compatibility with all IBM software.

**Dot pitch** The image on an RGB color monitor is made up of a series of tiny dots. Dot pitch measures the distance between those dots. Anything finer than .38mm is considered high resolution.

● **The PRINCETON HX-12** RGB color monitor, with a dot pitch of .31mm, offers the finest resolution in its class. The HX-12 delivers 16 crisp, sharp colors including clean whites without color bleed—a not-so-easy accomplishment in an RGB monitor.

**Price** All Princeton monitors set the price/performance standard in their class. The SR-12 at \$799 compares favorably with monitors costing hundreds more. The HX-12 is in a class by itself at \$695.

● **The PRINCETON MAX-12**, with easy-on-the-eyes amber phosphor, sets the standard for monochrome monitors at \$249. The MAX-12's dynamic focusing circuitry ensures sharpness not only in the center but also in the edges and corners. And it runs off the IBM PC monocard—no special card is required.



All three monitors feature a non-glare screen and an IBM compatible cable. A PCjr adapter cable is also available for the HX-12. And to see your Great Ideas from the best possible angle, you can put your Princeton monitor on the Princeton Undergraduate Tilt and Swivel Base for only \$39.95. **Or, while supplies last, get the Undergraduate FREE with the purchase of a MAX-12 monitor.**

**Image** The ultimate test of any monitor is how the image looks to your own eyes. Compare the Princeton monitors side-by-side with the competition at Computerland, Entre or your local independent dealer.

Do it soon. You and your Great Ideas deserve the best.

Circle 310 on inquiry card.

For more information call toll-free:  
**800-221-1490 Ext. 804**

**PRINCETON**<sup>™</sup>  
GRAPHIC SYSTEMS  
AN INTELLIGENT SYSTEMS COMPANY

170 Wall Street  
Princeton NJ 08540  
TLX 821402 PGS Prin

**Technologically tuned for excellence**

DECEMBER 1984 • BYTE 57



## IMSI Presents PC Paintbrush™

With PC Paintbrush, you'll now be able to do things that MacPaint users can only dream about.

Because, unlike them, you'll be working with a palette of up to 16 vibrant colors, depending on your color card.

And, as you'll notice, you'll also have drawing tools, pull-down menus, and a range of brush widths and shapes. Plus your choice of mouse or joystick.

In addition to freeform drawing, you'll be able to draw precise triangles, rectangles, boxes, circles and ellipses.

You'll be able to cut, paste, and move things around. Even enhance graphs, text, and images from other programs like Lotus 1-2-3, Wordstar, and SuperCalc 3.

But don't stop with painting. PC Paintbrush also gives you an electronic type shop to work with. Several fonts, from Olde English to Computer. Each in seven styles (boldface, italics, underline, etc.) and seven sizes (from 9-point body copy to 72-point headlines).

All of which makes it great for designing everything from fliers and report covers to greeting cards and birthday banners. (For a wall-sized work of art, just print sideways.)

The possibilities are endless. But the best way to see for yourself is to see for yourself. Get a demonstration at your nearest computer store.

Then, draw your own conclusions.



**Imisi**  
SOFTWARE PUBLISHERS

Circle 390 on inquiry card.

INTERNATIONAL MICROCOMPUTER SOFTWARE, INC.  
633 Fifth Avenue • San Rafael, CA 94901 • 415/454-7101

- |                     |                                                                                                                                                                                                                                                                                       |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>RUNS ON:</b>     | IBM PC/compatibles, 192K RAM, 1 drive, DOS 2.0 and up. IBM PCjr., 256K RAM, 1 drive, DOS 2.0 and up.                                                                                                                                                                                  |
| <b>MICE:</b>        | Summagraphics, Mouse Systems, Microsoft.                                                                                                                                                                                                                                              |
| <b>JOYSTICKS:</b>   | Any IBM compatible.                                                                                                                                                                                                                                                                   |
| <b>COLOR CARDS:</b> | Amdek, Hercules, IBM, PCjr., Quadram, Scion, Tecmar.                                                                                                                                                                                                                                  |
| <b>MONITOR:</b>     | Color or black and white.                                                                                                                                                                                                                                                             |
| <b>OUTPUT:</b>      | Printers: IBM/Epson graphics, Epson FX-80 and 100, MX 80 and 100, IDS Non-Color, IDS Prism Color, NEC 8023, C-Itoh 8510, Okidata 8Xor9X series, Radio Shack CGP-220, Quadram Quadjet, Transtar Color, PrintaColor TC1040, Diablo C150, Xerox 1770, Tektronix 4695. Plotter: HP 7475A. |

PC Paintbrush is a registered trademark of ZSOFT CORP.

# C·L·U·B·S & N·E·W·S·L·E·T·T·E·R·S

● **NEW HORIZONS FOR TS USERS**—*T-S Horizons* is a monthly newsletter for owners of Timex Sinclair computers. It provides programs, hardware projects, new-product news, product reviews, programming tutorials, and more. An annual subscription (12 issues) is \$12, \$18 in Canada, and \$24 overseas. Write to *T-S Horizons*, 2002 Summit St., Portsmouth, OH 45662.

● **FEEDBACK PRINTED BIMONTHLY**—Entek, an engineering software and consulting firm, produces a bimonthly publication called *Enounce* to keep its customers informed. *Enounce* covers news briefs, software updates, new-product information, and product previews. It highlights products and applications, introduces Entek staff members, and prints reader feedback. For information, contact Vicki Forbes, Entek Scientific Corp., Suite 316, 4480 Lake Forest Dr., Cincinnati, OH 45242, (513) 563-7500.

● **CALIFORNIA DREAMING** Anyone interested in the Glendale/LaCrescenta Users Group for CP/M and Epson QX-10 owners can write to G. J. Jamriska, 2960 Hawkridge Dr., LaCrescenta, CA 91214.

● **QUINCY USERS MEET** The Great River Microcomputer Users Group (GRMUG) meets at 7 p.m. on the first Sunday of the month at the Quincy Computer Center in Quincy, Illinois, to discuss computers. Special-interest groups exist for games, applications, and utilities. A newsletter is produced

periodically, and the club collects the \$12 annual dues only as they are needed. For details, contact L. Moeller, GRMUG, 1226 Daniel Court, Quincy, IL 62301, (217) 223-5891.

● **THE VALUE OF EPSON Valnews**, "valuable news" for Epson computer users, is a nonprofit monthly publication produced by the Epson Users of San Francisco (EUSF). It previews products and provides in-depth user notes and tutorials. EUSF, also nonprofit, meets at 7 p.m. on the first Thursday of every month in the Fort Mason Center, Room C-205, San Francisco. A subscription (12 issues) is included in the \$15 annual membership fee. EUSF is an official Epson America User Group. For further details, contact Valnews, Suite 271, 904 Irving St., San Francisco, CA 94122.

● **MANY PROS IN NY** Members of the MicroPro Users Group of New York (MUGNY) share information about a variety of MicroPro products. The largest possible participation is encouraged. For details, contact Jeffrey Luria, MUGNY, 140 Riverside Dr., New York, NY 10024, (212) 724-5630.

● **ASTRONOMICAL DISCOUNTS**—People interested in computers,

astronomy, and science fiction are welcome to communicate with others having similar interests. The Plutonian Society receives discounts on astronomical materials. Contact Kazys Varnelis III, POB 21, Stockbridge, MA 01262.

● **QUARTERLY QUESTIONS** *The Columbia User's Newsletter*, an interactive communications forum produced quarterly by Sierra Digital Research, is designed to keep owners and users of Columbia Data Products' MPC/VP series of personal computers informed of the latest news. Comments and questions from subscribers are solicited; answers are printed along with new-product announcements from CDP, system operating information, and short utility programs. Subscription rates are \$5 within the U.S. and \$10 abroad. For information, contact Sierra Digital Research Inc., POB 50089, Reno, NV 89513, (702) 323-3856.

● **A DRILL FOR DENTISTS** *Focus on Dental Computers* is a monthly newsletter that features evaluations on at least two software packages a month. It provides timely information to assist dentists in selecting and optimizing computer systems. Interviews with leaders in the computer field are included.

Other professionals who may also be interested in the contents of this newsletter include financial management specialists, physicians, and computer aficionados. Subscriptions are \$95 a year for 12 issues. Contact Snyder Felmeister & Co., 383 North Kings Highway, Cherry Hill, NJ 08034.

● **ADAM OWNERS CLUB AND NEWS**—Owners of Coleco's Adam computer can benefit from the newsletter that is produced once or twice a season to keep you up-to-date on the latest news about the Adam. Adam's Apple, the sponsoring club, provides programs, tips to improve programming, and other highlights on the computer. Address all correspondence to Adam's Apple, 4835 Edsal Rd., Cleveland, OH 44124.

● **JOURNAL FOR GENEALOGISTS**—*Micro-ROOTS* is a bimonthly newsletter for all levels of computerists who are interested in genealogy. It contains articles on starting a search for your family roots, reviews of genealogical software and books, activities of user groups, techniques on archival research, a query column, and a calendar of related events. A subscription is \$24.95 a year. Contact *Micro-ROOTS*, Suite 32, 14208 Weeping Willow Dr., Wheaton, MD 20906.

● **IBM NEWS OF TORONTO** The Personal Computer Club of Toronto is a nonprofit corporation for businesspeople, teachers, students, professionals, hobbyists, and

(continued)

.....  
CLUBS & NEWSLETTERS is a forum for letting *BYTE* readers know what is happening in the microcomputing community. Emphasis is given to electronic bulletin-board services, club-sponsored classes, community-help projects, field trips, and other activities outside of routine meetings. Of course, we will continue to list new clubs, their addresses and contact persons, and other information of interest. To list events on schedule, we must receive your information at least four months in advance. Send information to *BYTE*, Clubs & Newsletters, POB 372, Hancock, NH 03449.



## LMC's 32-Bit Virtual Memory MegaMicro Is The-State-Of-The-Art UNIX Microcomputer

LMC's 32-bit MegaMicro provides mainframe or super-minicomputer performance at prices competitive with today's far less powerful 8- and 16-bit microcomputers. This is made possible by use of the next generation of logic chips—the National Semiconductor 16000-series. LMC MegaMicros incorporate: the NS16032 central processing unit which has true 32-bit internal logic and internal data path configured on the IEEE 796 multibus; demand-paged virtual memory implemented in hardware; and hardware 64-bit double-precision floating-point arithmetic.

The LMC MegaMicro is supplied with HCR's UNITY\* which is a full implementation of UNIX\*\* and includes the Berkeley 4.1 enhancements to take advantage of demand-paged virtual memory. Also included are C and FORTRAN. Typical multi-user systems with 33 megs. of fast (30 ms. average access time) winchester disk storage, a half meg. of RAM, virtual memory, hardware floating-point arithmetic, UNIX, C, and FORTRAN 77 are available for \$20,000 (and even less with quantity or OEM discounts).

\* UNITY is a Trademark of Human Computing Resources.  
\*\* UNIX is a Trademark of Bell Laboratories.

**LMC MegaMicros The Logical Alternative™**



**The Logical MicroComputer Company**

4200 W. Diversey, Chicago, IL 60639 (312) 282.9667



A member of The Marmon Group of companies

anyone else interested in IBM Personal Computers. Members of the club produce a newsletter, maintain a software library, and meet every month to hear guest speakers. Almost a dozen special-interest groups pursue their interests. The membership fee is \$30 a year. For further information, contact the Personal Computer Club of Toronto, POB 266, Station A, Toronto, Ontario M5W 1B2, Canada.

● **FOR JOB HEALTH & SAFETY**—Hardware, software, and procedural reviews that relate to the occupational health and safety of people in the industrial workplace is the focus of *Computers in Safety & Health*. You can receive the annual six issues for \$12.50. For details, contact the publisher, Kenneth Cohen, Consulting Health Services, POB 1625, El Cajon, CA 92022, (619) 579-6233.

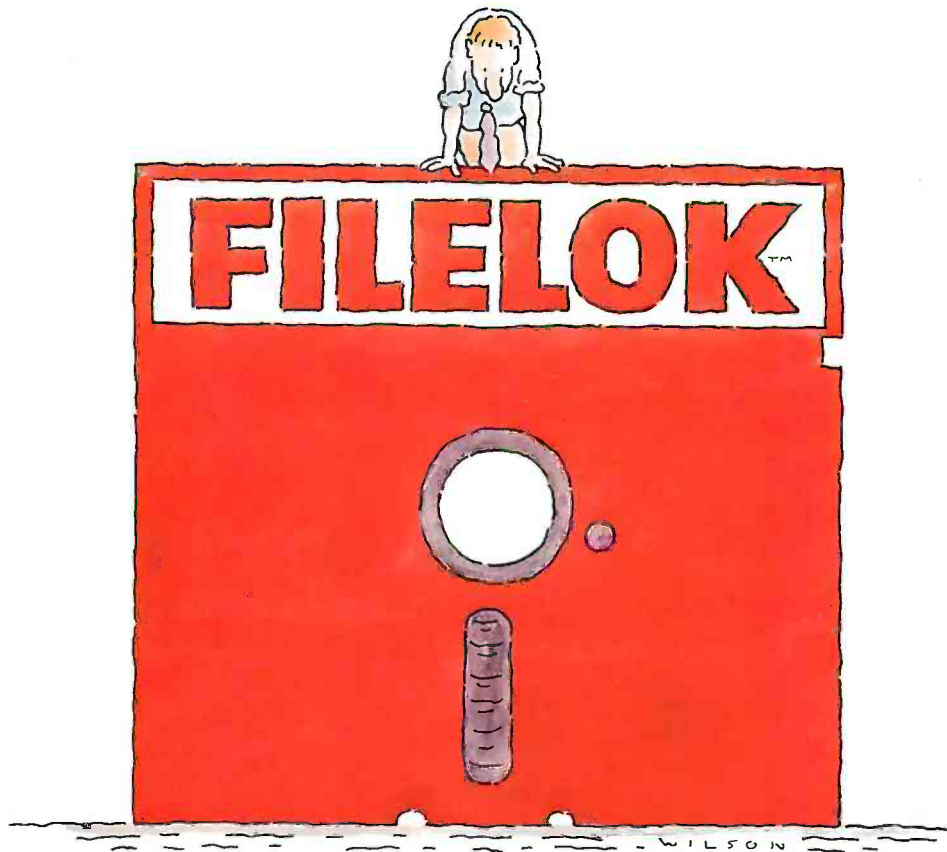
● **SUPPORT FROM EPSON** Epson America Inc. provides user-group support by offering to send the Official Epson User Group Starter Kit to Epson groups forming across the country. The Starter Kit contains a booklet with tips about how to run a successful club and outlines the services available to recognized Epson user groups, including prompt technical support from Epson and a toll-free number for EpSource, an electronic bulletin-board service. Your club can also benefit from the Techni-CALL Library, public-domain software, discounts, a speaker's forum, and national user-group conferences. Users wishing to form a group, join the network, or receive information can contact Margaret Johns or Chuck Champlin, Epson User Group Support, 2780 Lomita Blvd., Torrance, CA 90505, (213) 539-9140.

● **TRILINGUAL GREETINGS** The Global Computer Club (GCC) serves users in the European community by exchanging information through *Handshake*, a bi-monthly journal produced in English, French, and German. The £12 annual membership fee entitles you to receive the journal, which contains a swap shop, a contacts column, a computer update, information on postgraduate teaching series, and a robotics tutor. Contact Alphonse Boehm, Global Computer Club, 51 Applegarth Dr., Ilford, Essex IG2 7TQ, England.

● **FIRST FOR THE 16s** The Micro 16s Users Group for Fujitsu owners meets in the Los Angeles metropolitan area to share experiences, exchange information, listen to speakers, and witness demonstrations. A newsletter contains meeting times and locations, minutes of the last meeting, and the outline for future ones. For details, contact William H. Mestler, 4615 Ellenita Ave., Tarzana, CA 91356, (818) 881-1288.

● **DILIGENT PUBLIC DOMAIN IN NC**—The Capitol Area CP/M Users Group (CACP/MUG) maintains an extensive public-domain software library for its members. The focus is on CP/M-80, CP/M-86, and MP/M II. The group operates two RBBS/RCPM systems, and a newsletter is in the works. Meetings take place at 7 p.m. on the second Thursday of every month in the Dreyfus Auditorium at Research Triangle Park, Raleigh, North Carolina. The \$15 annual membership fee entitles members to library access and the RCPM. Interested persons can send a self-addressed, stamped envelope to Bill Weinle, CACP/MUG, 139 Pineland Circle, Raleigh, NC 27606. ■

# THE SNOOP-PROOF DISK.



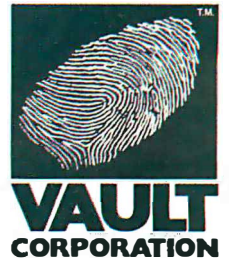
Vault Corporation, producer of the advanced Prolok™ and Telelok™ security disk technology, introduces Filelok™ the inexpensive, effective means of protecting confidential data files from unauthorized access and duplication. Now you can instantly protect all kinds of sensitive information, including word processing, spread sheets and graphics, as easily as saving a file.

Filelok data security disks provide file-by-file security selection, protected back-up copies, optional passwords, and hard disk compatibility. It works with virtually all PC®/MS-DOS® software, including the popular Lotus® 1-2-3® dBase II® and III® and WordStar®. All this comes on a U.S.-made 5¼-inch, double side/double density disk of the highest quality. With reinforced hub and lifetime warranty. Certified 100% error-free. The same kind of high performance disks you require every working day with one important difference—they're protected.

Filelok's genius is its simplicity of use coupled with an extremely high level of protection. It looks like an unprotected disk and works like an unprotected disk. Simply tell the computer which file(s) to protect and on which disk drive they're located. Instructions can be as simple as B:FL A:(applications software).

Filelok eliminates the need for expensive add-on hardware. All the technology is on the disk itself. Filelok disks are marked with unique physical "fingerprints." And no two are alike. A precise description of the print is encoded on each disk. Prints and descriptions are compared whenever a protected file is accessed and an *exact* match must occur before any decrypted data is released. Protected back-ups are easily made. However, to read them the original Filelok disk must be present in the system. Unauthorized copies having a different or non-existent fingerprint yield only encrypted—and useless—data.

For the Filelok dealer nearest you, call 1-800-445-0193. In California, call 1-800-821-8638. We're adding dealers as quickly as possible but if you can't find one nearby, simply call either of the numbers above. Or write Vault Corporation, 2649 Townsgate Road, Suite 500, Westlake Village, CA 91361. And do it now. Because some people are more nosy than you think.



## FILELOK. DATA SECURITY, RIGHT ON THE DISK.

Copyright ©1984 Vault Corporation. Filelok, Prolok and Telelok are trademarks of Vault Corporation. PC-DOS is a trademark of International Business Machines Corporation. MS-DOS is a trademark of Microsoft Corporation. Lotus and 1-2-3 are trademarks of Lotus Development Corporation. dBase II and III are trademarks of Ashton-Tate. WordStar is a trademark of MicroPro International Corporation. Dealer inquiries welcomed.

# In the 92 seconds it find any file you need



Ampex 20 MB hard disk with 25 MB tape backup.

<sup>1</sup>PC Megastore is a trademark of Ampex Corporation. <sup>2</sup>IBM-PC is trademark of International Business Machines. <sup>3</sup>Apple II and IIe are trademarks of Apple Computer.



# takes to read this ad, on our backup streamer.

Ⓛ In the 1 hour, 4 minutes other streamers take, you could call your broker. Linger over coffee. Wade through the Wall Street Journal. Ⓛ And read this PC Megastore™ ad too. ⊖ So take the time.

You'll more than make it up with a PC Megastore hard disk and tape hooked to your IBM-PC\* or compatible, Apple II or IIe, because all the files you need—both current and archive—will always be right where you need them.

Ⓛ Just a keystroke away. Ⓛ The secret? Only Ampex backs up a 20 MB hard disk with another 25 megabytes\* of addressable storage—a unique, bootable streamer with cache memory. That not only means you can address a file in 92 seconds, you can backup files offline just by touching a couple of buttons. ⊖ Without tying up your computer. ⊖ Your time. Ⓛ Or a small fortune in floppies. (In fact, our 45 megabytes of available storage cost about half the price per MB of other hard disks.) So consider your time, money and convenience. Ⓛ And our quality. The PC Megastore system is backed by a full year warranty from Ampex, a company known for manufacturing quality computer peripherals for over 20 years. Ⓛ Take a moment. Call 800 421-6863, or 213 640-0150 in California. Or write: Ampex Computer Products Division, 200 N. Nash St. MS M-11, El Segundo, CA 90215. We'll give you a dealer's name so you can buy a PC Megastore system. Ⓛ Then in no time at all, you'll make up for the 92 seconds you spent reading this ad.

**AMPEX**  
Ampex Corporation • One of The Signal Companies

\*PC Megastore is upgradeable and comes in four models: 20 MB with 25 MB tape, 10 or 20 MB disk, or 25 MB tape.

# THE GREAT UNKNOWN

The Leading Edge™  
Personal Color Computer  
At only \$2,495 standard,  
it's the great new color  
PC that everybody is just  
starting to hear about.



It's fully covered by a full  
one-year warranty  
backed by a nationwide  
network of service  
centers, and a lifetime  
HELP HOTLINE  
800-343-6857

It's far faster than the  
IBM PC (50%), and more  
powerful (256K standard,  
expandable to 640K).  
Comes with dual 5¼"  
disk drives; (also available  
10 Megabyte hard disk).

It's compatible with  
industry standard soft-  
ware (like Lotus™ 1-2-3™,  
Leading Edge™ Word  
Processing, dBase II®,  
Nutshell™, etc), and  
comes with MSDOS® and  
GW Basic® to get you up  
and running instantly.

**THE LEADING EDGE PERSONAL COLOR COMPUTER, ONLY \$2,495. STANDARD WITH COLOR MONITOR, KEYBOARD, CPU WITH 256K, PARALLEL PORT, SERIAL PORT AND SOFTWARE TO GET YOU RUNNING.**

LEADING EDGE PRODUCTS, INC.

LEADING EDGE PC AND SYSTEMS DIVISION, 225 TURNPIKE STREET, CANTON, MA 02021, 800-343-6833, (617) 828-8150  
FORTUNE DIVISION, 225 TURNPIKE STREET, CANTON, MA 02021, 800-354-0554, (617) 828-8150

IBM is a registered trademark of International Business Machines Corporation.

Lotus and 1-2-3 are trademarks of Lotus Development Corporation. dBase II is a registered trademark of Ashton-Tate. Nutshell is a trademark of Nashoba Systems, Inc. Leading Edge is a trademark of Leading Edge Products, Inc.

MS DOS and GW Basic are registered trademarks of Microsoft Corporation.

Circle 226 on inquiry card.

# READ ONLY



*A review of the IBM Personal Computer Family. Vol. 1, No. 2*



## HARDWARE NEWS

**Progress.** Even for a youngster with unusual potential, the IBM PCjr has made a lot of progress in its first year.

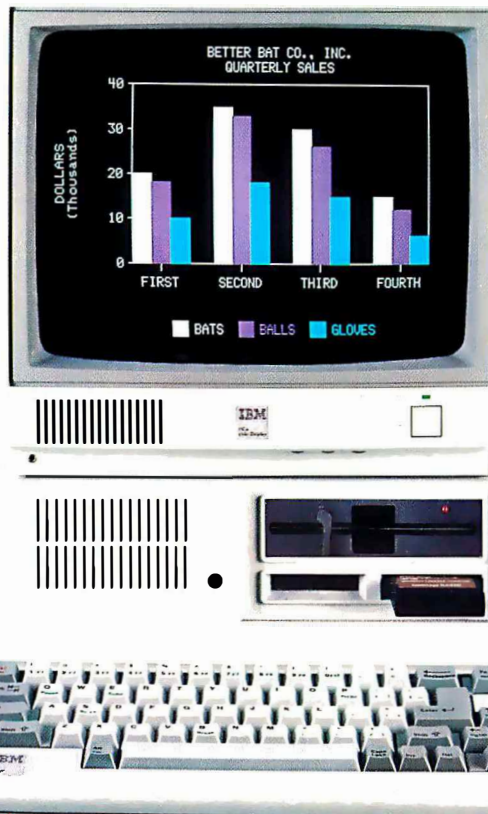
Consider memory for example. The IBM PCjr comes with up to 128KB of internal user memory. You can also add external memory expansion units of 128KB each, up to a total of 512KB. That's far more potential memory than other computers of its price range and weight class (10 pounds).\*

Increased memory allows you to take full advantage of the IBM PCjr's powerful 16-bit processor. With up to 512KB of available memory and PCjr's double-sided diskette drive, you can run thousands of best-selling programs that have been developed for the IBM PC. If you're a programmer, the PCjr joins the other members of the IBM PC Family as a full-fledged application development tool.

There is also a variety of plug-in cartridge programs, which work faster than diskettes and don't take up any user memory. Three popular examples are Lotus 1-2-3™, PCjr Color-Paint, and Managing Your Money™ by financial expert Andrew Tobias. And every PCjr comes with cassette BASIC built into the system board.

PCjr makes it easy and affordable to start small and grow at your own

pace. The \$599 PCjr Entry Model, for example, comes with 64KB of memory, runs cartridge programs, and can easily be expanded into a diskette model. The PCjr Enhanced Model at \$999\*\* offers 128KB of memory—enough to run many programs from the IBM PC software library—and a 360KB diskette drive.



*Cartridge-based programs for PCjr include Lotus 1-2-3™.*

No matter which model you choose, the IBM PCjr's 13 ports for plug-in options make it easy to add to your system, from more memory, to a modem, joysticks (PCjr can accommodate two), color monitor, or other peripherals.

**Keys and colors.** The IBM PCjr now comes with a new typewriter-style cordless keyboard that frees you to work up close or across the room from the system unit.

While PCjr can be connected to just about any display, including your TV set, the IBM PCjr Color Display offers some real advantages at a very reasonable price.

It has a built-in speaker and an earphone jack for educational and entertainment programs that feature music and sound effects. The non-glare RGB screen gives you better character definition and clarity than a color composite monitor. And since the PCjr Color Display is designed to be placed on top of the system unit, it's a space-saving addition to your PCjr system.

Whatever monitor you decide to add to your PCjr system, there's no extra expense for an additional interface card. Ports for both monitors and serial printers are built in.

\*Weight does not include power pack and monitor.

\*\*Prices shown apply at IBM Product Centers. Lotus 1-2-3 is a trademark of Lotus Development Corporation. Managing Your Money is a trademark of MECA.



## UP AND RUNNING

**First String.** It didn't take the IBM PCjr long to make the team. In its first year of eligibility, PCjr was picked by coach Grant Teaff to play a key position for the Baylor University football team.

Coach Teaff has a practiced eye for players with potential. He's coached the Baylor Bears to two Southwest Conference championships, been named Southwest Conference Coach of the Year five times, and was National Coach of the Year in 1975.

The Bears' coaching staff has used computers to help analyze scouting reports and playing patterns of opposing teams for nearly ten years. In the beginning, though, there was a lot of competition for a limited amount of computer time.



Coach Teaff and his assistant coaches had to write up all their game and player information and then have it keypunched. After that came a wait for processing time on Baylor University's mainframe computers, time that had to be shared with other departments and the university administration. Analysis of a game often wasn't available until a week after it had been played.

PCjr helped change all that.

**Winning Tendencies.** Coach Teaff calls the IBM PCjr "the ideal football coaching tool." With up to 512KB of available memory, it's powerful enough to make his staff independent of the University's central computers. And PCjr and the PCjr Color Display are inexpensive and compact enough to be used in offensive and defensive staff meeting rooms.

Using software developed by Coach Teaff, PCjr enables the Bears' coaches to enter information as they view game film of an opposing team and to see results immediately. When play-by-play statistics of several games are compiled and analyzed on PCjr, the coaches are able to identify tendencies of a team in given situations. They're then able to adjust their own game plan accordingly.

When Baylor plays new opponents, for instance, the two teams exchange films of past games. PCjr is used to analyze variables such as down, distance, and type of play. The Baylor coaches enter the game with much the same level of knowledge as if they'd played the new team for years.

The IBM PCjr helps out with other coaching duties as well. Team statistics, information about possible recruits, and numerous

business and financial chores are all part of its workload.

Other coaches around the country had a chance to see the benefits of computerized coaching techniques this summer when members of the Baylor coaching staff demonstrated their programs at the nationwide football and basketball clinics sponsored by The Coaches, Inc.

Coach Teaff points out that a PCjr could make the difference between winning and losing to teams—small high schools, for example—with a limited budget and coaching staff. Using the PCjr, he says, "is like adding two or three men to the staff."

Not bad for a 10-pound, first-year player.



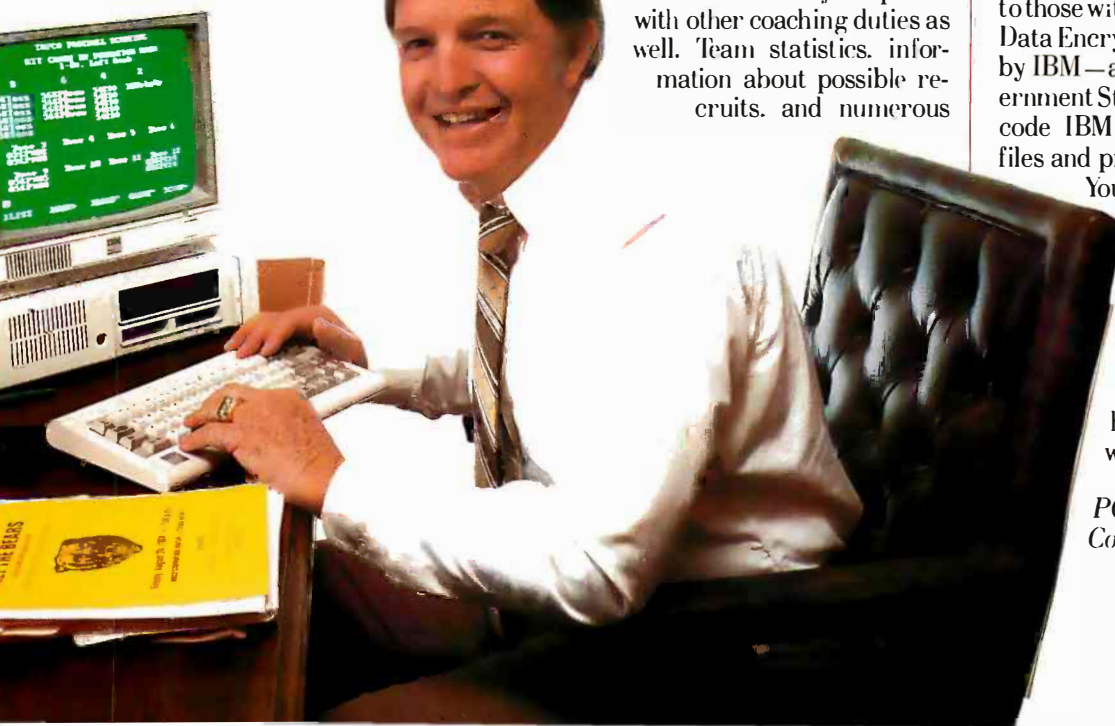
## WHAT'S THE PROGRAM?

**Maximum Security.** Some information belongs under lock and key. But the rapid growth of personal computing and computer networks makes it increasingly difficult to keep it there.

Data Encoder software from IBM can help ensure that sensitive information—personnel and payroll records, for instance—is available only to those with a need to know. It uses the Data Encryption Algorithm developed by IBM—and adopted as a U.S. Government Standard—to encode and decode IBM Personal Computer data files and programs.

You don't have to be a master cryptographer to use Data Encoder. For members of the IBM Personal Computer Family with 192KB of memory, there's a full screen interface with menus and help screens. Systems with 128KB use easy

*PCjr is a team player for Coach Grant Teaff.*



DOS-like commands. You designate the key that triggers encoding and decoding procedures.

Files protected by Data Encoder can still be sent through IBM Personal Communications Manager or any other communications program with a text transparency feature. Without Data Encoder software and the proper security key, however, the information remains unintelligible.

So much for prying eyes.

**In the clear:** While some people are determined to keep things confidential, others want nothing less than perfect clarity. The following new members of IBM's growing family of programming productivity tools can help remove that unwanted element of mystery from your application programs.

The IBM Professional Debug Facility can help make short work of improving your assembler language programs. It includes a Resident Debug Tool for full function, full screen interactive debugging, a Disk Repair Program, and a Non-maskable Interrupt card for access to a system that's locked because of program error.

The IBM Personal Computer Application Display Management System (ADMS) simplifies creation of clear, informative screens for application programs. Since screen development is one of the most time-consuming programming tasks, ADMS can help dramatically increase your application development efficiency and productivity.

ADMS consists of two parts. The Application Display Designer is a screen building program that significantly reduces the program coding required for an application. The Application Display Manager is a runtime program that interprets the screen design code.

Screens defined with ADMS remain independent of the application program, so they can be modified or redefined without affecting the logic of the application.

**The view from the top.** It's worth noting that programs developed with the help of ADMS can run under TopView, IBM's new multitasking operating environment.

TopView's multitasking capabilities allow you to work quickly and efficiently with a wide range of application programs. You can switch rapidly from one program to another without reloading diskettes and can copy information from one application to another. Sales figures from a spreadsheet program and a document from a word processing program, for example, can be used concurrently to produce a sales report combining financial information and text.

In addition, the TopView operating environment supports advanced windowing facilities, data transfer among different applications, and pointing devices such as a mouse. All are features that enable you to work easily with a variety of applications.

#### *Data Encoder software from IBM.*

There's also an IBM TopView Programmer's Toolkit available that contains the routines, utilities, and systems related information necessary to develop applications that run under TopView.



#### **FUN AND GAMES**

**Medieval adventures.** The ideal game is easier to define than to find: it should be entertaining *and* enlightening. There are new programs from IBM that manage wonderfully to be both.

King's Quest from IBM, for example, is chiefly for fun but does impart a few important lessons. The hero of this colorful three-dimensional adventure game, the valiant Sir Grahame, is sent by the King of Daven-

try to search the countryside for three magical items that will prevent the



#### *King's Quest software from IBM.*

kingdom's collapse. Along the way, he encounters dangerous creatures, makes new friends, and avoids—or tries to avoid—treacherous terrain.

King's Quest is unusually enjoyable because you interactively control Sir Grahame's wanderings, helping him duck, jump, or swim his way through the quest. Many tasks can be solved in different ways, and more creative solutions are awarded higher scores.

Hence also the educational value. Cleverness and imagination are rewarded. And a few valuable practical lessons are reinforced along the way. Looking, for instance, before one leaps into alligator-filled moats and deep, dark holes.

King's Quest runs on the IBM PCjr and makes good use of some special PCjr capabilities. Sir Grahame's movements, for example, are unusually smooth and realistic because multiple video buffers in main memory are used instead of a single chip to create the animation effects. PCjr's three voice sound creates an impressive variety of sound effects, such as a fanfare of horns when the castle door opens. And PCjr's ability to produce 16 colors lends a touch of realism to an imaginary kingdom.

**Modern machines.** But can a program with more serious didactic intent be as enticing as Sir Grahame's rough and tumble lessons? Yes, if it's Rocky's Boots™, winner of *Learning* magazine's Software of the Year award and of high praise from *The New York Times*.

In fact, Rocky's Boots from IBM is also a quest for creative solutions to a series of different games. Along the way, both children and adults can learn the basics of electronic circuitry and of the Boolean logic that drives computer operations.

Lest that sound too intimidating, remember that the learning is a by-product of games in which you build various simulated machines on your display screen. Early sections of Rocky's Boots guide you through basic instructions about building and activating simple electronic devices.

You're also introduced to the various "spare parts" and "tools"—such as clackers, boppers, alligators, and alligator detectors—that may come in handy. Later in the program there are more challenging games to play using the machines you've built.

All in all, Rocky's Boots is as thoroughly engrossing as King's Quest. And on one point, at least, it's easier: Sir Grahame has to make do without an alligator detector.

**Christmas cheer:** Rocky's Boots and King's Quest are part of a special Christmas collection of entertainment and educational software from IBM.

Some others in the Christmas collection come from the same series of IBM learning games as Rocky's Boots. They include Bumble Games™, Bumble Plot™, Gertrude's Puzzles™, Gertrude's Secrets™, and Juggles' Butterfly™. See your authorized IBM Personal Computer dealer, IBM Software dealer, or IBM Product Center for complete details.

The Learning Company reserves all rights in the Juggles, Bumble, Gertrude, and Rocky characters and their names as a trademark and under copyright law. Bumble Games, Bumble Plot, Gertrude's Puzzles, Gertrude's Secrets, Juggles' Butterfly, Rocky's Boots, and The Learning Company are trademarks of The Learning Company.



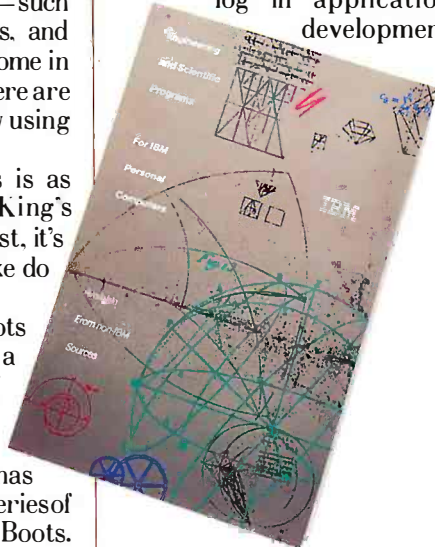
## HARDCOPY

**Full Disclosure.** If business applications or entertainment programs aren't what you're after, there's a new software listing available from IBM, one with a long title but a specific purpose: the directory of *Engineering and Scientific Programs for IBM Personal Computers Available from Non-IBM Sources*.\*

It lists programs in a wide variety of engineering/scientific categories, from Computer Graphics to Lab Auto-

mation and Statistical Techniques. The *Engineering and Scientific* directory includes program descriptions, minimum configuration requirements, initial availability dates, and vendor information.

If your department or laboratory is suffering a backlog in application development



*Directory of engineering and scientific programs for IBM Personal Computers.*

work, one of these programs—in original form or with a little modification—may be the answer.

For information about where to get the *IBM Engineering and Scientific* directory, see the box at the end of this issue of *Read Only*.

\*IBM has not evaluated these programs and makes no comment, warranty, or guarantee as to their functions, quality, or performance.

**IBM**®



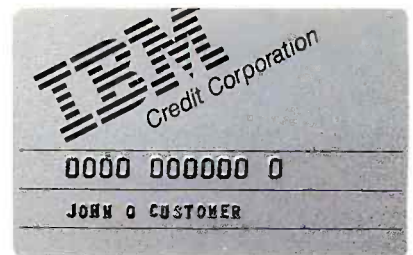
## TIPS AND TECHNIQUES

**Living Dangerously.** Diskettes lead dangerous lives. When they're not being folded, stapled, or otherwise rendered unfit for service, you might think they could at least spend a quiet evening in front of the TV set.

But no. Danger lurks there, too. All color TV sets and many color monitors have a degaussing coil around the face of the tube that demagnetizes the shadow mask inside the tube when the set is turned on.

If you keep your diskettes anywhere near (within a foot or so) the front of your color monitor or TV set, they may be exposed to a large shot of AC magnetic field every time you turn on the power. This could have a fatal and irreversible effect upon the data stored on the diskettes.

Don't degauss your diskettes.



## IBM CREDIT CARD

The new IBM Credit Card gives you a convenient way to get started in personal computing or to add hardware and software to your IBM Personal Computer system. It's available with any purchase of \$300 or more. You can apply for the card and make a purchase with it on the same day. See your IBM Product Center or participating authorized IBM Personal Computer dealer for details.

For more information about IBM Personal Computer products discussed in this issue of *Read Only*, see your authorized IBM Personal Computer dealer or IBM Product Center. To learn where, call 800-447-4700. In Alaska and Hawaii, 800-447-0890.

©1984 International Business Machines Corporation  
Little Tramp character licensed by Bubbles Inc., s.a.

# B·O·O·K R·E·V·I·E·W·S

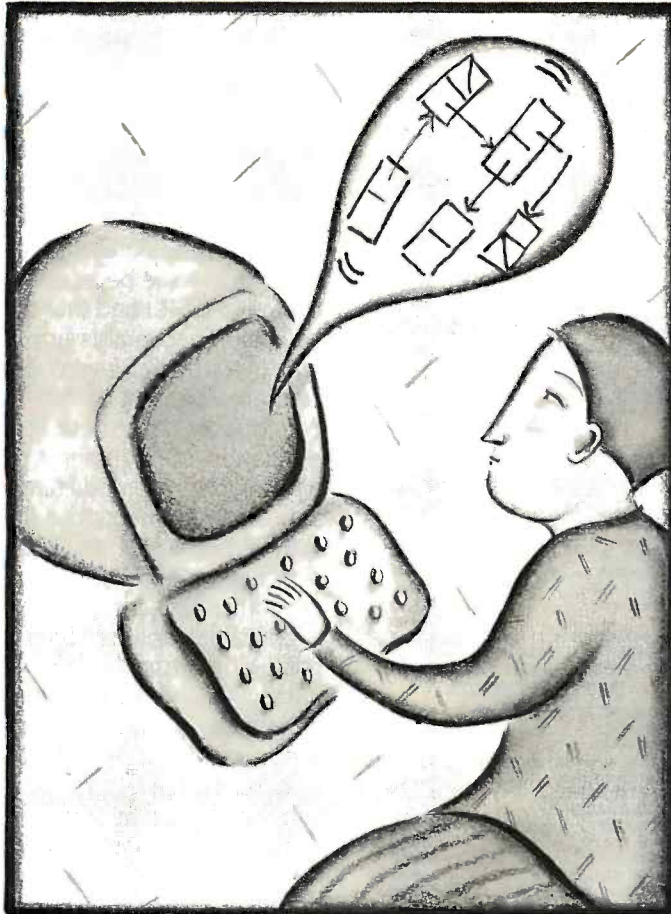
LISPCRAFT  
Robert Wilensky  
W. W. Norton  
New York: 1984  
384 pages, \$19.95

TALKING COMPUTERS  
AND TELECOMMUNICATIONS  
John A. Kuecken  
Van Nostrand Reinhold  
New York: 1983  
256 pages, \$26.50

ASSEMBLY LANGUAGE  
PRIMER FOR THE  
IBM PC & XT  
Robert Lafore  
New American Library  
New York: 1984  
501 pages, \$21.75

COMPUTER ETHICS:  
A GUIDE  
FOR THE NEW AGE  
Douglas W. Johnson  
Brethren Press  
Elgin, IL: 1984  
120 pages, \$6.95

LISPCRAFT  
Reviewed by Jerry Smith



A variety of software products available recently make use of programming techniques that originated in the field of artificial intelligence (AI). Examples are database systems that can process simple English queries and packages for solving systems of equations. These products are indicative of an increasing acceptance of the developments in AI. As a result, we may expect an increased interest in the tools and techniques of this discipline. One of the oldest tools used by AI researchers is LISP, a list-processing language. Several LISP interpreters are available for microcomputers.

LISP as a programming language is quite different from sequentially rigid, procedural languages, such as PL/I and FORTRAN. With these procedural languages you are always aware of and confronted with the computer's basic architecture, much like programming in assembly language. LISP, on the other hand, provides you with a

higher-level data structure, the list, which becomes the programmer's basic building block. In writing a text for such a language, it would be easy to introduce LISP via a comparison with the more primitive languages already mentioned. Fortunately, Robert Wilensky in *LISPCraft* avoids this approach from the very beginning, rarely making comparisons with other languages.

Wilensky begins with a discussion of the basic expressions in LISP in terms of arguments and commonly used functions. He uses this opportunity to acquaint the reader with LISP's approach to expression evaluation. While the author appropriately avoids comparison of LISP to other languages, he seems aware of the likelihood that the reader will make such an association.

The evaluative, functional nature of LISP is very conducive to interactive programming. Wilensky uses this feature of LISP to its full potential by illustrating each new feature of LISP with a sample interaction. The reader is thus an active participant in spirit, if not in fact. While reading the text I was logged on to my computer, actively following the examples. In addition to the immediate feedback you get, this encourages the noting and documenting of differences between your version of LISP and that used by the author.

With LISP there is no accepted language standard. The dialect of LISP used in this text is FranzLISP. Lack of a standard for a language often makes choosing and reading a text a less than pleasant experience. (I have found this to be the case with several Pascal texts.) Wilensky de-emphasizes this in two ways. First, he concentrates on the basics. Only after developing the central idea of a feature

(continued)



COMPUTERBANC

# EXPAND YOUR ACCOUNT... SAFELY!

GET SERIOUS. STOP PAYING HIGH PRICES NOW!

THOUSANDS OF AVAILABLE ITEMS. CALL FOR COMPLETE PRICING.

**SYSTEMS**

**IBM PC**  
256K Two 360KB Disk Drives, Color  
Graphics/Monochrome Graphics board,  
Parallel Printer Port, Monochrome Display  
(Amber/Green), DOS 2.1.  
**LIST PRICE \$2950.00 — ONLY \$2095.00**

CALL FOR OTHER BUNDLED SYSTEMS

SUPER XT ..... \$2795.00

**IBM SOFTWARE**

**LOTUS** 1-2-3 ..... \$299.00  
**LOTUS** Symphony ..... 449.99  
**MICROPRO** Wordstar ..... 249.00  
**ASCII Express** For IBM ..... 125.00  
Wordstar Professional ..... 359.00  
Infostar ..... 249.00  
Multimate ..... 269.00  
**MICROSOFT** Word ..... 229.00  
Word W/Mouse ..... 279.00  
Multiplan ..... 139.00  
Project ..... 159.00  
**ASHTON TATE** Friday ..... 179.00  
dBASE II ..... 280.00  
dBASE III ..... 359.00  
Framework ..... 389.00

**LIFETREE SOFTWARE** Volkswriter ..... 119  
Volkswriter Deluxe ..... 169.00

**FOX & GELLER** Quickcode ..... 139.00  
dUtil ..... 59.00  
dGraph ..... 149.00

**MICROBIM** Rbase-4000 ..... 295.00  
FFS Write ..... 89.00  
File ..... 89.00  
Report ..... 89.00  
Proof ..... 79.00  
Access ..... 79.00

ENERGRAPHICS ..... 269.00

NORTON UTILITIES ..... 59.00

**IBM HARDWARE**

**AST** Six Pack Plus 64K ..... 259.00  
MegaPlus II ..... 259.00  
PC Net 1 Starter Kit ..... 830.00  
**QUADRAM** Quadboard 0-K ..... 219.00  
Quadboard I or Microfazer 64K ..... 205.00  
Quadlink ..... 479.00

**MICROSCIENCE**

10MB Winchester ..... 859.00  
**HERCULES** Mono Graphics ..... 329.00  
Color Card ..... 199.00  
**PLANTRONICS** Colorplus ..... 389.00  
5TB Rio plus 64K ..... 249.00  
Super Rio ..... 259.00  
Graphix +II NEW ..... 309.00  
**TEAC** 55B ..... 135.00  
55F ..... 180.00  
**TANDON** TM100-2 ..... 179.00

**TALL GRASS**

12MB External W/Tape ..... 2799.00  
RAM 64K upgrade ..... 35.00

MOUSE SYSTEMS Optical Mouse ..... 189

ALSO - XCOMP, PERSYST, ORCHID,

TITAN AND OTHERS

**PRINTERS LETTER QUALITY**

**BROTHER** HR-15 ..... 375.00  
HR-25 ..... 629.00  
HR-35 ..... 859.00  
**JUKI** 6100 ..... 429.00  
**NEC** 2030 ..... 659.00  
2050 ..... 799.00  
3530 ..... 1229.00  
3550 ..... 1539.00

**PRINTERS DOT MATRIX**

**STAR MICRONICS** Gemini 10X ..... 259.00  
Gemini 15X ..... 389.00  
**EPSON** RX-80 F/T ..... 329.00  
FX-80 ..... 359.00  
FX-100 ..... 669.00  
**OKIDATA** 92A ..... 389.00  
93A ..... 649.00  
84A ..... 949.00  
**PANASONIC** 1091 ..... CALL  
**TOSHIBA** 1350-P ..... 1399.00  
**EPSON** LQ1500 ..... 1299.00

**MONITORS**

**AMDEK** 300 ..... 129.00  
300A ..... 145.00  
310A ..... 169.00  
Color I+ ..... 269.00  
Color II ..... 459.00  
**TAJAN** Composite Amber ..... 119.00  
121/122 ..... 149.00  
420 (RGB) ..... 439.00  
415 (RGB) ..... 489.00  
**PRINCETON GRAPHICS** HX-12 ..... 469.00  
SR-12 ..... 649.00  
MAX-12 ..... 189.00  
**ZENITH** ZVM-122 Amber ..... 95.00  
ZVM-123 Green ..... 95.00  
**NEC** 1201 Hi Res Green ..... 139.00  
1205 Hi Res Amber ..... 139.00  
1206 Green ..... 99.00  
JC1216 Color ..... 359.00

**MODEMS**

**HAYES** 1200 ..... 469.00  
1200B ..... 389.00  
300 ..... 199.00  
Micromodem //e ..... 219.00  
**ANCHOR** Mark X ..... 109.00  
Mark XII ..... 259.00  
Volksmodem ..... 59.00  
**NOVATION** Smart Cat Plus ..... CALL  
Access 1-2-3 ..... 419.00  
Apple Cat II ..... 239.00  
J-Cat ..... 99.00  
**U.S. ROBOTICS** PC Modem ..... 365.00  
Password ..... 349.00  
**PROMETHEUS** Promodem 1200 ..... 329.00

**APPLE PRODUCTS**

**MICRO SCI** AZ drives ..... 179.00  
**RANA** ELITE 1 ..... 219.00  
**TEAC** drive ..... 189.00  
**APPLE** Compatible drive ..... 169.00  
**WESPER** Interface ..... 69.00  
**BUFFERED** 16K ..... 139.00  
**SYSTEM SAVER** Fan ..... 69.00  
**MICROSOFT** Premium //e ..... 279.00  
Softcard CP/M ..... 29.00  
Multiplan ..... 129.00  
**MAC** Multiplan (Macintosh) ..... 129.00  
Basic (Macintosh) ..... 109.00  
**APRICORN** Serial Card ..... 69.00  
Z-80 Card ..... 59.00  
**ASCII** Express Professional ..... 89.00  
**MAXELL** S/S ..... 19.00  
D/S ..... 27.00  
**KOALA** Touch Tablet ..... 79.00  
**HAYES** Mach III JoyStick ..... 39.00  
**THUNDERCLOCK** ..... 119.00  
**MOCKINGBOARD** ..... CALL  
**APPLEMOUSE II** ..... 129.00  
**VIDEX** Ultraterm ..... 179.00  
**80 COLUMN/64K** Interface //e only 99.00  
**80 COLUMN** Card II+ only ..... 59.00

**WE SUPPORT THESE FINE SYSTEMS:**  
Apple, Compaq, IBM, Sanyo and many  
more.

TELEX #550757/ANSWER BACK-COMPUTERBNK UD



714/841-6160

COMPUTERBANC

16783 Beach Blvd., Huntington Beach, CA 92647

All products are in factory sealed packages. We guarantee all items for 30 days. Within this period, defective merchandise returns must be accompanied by RMA number. All other returns will be subject to a 10% restocking fee. For prepaid orders, there will be a 3% shipping charge. 5% for UPS Blue Label \$5.00 maximum; all orders outside U.S.A. at 15% shipping. There will be an additional \$4.00 surcharge on C.O.D. orders. Cash or Cashiers check is required on C.O.D. orders. California residents add 6% sales tax. Prices subject to change without notice.

© Copyright 1984 COMPUTERBANC All Rights Reserved

**BOOK REVIEWS**

does he pay particular attention to the specifics of FranzLISP. This approach is beneficial to users and non-users of this LISP dialect. Second, for the benefit of FranzLISP users, the author provides in later chapters specifics of and enhancements due to this dialect. By this time, users of other dialects are not distracted and FranzLISP users obtain useful information. This approach also facilitates the use of the text as a reference manual.

There are two cases in which the nonstandard nature of LISP is readily apparent—debugging and error handling. These are concerns with any book about a programming language. Wilensky handles them in separate chapters. He has divided his material into relatively small, focused chapters and follows each chapter with concise summaries and exercises.

I remember first studying LISP and being somewhat confused over the different types of functions available. This is a critical issue because functions and function calls are central to LISP. I find that this text almost anticipates such confusion and builds upon each discussion of function type in a straightforward, comparative way. Wilensky concentrates on lambda functions first. After the reader is comfortable with these functions, which always lead to evaluation of arguments, the author introduces other types, such as lambda functions, which do not cause evaluation of arguments. Additionally, he explains functions with respect to EXPRs, FEXPRs, and LEXPRs. The discussion here is excellent.

Another aspect of LISP for which a clear understanding is critical is variable scoping. LISP uses what are essentially global and local variables. Variables that are not passed as arguments, but that exist outside of and are referenced by functions, may have their values change. These are called free variables. Since LISP programs execute interpretively, potentially calling any LISP function already defined, it is impossible to determine the limits or ramifications of free variable referencing until execution time. This is frequently termed dynamic scoping, as opposed to lexical scoping in languages such as PL/I, in which you can determine a variable's scope by context.

A final aspect of LISP that is critical in any text is LISP internals. Wilensky discusses the binary-tree approach used by LISP for storing lists and the way in which LISP manages its symbol table.

Another aspect of LISP that the author covers nicely is recursion, the process whereby a function calls itself. The discussion is complete and supplemented with diagrams, important for users who are accustomed to languages that do not let you use recursion. Wilensky also covers iteration, for those who prefer this approach to recursion. He gives examples contrasting these totally different approaches to implementing repetition in a program with consideration for the advantages of each approach. Conditional testing and logical operators are handled in an early chapter, with these features being used frequently in subsequent examples.

Although the chapter on reading and printing is essen-



tially complete, I would have appreciated more examples. However, I also recognize that input/output is implementation-specific.

Earlier I mentioned the possibility that programmers new to LISP could be adversely affected by prior knowledge of dissimilar languages. A tendency to structure LISP programs like those written in other languages is harmful to the extent that you may not make the most of those features inherent in LISP. Wilensky addresses this issue with two chapters on LISP applications. This gives the reader/programmer a flavor for LISP and the power inherent in its list-processing approach.

*LISPcraft* addresses the critical issues well, as should any text. However, it is the organization and method of presentation that makes it such a good text and reference.

*Jerry Smith* (1500 Layton Lane, Signal Mountain, TN 37377) is an assistant professor of computer science at the University of Tennessee-Chattanooga with research interests in database and knowledge-based systems.

TALKING COMPUTERS AND TELECOMMUNICATIONS

Reviewed by Michael O'Neill

The title of this book and the description on the dust jacket are misleading. I got the impression that *Talking Computers and Telecommunications* might be an introductory survey of the whole range of computer applications in telecommunications and was concerned with the social forces that formed this technology, as well as the technology itself. In fact, *Talking Computers* is not a survey, does not cover a wide range of topics, and is not especially concerned with the origins of the technology it does deal with.

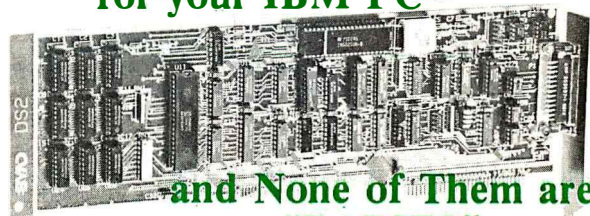
The book is actually a discussion of the technical aspects of two specific topics. The first part of the book deals with design considerations for equipment to automatically dial and answer telephones. This section details the various control signals used by the phone system and describes what sort of circuitry is needed for recognition and generation of those signals.

The second part describes some of the equipment available for the computer-controlled electronic generation of speech. The author treats, in great detail, Moser encoding (used by National Semiconductor) and linear predictive coding (used by Texas Instruments). He also includes material on the production and characteristics of natural speech and a chapter on the digitization of speech waveforms. A final chapter gives an introduction to and evaluation of work in automatic speech recognition. Except insofar as telephone-quality speech reproduction is considered a standard for speech generation, there is no connection between the two parts of this book.

This is not a how-to book; it is a how-to-go-about-it book. You will not find fully elaborated designs here. Instead, the author provides general guidelines and presumes that

(continued)

**INTRODUCING...BYAD's  
Family of Coprocessors  
for your IBM PC®**



**and None of Them are  
"BABIES"**

**BYAD Offers Grownup Solutions  
To Your Coprocessing Needs**

**DS2:** The DS2 is our popular performer. It contains a Z80B processor, 64K bytes of RAM and a 8250 UART, addressable by the IBM as either COM1 or COM2. With each DS2, BYAD provides a licensed copy of Digital Research Inc.'s CP/M®-80 Version 2.2 operating system. The package also includes all BYAD's software utilities which expand the base capabilities of CP/M, allowing the DS2 to interface to other CP/M systems.

**BYWAY 100:** The BYWAY 100 Coprocessor may function as a programmable front end communications controller. It is equipped with a Z80B processor, 64K bytes of RAM and an 8250 UART. The UART is only addressable from the BYWAY 100's Z80B, thus freeing up the IBM PC for processing other tasks simultaneously. BYAD provides its utilities and CP/M-80 as a development environment. Additional support software is available.

**BYWAY 200:** BYAD offers its newest product, the BYWAY 200 Coprocessor, as the ultimate front-end communications controller for the OEM and end user. The BYWAY 200 contains a Z80B processor, 64K bytes of triported DRAM, a 4-channel DMA controller, 2 high speed serial ports and 3 sockets for EEPROM, EPROM, 8K by 8 IRAM, and PROM. It can be programmed to support all asynchronous, synchronous and data link protocols.

**Multi-User Capability:** BYAD's product family now allows you to convert your IBM PC into a multi-terminal, multi-user system. This capability can be accomplished by "stacking" multiple BYAD systems into a single PC. Each system runs a copy of the MT86/80™ software, using a low cost asynchronous CRT.

**We are sure you'll agree with us that  
BYAD offers the IBM PC user mature,  
sophisticated coprocessor capabilities.**



**BYAD Inc.**

BYAD Inc.  
95 West Algonquin Road  
Arlington Heights, Illinois 60005  
(312) 228-3400

(DEALER INQUIRIES WELCOME)

CP/M is a registered trademark of Digital Research.  
IBM is a registered trademark of International Business Machine Corporation.  
MT86/80 is a trademark of Brainchild Computer Works, Inc.

## 64K S100 STATIC RAM

**\$179<sup>00</sup>**  
KIT

**NEW!**

LOW POWER!  
150 NS ADD \$10



BLANK PC BOARD  
WITH DOCUMENTATION  
\$55

SUPPORT ICs + CAPS  
\$17.50

FULL SOCKET SET  
\$14.50

FULLY SUPPORTS THE  
NEW IEEE 696 S100  
STANDARD  
(AS PROPOSED)  
FOR 56K KIT \$165

ASSEMBLED AND  
TESTED ADD \$50

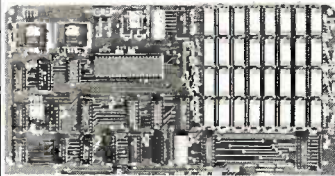
### FEATURES: **PRICE CUT!**

- \* Uses new 2K x 8 (TMM 2016 or HM 6116) RAMs.
- \* Fully supports IEEE 696 24 BIT Extended Addressing.
- \* 64K draws only approximately 500 MA.
- \* 200 NS RAMs are standard. (TOSHIBA makes TMM 2016s as fast as 100 NS. FOR YOUR HIGH SPEED APPLICATIONS.)
- \* SUPPORTS PHANTOM (BOTH LOWER 32K AND ENTIRE BOARD).
- \* 2716 EPROMs may be installed in any of top 48K.
- \* Any of the top 8K (E000 H AND ABOVE) may be disabled to provide windows to eliminate any possible conflicts with your system monitor, disk controller, etc.
- \* Perfect for small systems since BOTH RAM and EPROM may co-exist on the same board.
- \* BOARD may be partially populated as 56K.

## 256K S-100 SOLID STATE DISK SIMULATOR!

WE CALL THIS BOARD THE "LIGHT-SPEED-100" BECAUSE IT OFFERS AN ASTOUNDING INCREASE IN YOUR COMPUTER'S PERFORMANCE WHEN COMPARED TO A MECHANICAL FLOPPY DISK DRIVE.

### PRICE CUT!



BLANK PCB  
(WITH CP/M\* 2.2  
PATCHES AND INSTALL  
PROGRAM ON DISKETTE)  
**\$69<sup>95</sup>**  
(8203-1 INTEL \$29.95)

#### FEATURES:

- \* 256K on board, using + 5V 64K DRAMS.
- \* Uses new Intel 8203-1 LSI Memory Controller.
- \* Requires only 4 Dip Switch Selectable I/O Ports.
- \* Runs on 8080 or Z80 S100 machines.
- \* Up to 8 LS-100 boards can be run together for 2 Meg. of On Line Solid State Disk Storage.
- \* Provisions for Battery back-up.
- \* Software to mate the LS-100 to your CP/M\* 2.2 DOS is supplied.
- \* The LS-100 provides an increase in speed of up to 7 to 10 times on Disk Intensive Software.
- \* Compare our price! You could pay up to 3 times as much for similar boards.

**\$259<sup>00</sup>**

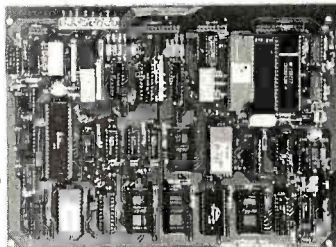
#LS-100 (FULL 256K KIT)

## THE NEW ZRT-80 CRT TERMINAL BOARD!

A LOW COST Z-80 BASED SINGLE BOARD THAT ONLY NEEDS AN ASCII KEYBOARD, POWER SUPPLY, AND VIDEO MONITOR TO MAKE A COMPLETE CRT TERMINAL. USE AS A COMPUTER CONSOLE, OR WITH A MODEM FOR USE WITH ANY OF THE PHONE-LINE COMPUTER SERVICES.

#### FEATURES:

- \* Uses a Z80A and 6845 CRT Controller for powerful video capabilities.
- \* RS232 at 16 BAUD Rates from 75 to 19,200.
- \* 24 x 80 standard format (60 Hz).
- \* Optional formats from 24 x 80 (50 Hz) to 64 lines x 96 characters (60 Hz).
- \* Higher density formats require up to 3 additional 2K x 8 6116 RAMs.
- \* Uses N.S. INS 8250 BAUD Rate Gen. and USART combo IC.
- \* 3 Terminal Emulation Modes which are Dip Switch selectable. These include the LSI-ADM3A, the Heath H-19, and the Beehive.
- \* Composite or Split Video.
- \* Any polarity of video or sync.
- \* Inverse Video Capability.
- \* Small Size: 6.5 x 9 inches.
- \* Upper & lower case with descenders.
- \* 7 x 9 Character Matrix.
- \* Requires Par. ASCII keyboard.



BLANK PCB WITH 2716  
CHAR. ROM, 2732 MON. ROM  
**\$59<sup>95</sup>**

SOURCE DISKETTE - ADD \$10  
SET OF 2 CRYSTALS - ADD \$7.50

WITH 8 IN.  
SOURCE DISK!  
(CP/M COMPATIBLE)

**\$129<sup>95</sup>** (COMPLETE KIT,  
# ZRT-80 2K VIDEO RAM)

## Digital Research Computers

P.O. BOX 461565 • GARLAND, TEXAS 75046 • (214) 225-2309

**TERMS:** Add \$3.00 postage. We pay balance. Orders under \$15 add 75¢ handling. No C.O.D. We accept Visa and MasterCard. Texas Res. add 6-1/8% Tax. Foreign orders (except Canada) add 20% P & H. Orders over \$50 add 85¢ for insurance.

## BOOK REVIEWS

you have enough knowledge of hardware and software to choose the method best suited to your needs. Kuecken includes a number of circuit diagrams and BASIC computer programs, but these are used more to illustrate principles than to exemplify practical systems.

The author has evidently had extensive experience designing the types of systems he discusses. He offers much practical advice about such matters as how well you can expect real telephone signals to conform to published standards and how well you can expect speech-synthesis systems to perform.

A minor problem with this book is the author's tendency to include more information than is really necessary. This is particularly noticeable in his discussion of the Texas Instruments speech-synthesis chip; he gives a more extensive presentation of the internal workings of this chip than is really needed to apply it, and the applications information gets buried in all this detail. In the chapters on sound and speech and their generation, the author lets his interest in music carry him away. He includes a good deal of information that is not relevant to the subject of speech generation. Although I share Kuecken's interest in music and I think that his use of a musical perspective is a good way to introduce the subject of sound, his inclusion of irrelevant and speculative material will confuse many readers. (One practice of the author's that I would be glad to see used elsewhere is his inclusion of musical-note equivalents of frequencies. These help to clarify the relations between various frequencies.)

I have noticed two errors of fact in *Talking Computers*. The first one occurs when the author describes the production of musical waveforms using the Fourier transform, i.e., by adding together sine waves of various frequencies. So far, so good. He then claims, incorrectly, that this is similar to the operation of a Moog synthesizer. (The Moog machine works by filtering a complex waveform; see reference 1.) That error is not especially important. The second error is. Kuecken claims that the fast Fourier transform requires about 2N operations; it actually requires a number of multiplications proportional to NlogN (N is the length of the sequence to be transformed; see reference 2). This may be a typographical error; still, the text is wrong.

Kuecken has written an eminently readable book. Those who are interested in the topics covered by *Talking Computers and Telecommunications* should find it useful. I hope that the misleading dust-jacket copy does not prevent it from reaching its proper audience.

#### REFERENCES

1. Moog, R. A. "A Brief Introduction to Electronic Music Synthesizers." *BYTE*, December 1982, page 278.
2. Brigham, E. O. *The Fast Fourier Transform*. Englewood Cliffs, NJ: Prentice-Hall, 1974, page 8.

Michael O'Neill (2227 Dwight Way #4, Berkeley, CA 94704) has been a programmer for 20 years.

(continued)

# The only Modula-2 native code compiler for 8086/8088-based machines and VAX<sup>®</sup> systems.

**All the strengths of Pascal, plus improvements in every respect.**

Modula-2 is Niklaus Wirth's second generation programming solution. All the best features of his Pascal language plus major features for true modularity, support for multi-tasking, type checking between program modules, syntax improvements, and features for increased portability (to name just a few).

**A complete program development system.**

LOGITECH MODULA-2 includes a complete implementation of Wirth's design, plus 8086 large model support and additional LOGITECH modules (including display handling and dynamic string handling).

A complement of powerful debugging tools—including compile-time error checks and symbolic debugging—is included.

**Professional support from the people who wrote LOGITECH MODULA-2.**

LOGITECH's Modula-2 is a professional development tool, backed by the most professional support available for Modula users.

**LOGITECH's complete Modula family:**

- MODULA-2/86™ native code 8086/8088 compiler
- MODULA-2/VMS™ VAX-resident compiler
- MODULA-2/VX86™ VAX to 8086/8088 cross compiler

**Don't start another project without considering LOGITECH MODULA-2.**

Trademarks: MODULA-2/86, MODULA-2/VX86, MODULA-2/VMS—LOGITECH, Inc.  
Registered Trademarks: VAX—Digital Equipment Corporation

Circle 234 on inquiry card.

**LOGITECH MODULA-2**

**LOGITECH  
MODULA-2**

**To order, or for more information,  
call or write:**

**Chris Cale, 805 Veterans Blvd.  
Redwood City, CA 94063  
(415) 365-9852**

**In Europe contact: Willy Steiger,  
LOGITECH SA, Switzerland.  
(021) 77 45 45**



**LOGITECH**

It's always smart to think  
before you do.

# Quick•Plan™

The Executive Project Planning System

## Features:

- Menu driven.
- 250 activities / 500 connectors.
- All input can be edited with full feature editor.
- User specified time units - minute, hour, day, week, month.
- Precedence logic (Activity on Node capability) with Finish-to-Start, Start-to-Start, Finish-to-Finish, Start-to-Finish, Logic Connectors.
- Activities and Resources can be transferred between projects.
- Both printed copy and screen displays can be used for output.
- Assignable and selectable Activity Numbers and Activity Codes.
- Multiple currencies (with a currency converter within the program).
- Six resources per activity.
- 100 item resource library.
- All activities can carry Time, Cost, and Resources.
- Permits specified dates with constraint options.
- TAILS and LAGS to simplify modelling.
- Memory resident system for maximum computational speed.
- Network logic display with ability to zoom, spread, and isolate activity displays.

### QUICK•PLAN RUNS ON MS DÒS\*

for Data General DT\*, DEC Rainbow+\*, HP 150\*, IBM Compatibles\*, Texas Instruments PC\*, and WANG PC\*; 80 or 132 wide printer with 384K RAM and a graphics option.

Having been successfully placed in offices worldwide, Quick•Plan is recommended by users as the management tool of the future.

PLEASE ALSO CONSIDER OUR "BIG" MANAGEMENT AND PROJECT PLANNING SYSTEM (MAPPS).



**Mitchell  
Management  
Systems Inc.**

FORMERLY STRUCTURAL PROGRAMMING INC.  
Westborough Office Park  
2000 West Park Drive  
Westborough, Mass 01581 U.S.A.  
Telephone (617) 366-0800 TWX 710-347-1054

\*Registered trademarks of Data General, Digital Equipment Corp., Hewlett Packard, International Business Machines, Texas Instruments and Wang Laboratories.

## BOOK REVIEWS

ASSEMBLY LANGUAGE PRIMER FOR THE IBM PC & XT  
Reviewed by John Figueras

Anyone who is new to assembly-language programming on the IBM Personal Computer (PC) and feels completely at sea will find a welcome port in Robert Lafore's *Assembly Language Primer for the IBM PC & XT*.

The problem for beginners in 8088 assembly language is twofold. There is, of course, the language itself, with its several peculiar ways of addressing memory, its hundreds of mnemonics, and the question of how to apply the operations to solve a given problem. But beyond this is the problem that assembly-language programs must run in a specific operating environment. A knowledge of the language alone might enable a person to write a program to add two numbers, but how is the answer to be displayed? This is why abstract presentations of assembly language based solely on chip architecture (such as the highly recommended *The 8086 Book* by Russell Rector and George Alexy, Berkeley, CA: Osborne/McGraw-Hill, 1980) are poor beginning texts, although they are of great value to the experienced programmer who wishes to find succinct descriptions of commands without wading through a lot of exposition.

Lafore recognizes the beginner's plight and has written a book that teaches assembly language within the context of the IBM (MS-DOS) operating system and not as an abstract expression of the properties of a microchip. The approach has many advantages for the beginner. First, it provides orientation in the use of assembly language: the utility of the op codes can be appreciated. They are not abstractions with obscure applications. Second, it provides good examples of how to go about organizing an assembly-language program. What do code, data, and stack segments do? When do you need to worry about them? The meaning of the questions and the answers becomes eminently clear when you encounter the problems of space conflicts within large, unsegmented programs. This topic leads naturally into the concept of the address segment, which is a rather bewildering notion to beginners. Lafore makes it easy to understand, for which he has at least my thanks. Lafore's strength is that he leads the reader to appreciate, by means of simple examples, the virtue of segmentation and how to go about setting it up in a program.

The author starts gently, postponing arcane considerations of binary and hexadecimal arithmetic, which are confined to Appendix A, and focuses on the use of DEBUG to examine memory and assemble small programs (MS-DOS 2.0 contains a miniassembler buried in DEBUG). The first four chapters cover DEBUG before the full-size IBM Macro Assembler is introduced. These chapters provide an excellent introduction to DEBUG, as well as exposure to the rudiments of machine-language programming.

The explanations in chapter 5 of how to use the Macro Assembler are outstanding: no wasted words, no confu-

(continued)

# When all else fails.

Most diskettes are pretty good.

And some of the time that's good enough.

But next time you throw away one that won't format or you lose the cash flow analysis you've been working on for weeks, make a mental note to try a box of Dysan diskettes.

They're better.

So much better, in fact, that major computer manufacturers put their names on our diskettes and sell them as their own.

Without fear of failure.

You see, we make our diskettes better with advanced manufacturing processes that our competitors have yet to figure out.

And we test them.

Almost to the point of absurdity.

Dysan diskettes are inspected almost a hundred times as they come down the line. They're tested to performance levels way beyond industry standards. And each one is certified to be 100 percent error free.

Then our corporate quality assurance fanatics come along and check them all over again. For all

the same things. Plus some things only they understand.

When we're done, you get exactly what you wanted in the first place. Diskettes that will record and retain all your data all the time.

We don't expect you to keep all that in your mental note, but we would like you to remember your last diskette failure.

And when your computer products dealer offers you another box of pretty good diskettes, tell him you're ready for something better.

Dysan.

Call toll free for the name of the Dysan dealer nearest you. (800) 551-9000.

Dysan Corporation, 5201 Patrick Henry Drive, P.O. Box 58053, Santa Clara, CA 95050, (408) 988-3472.

## *Dysan*<sup>®</sup>

**Somebody has to be better  
than everybody else.**

Circle 136 on inquiry card.

Dysan is a registered trademark of Dysan Corporation. © 1984, Dysan Corporation.  
PFS:® is a registered trademark of Software Publishing Corporation.

# Dysan

## Flexible Diskette

**FREE PFS: write  
DEMO DISKETTE.**  
There's an extra diskette in every specially marked Dysan box. It demonstrates the best-selling word processing program, PFS: WRITE. And it can be easily converted to a data diskette. See your Dysan dealer today. Quantities are limited.

# HOW TO SHOP AT MICRO MART BY PHONE.

For when you can't stop by your local Micro Mart store. **ORDERS ONLY**

## 1-800-241-8149

New Micro Mart stores are opening all over the Southeast. But if we haven't yet opened a store near you, don't give up. Call us on the phone. It's the next best thing to the personal, professional service you'll find in every one of our stores. Expert advice, your best price and immediate support service. Plus the largest selection of computer products around.

### Networking/ Protocol Conversion

**SNA & BISYNC** 3780, 5251, 3274, 3278.

**PG TURBO** 186 by ORCHID, 80186 coprocessor board.

**IRMA / IRMALINE** Replaces 3278's w/PC's.

**IRMAPRINT** Upgrades IRMA to 3279 graphics capability.

**IRMAPRINT** Enhances IRMA graphics.

**PCnet** By ORCHID, complete line.

**BLUE LYNX 5251** Mod 12 & 3276

Emulators by TECHLAND.

**SANTA CLARA PC** Terminal. Local area network.

**SOFTWARE LINK Multilink.** Allows multiple users under PC DOS.

### Printers & Plotters

Micro Mart has thousands in stock.

**AMDEK AMPLOT II**, 6 pen plotter, supports Lotus.

**HOUSTON INSTRUMENTS** Plotters and digitizers.

#### Dot Matrix

**EPSON FX80 & 100, RX80 & 100** and LQ1500

**EPSON JX 80**, color printer.  
**SMITH CORONA D-300**, by TEC, 140 cps.  
**OKIDATA 92 & 93, ML84**, (200 cps.) w/opt. IBM PROMS, Pacemark 2410, (350 cps.)  
**TOSHIBA P-1351 & 1340**.  
**DATAPRODUCTS PRISM 8050 Color**, 132 col., 200 cps.

**STAR MICRONICS** Complete line of Gemini, Delta and Radix.

**TEXAS INSTRUMENTS 855**.  
**NEG Pinwriters, P2 & P3**, 180 cps.

**DIABLO C-Series C-150**. Color ink jet printer. IBM color compatible.

**QUADRAM Quadjet**. Color ink jet printer. Lotus compatible.

#### Letter Quality

**NEC Spinwriters** 2050, 3550 & the new 8850.

**DIABLO 620, 630 & 630 ECS**.

**G-ITOH Starwriter**, 40 cps; **Printmaster**, 55 cps.

Micro Mart has a full range of Form Handling options and Peripheral Devices.

### Floppy Disk Drives

**TANDON TM 100-2, DD/DS, 360K**.

**1/2 HEIGHT DISK DRIVES** From SHUGART, PANASONIC, TEAC. PC, XT and AT compatible.

### Hard Discs

We carry all major name brands so if you don't see it—ask for it.

### Multifunction Boards

**SIXPAK 64-384K**, multifunc.

**MEGAPLUS 64-512K**, max. 8 func.

**I/O PLUS Ser., Clk., Splr., Ramdisk, opt. 2nd Ser., Par., & Game.**

**QUADRAM QUADBOARD**, New Version, 64-384K, multifunc.

**TECMAR CAPTAIN**, 64-384K, multifunc.

**TALLTREE J-RAM II**, 0-512K, multifunc., w/J-RAM Software.

**MICROLOG BABY BLUE II**, 64-256K, Z80 coproc., extra software.

**ORCHID PC Blossom**, 64-384K multifunction with optional PCnet Piggy-Back.

**MAYNARD Sandstar**, mod. Floppy & Hard Disc Controllers.

### Graphic Cards

**PERSYST BoB board**.

**STB Graphics Plus II**, color & mono, w/par. port & software.

**HERCULES Mono & color** graphics cards support Lotus on IBM.

**PLANTRONICS ColorPlus +**, HiRes color bd., par. port w/software.

**TECMAR Graphics Master**, HiRes color & mono supports Lotus.

**QUADRAM QUADCOLOR I & II**, color cards.

**PARADISE SYSTEM Multi-display** or **Modular Graphics Cards**, color & mono, parallel port.

### Software

#### Accounting

**SORCIM / IUS A/P, A/R, G/L**, inventory, order entry, payroll.



**PEACHTREE PERIPHERALS** The P-10, 20 & 50, auto boot, int. & ext. instal.

**SYSGEN 10 & 20Meg** w/streamer tape.

**SYSGEN Image**, streamer tape back-up for your IBM XT.

**BERNOULLI TECHNOLOGY** Hard Disc Subsystems.

### Chips

**INTEL 8087** High speed math coprocessor.

**64K RAMCHIPS** For the IBM-PC compatibles and their boards.

**PEACHTREE A/P, A/R, G/L**, payroll, job cost, inventory, order entry.

**Spreadsheets & Integrated Packages**

**ASHTON-TATE Framework**

**LOTUS Symphony and Lotus**.

**MICROSOFT MultiPlan**, comes with choice of templates.

**MDBS Knowledge Man**.

**SORCIM SuperCalc 3, Version 2.0**, new enhancement pkg.

## Atlanta, New Orleans, Charlotte, Louisville, Nashville, Raleigh,

**SPI Open Access.** \_\_\_\_\_  
**Enhancements & Utilities**  
**FOX & GELLER** Complete line of enhancements for dBase II, III & Rbase 4000. \_\_\_\_\_  
**NORTON** Utilities. \_\_\_\_\_  
**ROSOFT** ProKey 3.0. \_\_\_\_\_  
**CENTRAL POINT SOFTWARE** Copy II PC. \_\_\_\_\_  
**ATI** Training, critic's choice software tutorials. \_\_\_\_\_  
**SOFTSTYLE** SetFX + and Printworks. \_\_\_\_\_  
 Printer control packages. \_\_\_\_\_  
**SIDEWAYS** Inverts printout. \_\_\_\_\_  
**BORLAND** Sidekick. \_\_\_\_\_  
**LIVING VIDEO TEXT** Think Tank. \_\_\_\_\_  
**Compilers & Language Tools**  
**LATTICE** C-Compilers. \_\_\_\_\_  
**MICROSOFT** Complete line. \_\_\_\_\_  
**DIGITAL RESEARCH** Complete line. \_\_\_\_\_  
**BORLAND** Turbo Pascal, Turbo Toolbox and more. \_\_\_\_\_  
**Graphics & CAD**  
**Zsoft** PC Paint Brush, mouse driven graphics w/screen dump util. \_\_\_\_\_  
**DECISION RESOURCES** ChartMaster/Sign-Master graphics pkgs. \_\_\_\_\_  
**AUTODESK** AutoCAD. \_\_\_\_\_  
**ENERTRONICS** Energraphics, low cost graphics & CAD package. \_\_\_\_\_  
**MICROPRO** ChartStar. \_\_\_\_\_  
**DIGITAL RESEARCH** Presentation Master. \_\_\_\_\_  
**Communications**  
**MICROSTUF** CROSSTALK XVI. \_\_\_\_\_  
**HAYES** SMARTCOM II. \_\_\_\_\_  
**VM** Relay. \_\_\_\_\_  
**Word Processors**  
**MULTIMATE** With spelling checker and tutorial. \_\_\_\_\_  
**SAMNA III**, New Flagship wd. processor. \_\_\_\_\_

**Office & Project Planning**  
**HARVARD** Harvard Project Manager. \_\_\_\_\_  
**IUS** Easy Sales Pro. \_\_\_\_\_  
**MICROSOFT** Project. \_\_\_\_\_  
**Data Base Managers**  
**MICRORIM** 4000 or 6000, Report Writer & Clout options. \_\_\_\_\_  
**GMS SYSTEMS** Power-base. \_\_\_\_\_  
**ASHTON-TATE** dBase II & III. \_\_\_\_\_  
**MICROSTUF** Infoscope. \_\_\_\_\_  
**Modems**  
**HAYES** Smartmodem 300, 1200, & 1200B. \_\_\_\_\_  
**NOVATION** Complete line of int. & ext. \_\_\_\_\_  
**RIXON** 1200-4800 BAUD sync. & async. models. \_\_\_\_\_  
**ANCHOR AUTOMATION** Signalman Mark XII. \_\_\_\_\_  
**VEN-TEL** 1200 BAUD Half Card for the IBM portable & XT. \_\_\_\_\_  
**POPCOM** Popcom. Internal and external modems with voice & data communications. \_\_\_\_\_  
**Miscellaneous Hardware & Accessories**  
**DYSAN** DS/DD. Quantity savings. \_\_\_\_\_  
**MICRO MART** DS/DD, a 7 year warranty. \_\_\_\_\_  
**KEYTRONICS** 5150 & 5151 keyboards. \_\_\_\_\_  
**LQ SHEET FEEDERS** Cut sheet feeders for the NEC 3650 & C-ITOH printers. \_\_\_\_\_  
**MOUSE SYSTEMS** PC Mouse, optical w/software. \_\_\_\_\_  
**MICROSOFT** Mouse; Bus or serial mech. mouse with mouse menu software. \_\_\_\_\_  
**CURTIS** Monitor pedestal, keyboard extension cable, monitor extension cable. \_\_\_\_\_

**HAYES** Mach II & Mach III Joysticks. \_\_\_\_\_  
**PENCEPT** Penpad. Revolutionary digitizing tablet. \_\_\_\_\_  
**TOUCHSTONE TECHNOLOGY** Touchstone 1. Ten key pad w/ cursor control. \_\_\_\_\_  
**QUADRAM MICROFAZER**, print buffer: 8-128K. \_\_\_\_\_  
**TRIPPELITE** Back up power supply 200-1000 Watts, and ISOBAR surge protectors with 4 & 8 plug. \_\_\_\_\_  
**Monitors & CRT's**  
**PGS** MAX 12, amber, monochrome, 720h x 35Cv. \_\_\_\_\_  
**PGS** SR-12, 690h x 480v, w/dual scan cd. \_\_\_\_\_  
**PGS** HX-12, 690 Dot RGB. \_\_\_\_\_  
**QUADRAM** QUADCHROME, 690 Dot RGB. \_\_\_\_\_  
**AMDEK** COLOR I, IIA & IVT, RGB's. \_\_\_\_\_  
**AMDEK** COLOR 300, 500, 600, 700, 710, 725, new complete line of HiRes RGB's. \_\_\_\_\_  
**AMDEK** 300A/300G, composite monitors. \_\_\_\_\_  
**AMDEK** 310A, amber monochrome w/3 yr. warranty. \_\_\_\_\_  
**WYSE** Terminals, 100, 75, 50, entire line in stock. \_\_\_\_\_

We'd really like you to come by our stores, but if you can't, call us direct. When you need the right product at the right price, remember the service and support our local store experts and national distribution center can give you.

**Ask for expert advice and your best price.**

For information or the store location nearest you, call  
**(404) 449-8089**

© Copyright  
 Micro Mart 1984.  
 Technology  
 Corporate Campus  
 3159 Campus Drive  
 Norcross, Georgia 30071



**MICROSOFT** Word; w/or without mouse. \_\_\_\_\_  
**LIFETREE** VOLKSWRITER DELUXE. \_\_\_\_\_  
**MICROPRO** WordStar Professional series with Tutor, CorrectStar, MailMerge & Star Index. \_\_\_\_\_  
**SSI** WordPerfect. \_\_\_\_\_  
**PEACHTREE** PeachText 5000, Personal Productivity Series. \_\_\_\_\_  
**WORDMARC** Wordmarc. Critically acclaimed word processor. \_\_\_\_\_

**America's PC Specialist.**  
**MICRO MART**

Micro Mart is a registered trademark of Micro Mart, Inc.  
 IBM is a registered trademark of International Business Machines Corporation.

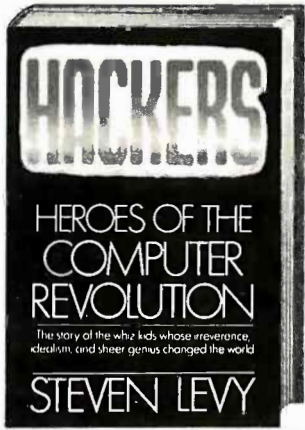
**Miami, Ft. Lauderdale, Tampa, Orlando, Tyson's Corner, Rockville.**



© 1984 Sylvia Plachy

## "What Tom Wolfe did for the original astronauts, Levy has done for HACKERS!"

Meet Peter Deutsch, who was still in short pants when he stumbled on the TX-0 at MIT; Bill Gosper, the Horowitz of computer keyboards and guru of the Hacker Ethic; Richard Greenblatt, who went into night phase so often that he zorched his academic career; Steve (Slug) Russell, who hacked the first video game and never made a dime from it; Lee Felsenstein, who brought the "junkyard approach" to computers; Efrem Lipkin, who loved machines but hated their uses; John Harris, star programmer who yearned for female companionship. Learn how the Ethic shared by these adventurers and visionaries brought about the computer revolution that has changed our world.



"A tour de force of storytelling. It'll hook you from the first page."

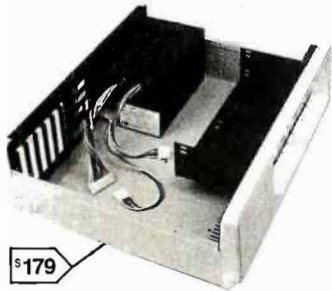
—Whole Earth Software Review

\* Joe McGinniss, author of *Fatal Vision*

**DOUBLEDAY**

### U S C Proudly introduces Our New "PROFESSIONAL COMPUTER CHASSIS/ POWER SUPPLY" for IBM PC/XT & Compatibles

Designed to enable easy, straight-forward conversion of IBM PC/XT & compatibles board-level products into complete microcomputer-based systems meeting specific performance and installation requirements.



**Features:**

- More than just another pretty face
- Sturdy to withstand the rigors of use in the intended environment.
- Good RF attenuation to eliminate interference with adjacent electronic equipment.
- High efficient switching power supply, with all DC cables-plug right in.
- Built in fan, 2 additional AC sockets plus card racks with plastic guides.
- Assembled & Tested

\$179

- Professional PC-Chassis (65W).....\$179.00
- Professional XT-Chassis (130W).....\$259.00

Dealers & OEM inquiries invited.

## U S Components

1055 Sunnyvale - Saratoga Rd.  
Sunnyvale, CA 94086  
TEL (408) 730-1399

Terms: Prepaid check or money order, Mastercard or Visa.  
Shipping Charges: U.S. FREE, Canada \$2.00, COD \$5.00 (No COD's to Canada)

## BOOK REVIEWS

sion. In this chapter, Lafore instructs us in the use of .BAT files for setting up assembly-language commands, including the passing of module names using dummy parameters 1%, 2%, and so on. This is the sort of thing that you see mentioned in IBM's documentation, but the mind-numbing effect of that documentation generally manages to hide anything of importance. Someone has to shake you by the shoulders and say, "Hey, this is useful!!" which is exactly what Lafore does throughout his book. That's why this is such a great book for programmers relatively new to the IBM PC.

Another advantage of Lafore's approach of centering on a specific machine is that you can gain good knowledge not only of assembly-language but also of the useful sub-routines that are available in MS-DOS and in the IBM ROM (read-only memory). Many examples show how to take advantage of system routines, and the range of applications described in the book is large and rich. The author discusses sound, starting from one note and proceeding to sirens and scales. He also covers communication with the outside world, including the keyboard, video display, and printer; by the end of chapter 4, I was able to write several routines at the system level for changing print style on printed output. (Remember, this was my first crack at 8088 assembly language.)

In a large section on graphics, Lafore describes plotting in black and white or in color, one-point plotting, simple fill routines, and implementation of Bresenham's algorithm for drawing lines. He provides a solid foundation for doing graphics using machine language.

Another large section covers use of the disk from machine language, including implementation of sequential and random-access files. A final section discusses interfacing assembly-language programs with BASIC and Pascal programs. Appendix B contains eight machine-language programs for illustrative purposes, including a small file manager for keeping track of birthdays, and the famous Sieve of Eratosthenes for benchmarking.

There are many things I like about this book. First, it is well written; the disfiguring ignorance of the English language found in much computer-related writing is absent. Second, the author makes no presumptions about the reader's knowledge: everything is laid out, even if it involves some repetition, which, for learning, is not bad. Third, the important things in assembly language are emphasized: no getting lost in the weeds of binary arithmetic. Explanations are offered with the attitude that "here's something interesting you might like to know"; the author makes it clear which information he presents is essential to programming and what is simply background. Many texts present all information as being of equal (and high) importance, with consequent information overload for the reader. Finally, this book can substantially deepen your knowledge of the IBM PC operating system. This provides a perspective on the use of system facilities that cannot be obtained by perusing IBM documentation, and

(continued)



# The new Canon TX-50 desktop computer.

## It fits any customer's business as well as his desk.



No matter how specialized your customers' business needs, Canon's new compact desktop computer is uniquely designed to accommodate them.

Because the TX-50 is a self-contained computer that can be customized for a wide range of specific business applications.

Its all-in-one design includes:

- A high-performance 16-bit microprocessor with MS-DOS† operating system. Standard 128KB memory is expandable to 256KB.
- Seven-inch high-resolution monochrome CRT display.
- Fifty-function LED keyboard plus separate ten-key calculator pad and cursor control keys.
- Three-inch compact floppy disk drive with 150 K-bytes memory capacity per side.
- Optional RS-232C serial interface and Centronics-type parallel interface available.
- Wire dot impact printer that gives a

sharp 5X7 dot matrix and has a maximum 30 characters per line. One original plus two copies can be made on plain paper in either black or red.

With such impressive, self-contained flexibility, the TX-50 is ideal in areas such as customer operations and counter service. Especially since the TX-50 provides such a huge range of varied functions, yet takes up so little space.

Businesses such as gasoline stations, banks, mail rooms, real estate brokers and numerous others will find the TX-50 particularly useful for sales, credit, loan or general customer calculations.

So if you're dealing with business, whether large or small, and you feel they need a rather special computer, consider the new Canon® TX-50 desktop computer. There isn't a desk it won't fit.

**For more information:**  
Call 1-800-323-1717, Ext. 302.  
(In Illinois call 1-800-942-8881, Ext. 302.)  
Or write Canon U.S.A., Inc.  
Systems Division/TX-Series  
P.O. Box CN 11250, Trenton, N.J. 08650

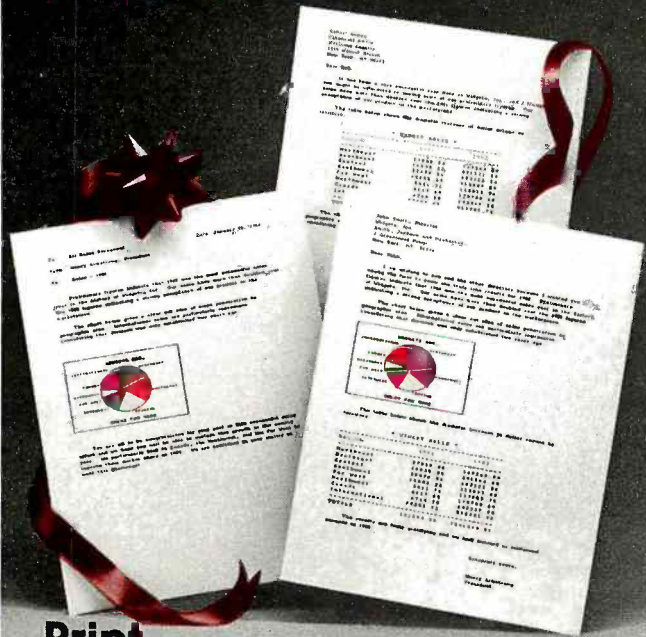
**Canon Systems Division**

Circle 53 on inquiry card.

© 1984 Canon U.S.A., Inc.  
†MS-DOS is a trademark of MICRO SOFT

# ShuffleBuffer™

## RAPS!



### Print

- spreadsheets
  - text
  - graphics
- in any order!**

### ShuffleBuffer™

- Has **Random Access Printing** . . . an intelligent processor which stores phrases, passages, entire letters, spreadsheets, graphics and commands, then prints the information in whatever order you want, as many times as you want.
- Has **FIFO printing (first-in, first-out)** . . . acts as a reservoir, accepts data at computer speed, prints on its own, freeing the computer for further tasks.
- Has **BYPASS Printing** . . . permits interruption of long-term buffer operations for straight-thru short-term printing.

### PLUS

Data compression . . . expands memory storage to 4 times. Infinite copy capability. Simple erase feature to clear buffer. Compatible with virtually any serial or parallel computer, serial or parallel printer (letter quality or dot matrix) as well as plotters and modems.

### WRAP it all up with SHUFFLE/BUFFER!

Call or write for the dealer nearest you:



Interactive Structures Inc.  
146 Montgomery Avenue  
Bala Cynwyd, PA 19004  
Telephone: (215) 667-4743



## BOOK REVIEWS

which is likely to be unappreciated by the novice user.

In a reference to Appendix D (which covers the DOS functions), Lafore writes, "It might be educational for you to look through this appendix, just to get a rough idea of the kinds of things these calls do. Many of the descriptions will be mysterious to you at this point, but by the time you finish this book, you will be reading appendix D for relaxation, like the Sunday comics." The author points beyond the subject of assembly language and seeks to give the reader a broader knowledge of MS-DOS that can be used as a springboard for further learning. This quote, by the way, is an example of the informal, often humorous approach Lafore takes.

At \$21.75 for a paperback, the price is a bit steep, even though the book has 500 pages. Nevertheless, it is a good value because it really does what it sets out to do: painlessly teach the beginner how to program an IBM PC in assembly language. In addition, it greatly deepens the reader's knowledge of the IBM operating system and provides a background that makes IBM's documentation comprehensible. Someone who knows nothing at all about programming or computers will not find this book useful; I came to it with some knowledge of machine language, although of a much different type (6502). But experienced programmers and anyone moderately skilled in writing BASIC would very much enjoy this book.

*Assembly Language Primer* is a language tutor, and it contains many good program ideas. Although it is well indexed, it is definitely not a reference text. And the word "Primer" must be taken literally since the advanced features of the IBM Macro Assembler are not described.

*John Figueras (65 Steele Rd., Victor, NY 14564) is a retired research chemist who teaches computer science on a part-time basis at the State University of New York at Geneseo.*

### COMPUTER ETHICS: A GUIDE FOR THE NEW AGE

Reviewed by Mark J. Welch

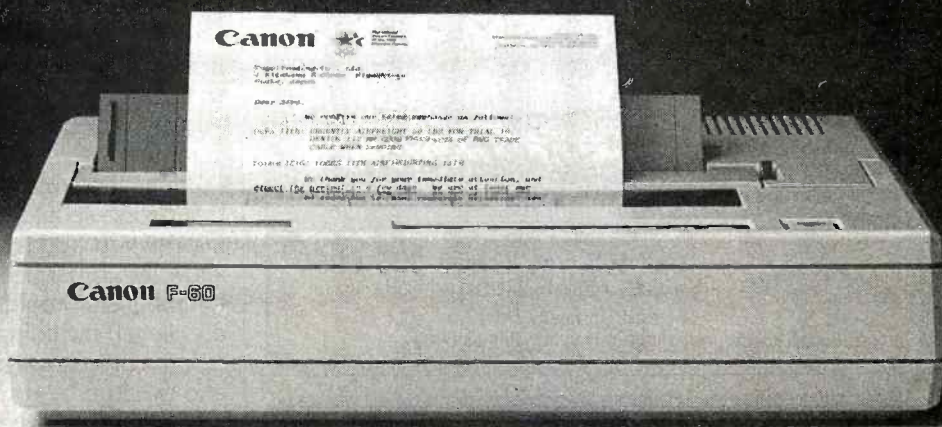
**C**omputer Ethics is an overview of many problems facing our newly computerized society. By addressing in a short volume the many ethical issues raised by personal computers, the author may make it easier for others to identify and expand upon them.

Douglas Johnson's background is religious, not technical, legal, or psychological. Thus the book contains more gut reactions than concrete examples, and the examples are from current popular media (mid-1983 newspaper and magazine articles). His intent is not to solve the problems or even analyze them carefully; instead, his goals are to show that computer ethics are desperately needed and to propose an approach.

Although Johnson's book is short and clearly written, it would have been more useful if it had been either expanded to include a more complete discussion or edited

(continued)

# How does a new, letter-quality, thermal transfer printer made by Canon sound? Very quiet.



Canon's advanced non-impact printing technology heralds yet another achievement—The F-60: a flexible, high-quality thermal transfer printer with Graphic Image capability.

Its letter-quality printing is good enough to use with a word processor; yet quiet enough to be seen and not heard. The F-60 operates at a dramatically low 45db, so it's perfect for even the most noise-conscious office.

Extreme flexibility gives access to three attractive printing modes. Printing speeds range from Graphic Image at a rapid 80cps, through Draft and Near-Letter-Quality to Letter-Quality at a smooth 20cps and an impressive high-resolution 36X24 dot matrix.

But its flexibility doesn't stop there. A simple system of interchangeable typestyle cartridges gives an incredible choice of eight different fonts.

The F-60 is also highly versatile. It handles not only thermal paper and overhead projection film, but also plain paper in single sheets, rolls or fan folded. Its self loading mechanism automatically inserts and advances the paper. It's even compatible with most leading personal computers.

Plus it prints in a choice of four bold colors.

And it does it very quietly, and at a very competitive price.

For upgraded performance, optional accessories include pin feed, tractors, roll paper holders and a serial interface card.

The new F-60 thermal transfer printer from Canon. You have to admit it sounds very good.

**For more information:**  
Call 1-800-323-1717, Ext. 300.  
(In Illinois call 1-800-942-8881, Ext. 300.)  
Or write Canon U.S.A., Inc.,  
Printer Division, P.O. Box CN 11250,  
Trenton, N.J. 08650

**Canon Printer Division**

Circle 54 on inquiry card.

**Special Purchase**

**MICRO-TERM, INC.**  
**ERGO® 4000**

**A 66-Line  
Word Processing  
Terminal**

**\$795**


ERGO® 4000 is the ASCII Terminal featuring 80-column by 66-line format for full-page display capability. Features include: 15 downloadable function keys, four video attributes, pass-through printer port, screen saver, alternate character generator, settable tabs, 24-line display, and user-definable custom mode. (Compatible with VT100 codes.) Most popular word processing packages are already modified to run on the ERGO® 4000.



**Call toll-free 1-800-325-9056**  
Ask for Department D  
44 East University Drive  
Arlington Heights, Illinois 60004

**Tek-Aids Industries, Inc.**

**SPECIAL OFFER ON 3M DISKETTES**



Everything that goes into a 3M diskette is manufactured and/or controlled by specifications set by 3M. From unique substrates and oxides, to hole punching and jacket fabrication, 3M does it all and does it well. With confidence in your complete satisfaction, 3M diskettes are certified to be error free and have an unlimited warranty against defects in workmanship or materials. And to help introduce you to the quality of 3M, we're running a special on their full range of information processing products, including—

- 3M Diskettes • 3M Mag Tape • 3M Data Cartridges

**PLUS!** Specials on many other products in our full range discount catalog of computer supplies. Call, write, or utilize reader service to obtain your FREE catalog with special offer coupon enclosed.

**LYBEN COMPUTER SYSTEMS**  
1250-E Rankin Dr. • Troy, MI 48083 • Phone (313) 589-3440

**Simply #1 in service and reliability.**

**IF IT'S WORTH REMEMBERING, IT'S WORTH 3M**

**BOOK REVIEWS**

to the length of a journal article.

Several problems raised in *Computer Ethics* have been addressed for many years by dozens of other books. The potential for error or abuse of large databases has been a popular topic. Likewise, computer "raiders" have received extensive coverage in the press. After reading far too much about both, I was glad that Johnson glossed over these problems.

I haven't seen much discussion of some other problems, however, and wish that Johnson had elaborated more on these. For example, he mentions the disparity in computer use between rich and poor students; the use of personal computers to download information and store it long after errors in the original file are corrected; and the problems raised by spending more time with computers than with people.

Johnson defines an ethic, explains why it is needed for computer use, and suggests a number of ground rules.

Understandable, perhaps indisputable, are suggestions that people should be allowed to see and correct database information about them; that society must realize and allow for disparities in computer access; and that computer buyers should be warned about computer uses that are illegal, including copying programs.

Some of Johnson's suggestions are less understandable and would probably be met with strong opposition. His suggestions regarding computer piracy are idealistic. First, he suggests that we "make it illegal to sell computer programs that can break any type of security codes." Severe penalties for software pirates, another suggestion, seems more acceptable.

Next, he suggests that "a law could require companies to give a purchaser enough [backup] program disks at a reasonable cost so pirating is neither feasible nor attractive. . . . If the user is a manager in a corporation with multiple personal computers, [the company should] provide an inexpensive way to supply the corporation with a larger number of disks and manuals." While few people would dispute either point, I doubt many software companies or users would want a law specifying exactly what is a "reasonable cost" or an "inexpensive way."

Johnson also suggests that consumer laws be expanded to give more rights to computer buyers, and that laws prohibit storing certain types of personal information on personal computers.

To enforce the laws, Johnson suggests that "spot checks" be used. While this might help prevent software piracy, I suspect (and hope) the idea will never gain support.

I took issue with a number of Johnson's proposals and wished for better proof of several "problems" and a more thorough discussion of some issues. Nevertheless, *Computer Ethics* is a helpful overview of some issues that will undoubtedly be the subject of many books and articles in the near future. ■

Mark J. Welch is the User News editor for BYTE's Microbytes section. He can be contacted at POB 372, Hancock, NH 03449.

Now available on the AT.

# WE DRESSED OUR UNIX\* SOFTWARE FOR YOUR IBM PC/XT



**Try it Risk FREE** — the first AT&T-licensed UNIX implementation for the IBM PC/XT. Shipping since August 1983, Venix/86 is the popular choice among knowledgeable UNIX users and developers. Here's why!

#### **Multi-User Capability...**

Share the same PC, disk, and printer with up to three users! Simply plug in a CRT and run.

#### **Multi-Tasking...**

Edit a file, print a report, run a spelling check, format a diskette...all at the same time.

#### **Berkeley Enhancements...**

Including vi, termcap, more and the c shell.

#### **Real-Time Extensions**

With semaphores, raw and asynchronous I/O, priority, shared data, I/O page addressing.

#### **Quad-Screen Windowing...**

Featuring four unique and powerful windows.

#### **MS-DOS Partitioning...**

Keep your DOS files and programs!

#### **Lean and Clean...**

192K RAM, 3.5 Mbytes on disk. Proven reliability.

#### **Applications...**

Networking, word processors, database managers, spreadsheets, menu interfaces.

#### **One Source with Unisource...**

Unisource is the leading publisher and developer of UNIX software for the IBM PC/XT and compatibles, DEC Professional 350, Rainbow, Micro-11, PDP-11, VAX series, and NCR computers. All our packages are fully documented and supported by our 800 user hotline. Call for a complete information kit or to arrange your 30-day Risk FREE Trial of Venix/86. Unisource Software Corp. Department 4109  
71 Bent St., Cambridge, MA 02141.  
Telex 92-1401/COMPUMART CAM  
**CALL 617-491-1264**



\*UNIX is a trademark of AT&T Technologies, Inc.  
Venix/86 implementation by VenturCom, Inc.

Circle 374 on inquiry card.



**Getting UNIX Software  
Down to Business**



*Hayes. Leading the way with quality telecomputing systems for the personal computers that businesses use most.*

When it comes to communicating—computer to computer—Hayes says it best. All you need is a Hayes Smartmodem (it's like a telephone for your computer) and Smartcom II<sup>®</sup> software, to get you into all the right places.

In no time at all, and with no assistance at all, you can create, send and store files, and automatically log on to information services. The communication possibilities are endless!

---

*Introducing our new Smartcom II.  
More connection capabilities.  
More convenience.*

---

Now Hayes goes even further to streamline your communications and optimize your connections.

Smartcom II software is currently available for more than 21 personal computers (with even more to come). That means you can communicate,

Smartcom to Smartcom, with an IBM PC and IBM PC AT, AT&T 6300, COMPAQ<sup>®</sup> and others.

And that's not all! Smartcom II also emulates the DEC<sup>®</sup> VT52 and VT100/102, now in widespread use in many businesses. This feature lets your personal computer "pretend" it's a DEC terminal, opening the door to a vast installed base of DEC minicomputers!

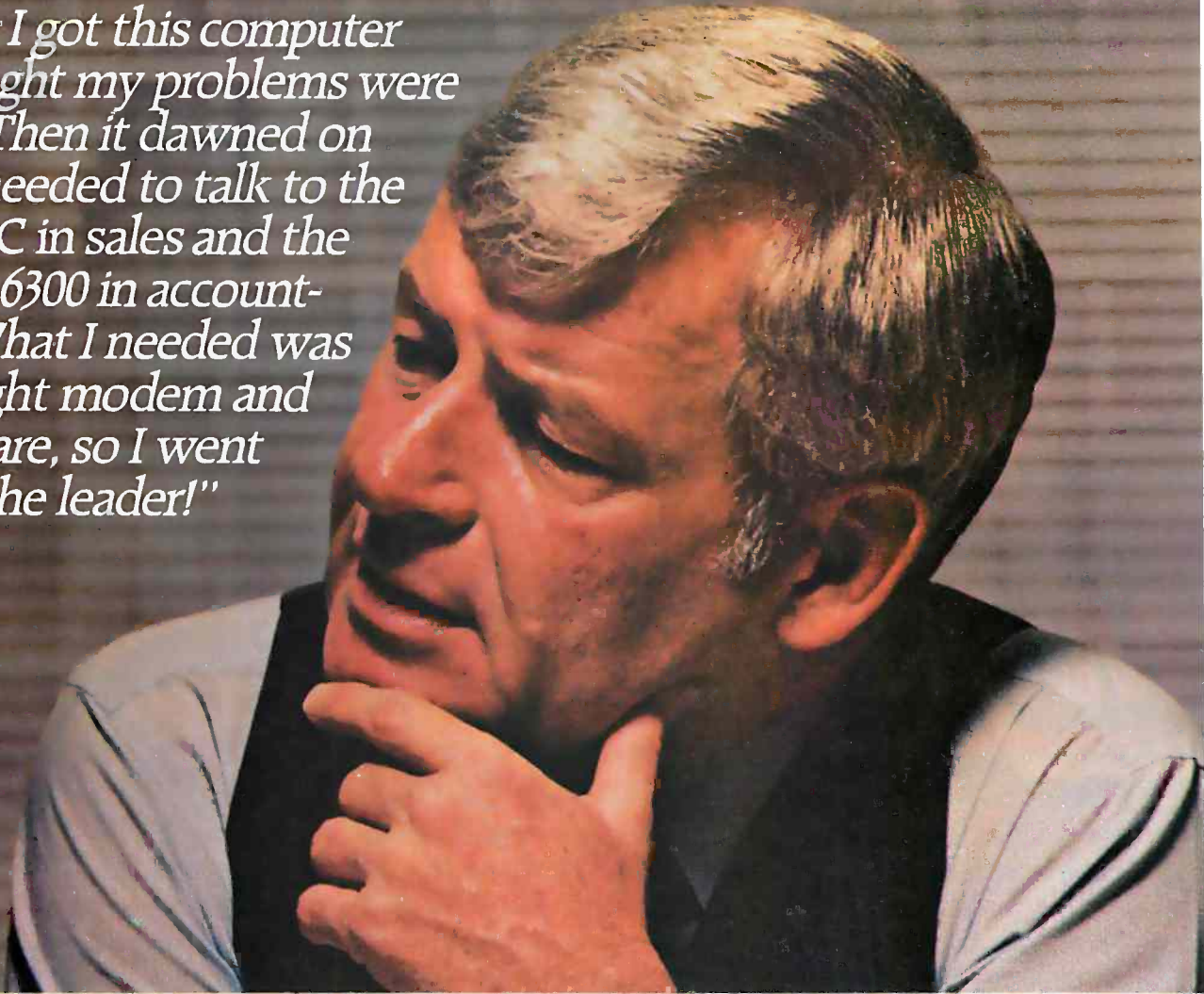
---

*We stand on protocol.*

---

In addition to the popular Hayes Verification protocol, the new Smartcom II also includes the XMODEM protocol, ensuring accurate transmission to a wide range of personal computers and mainframes at information services. By matching the protocol (or "language") of a remote computer to yours, Smartcom II can transmit information error-free, regardless of interference on the phone lines.

*"When I got this computer I thought my problems were over. Then it dawned on me I needed to talk to the IBM PC in sales and the AT&T 6300 in accounting. What I needed was the right modem and software, so I went with the leader!"*



---

***Voice to data—in the same call!***

---

With Smartcom II, you can easily switch from voice to data transmission (and back again), all in the same phone call. This saves you time and money, since you don't have to hang up and dial again.

---

***Your Hayes telecomputing system works—totally unattended.***

---

Smartcom II makes telecomputing simple, even when you're not there. It allows your Smartmodem to receive a message for you when you're out, and leave it on your disk or printer. And you can tell Smartcom II to "save" the messages you've created during the day, and automatically send them at night, when phone rates are lowest.

---

***Get your hands on the leader.***

---

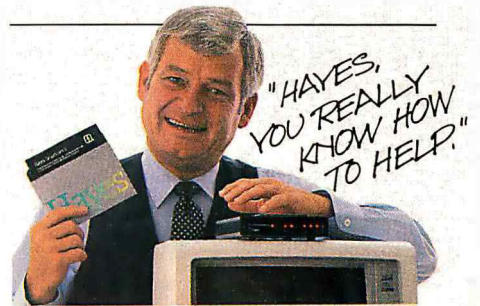
With an unsurpassed record of reliability, it's a small wonder Smartmodem

is such a smart buy! Smartmodem 300™ (the first of the Smartmodem series) dials, answers and disconnects calls automatically. Smartmodem 1200™ and Smartmodem 1200B™ (it plugs into an expansion slot inside an IBM PC or compatible), provide high-speed, high performance communications for businesses of all sizes.

And, when Smartmodem is purchased with Smartcom II, you have the most dependable telecomputing system available for your personal computer.

Everything we do at Hayes is designed to make communications easier for you. Feature-rich, direct-connect modems. Menu-driven software. Concise documentation. And a customer service organization, second to none!

See your dealer right now for a hands-on demonstration of Smartmodem and our latest version of Smartcom II. From the telecomputing leader. Hayes.



---

# Hayes

---

**Hayes Microcomputer Products, Inc.**  
5923 Peachtree Industrial Blvd.  
Norcross, Georgia 30092 404/441-1617.

Circle 175 on inquiry card.

# BACK UP YOUR HARD DISK DRIVE IN 3 MINUTES\*!



## MAYNSTREAM

BY MAYNARD ELECTRONICS

- backs up IBM-PC, XT, or AT compatible hard drive of any size.
- fully portable — back up any number of systems in your office.
- simple to use — put in program diskette and type "SAVE" — it's that easy!
- unlimited storage — when cartridge is full, drop in new cartridge and keep running.
- technically advanced — features file-by-file backup, read-after-write checks, automatic directory information.
- works with:
  - IBM-PC, XT, AT, and Portable PC<sup>†</sup>
  - Compaq, Compaq +, DeskPro<sup>†</sup>
  - NCR<sup>†</sup> Model 4
  - other 100% PC-compatible systems



### MAYNARD ELECTRONICS

430 E. Semoran Blvd.  
Casselberry, Florida 32707 • 305-331-6402

We make modern times better.

\* Actual time: 2 min/57 sec. Total files backed up: 376 consisting of 10,002,432 bytes. Computed on IBM-PC with 512K memory and one 10MB hard disk drive. Your actual back-up time may vary.

<sup>†</sup>IBM-PC, XT, AT, and Portable PC are trademarks of International Business Machines. Compaq, Compaq +, and DeskPro are trademarks of Compaq Computer Corporation. NCR is a trademark of NCR Corporation.

Australian Distributor: Dicker Data/78 Captain Cook Drive/Caringban, N.S.W. 2229/(02) 525-2122. United Kingdom Distributor: QCL/(0672) 20529. West German Distributor: Compu-Shack/Ringstrabe 56/5450 Neuwied 1/(02631) 29031/Telex 867716 CELGK. All Other European Export: Ashford International/Atlanta, GA/(404) 458-4017/Telex 15-4120 CHAMBOFCS ATL.



# E·V·E·N·T Q·U·E·U·E

## December 1984

● **dBASE, LOTUS DEMYSTIFIED**—dBASE II and Lotus 1-2-3 Seminars, various sites throughout the U.S. Both seminars stress the practical applications of these two popular programs. The fee is \$245 each or \$450 for both. Contact Software Institute of America Inc., 8 Windsor St., Andover, MA 01810, (617) 470-3880. *December*

● **ENGINEERING INSIGHTS** Continuing Engineering Education, Washington, DC. Among the courses are "Hands-On Programming in the C Language," "UNIX: A Hands-On Approach," and "Internet Systems and Protocols." Tuition ranges from \$730 to \$875. Contact Dick White, Continuing Engineering Education, George Washington University, Washington, DC 20052, (800) 424-9773; in the District of Columbia, (206) 676-8515. *December*

● **HI-TECH EXPLAINED** Advanced Technology Seminars, various sites throughout the U.S. Among the topics to be explored are local-area networks, voice/data integration, CAD/CAM, WordStar, and Lotus 1-2-3. Fees range from \$195 to \$885. Contact Bernie Ilson Inc., 65 West 55th St., New York, NY 10019, (212) 245-7950. *December*

● **INTEL WORKSHOPS** Microcomputer Workshops, various sites throughout the U.S. and Canada. Intel, the semiconductor memory manufacturer, is offering more than 20 workshops on microprocessor applications. A brochure is available.

Contact Customer Training, Intel Corp., 27 Industrial Ave., Chelmsford, MA 01824-3688, (617) 256-1374. *December*

● **PROFESSIONAL EDUCATION**—Seminars from the Institute for Professional Education, various sites in the U.S. Programs in statistics, management, simulation and modeling, personal computers, and computer science. Contact the Institute for Professional Education, POB 756, Arlington, VA 22216, (703) 527-8700. *December*

● **SEMINARS FOR PROS** Advanced Professional Education Seminars, various sites throughout the U.S. Seminar topics include the IBM PC, dBASE II, local-area networks, and UNIX. Fees range from \$545 to \$745. A calendar is available. Contact the Center for Advanced Professional Education, Suite 110, 1820 East Garry St., Santa Ana, CA 92705, (714) 261-0240. *December*

● **CONFERENCES, MEETINGS**—Conferences and Meetings of the Institute of Electrical and Electronics Engineers, various sites throughout the U.S. and the world. A calendar of conferences and meetings complete with contact persons is available. Contact IEEE Computer Society, POB 639, Silver Spring, MD 20901, (301) 589-8142. *December-January*

● **REFRESHERS FOR ENGINEERS**—Continuing Engineering Education, Washington, DC. Courses include "Communications Satellite Systems" and "Foundations of Modern Telecommunications Systems." Fees range from \$795 to \$920. Contact Continuing Engineering Education, George Washington University, Washington, DC 20052, (800) 424-9773; in the District of Columbia, (202) 676-8530. *December-January*

● **DATA COMMUNICATIONS TAUGHT**—Networks and Data Communications Short Courses, various sites throughout the U.S. A few of the courses to be held are "Introduction to Datacomm and Networks," "Designing Digital Communication Systems," and "Configuring Distributed Processing Systems." A catalog is available. Contact Integrated Computer Systems, 6305 Arizona Place, POB 45405, Los Angeles, CA 90045, (800) 421-8166; in California, (800) 352-8251 or (213) 417-8888. *December-February*

● **DEVELOPMENT SEMINARS**—Professional Development Seminars, various sites throughout the U.S. The Institute for Advanced Technology, a division of Control Data Corporation, presents seminars in a variety of areas, including data communications, database management, software engineering, CAD/CAM, personal

computers, office automation, and personnel management. A catalog is available. Contact Institute for Advanced Technology, Control Data Corp., 6003 Executive Blvd., Rockville, MD 20852, (800) 638-6590; in Maryland, (301) 468-8576. *December-February*

● **LEARN PERSONAL COMPUTING**—New York University Programs in Personal Computing, New York City. Continuing education credits can be earned as you learn about personal computers, application programs, languages, communications, and microcomputer technology. Fees and session lengths vary. A brochure is available. Contact New York University, School of Continuing Education, Data Processing and Systems Analysis Institute, 327 Shimkin Hall, New York, NY 10003, (212) 598-7771. *December-February*

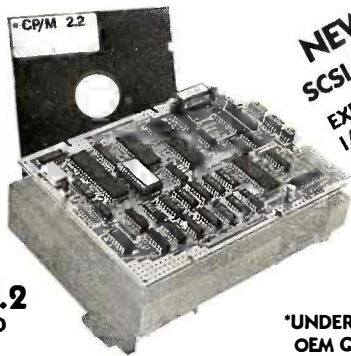
● **INFO PROCESSING SEMINARS**—New York University Seminars in Information Processing, various sites throughout the U.S. Seminars to be held include "Fundamentals of Information Processing for Nontechnical Executives," "The Management of Technical Personnel," and "Managing the Data Center." Contact New York University, School of Continuing Education, Seminar Center, 575 Madison Ave., New York, NY 10022, (212) 580-5200. *December-March*

● **MANAGEMENT COURSES OFFERED** Courses from the American  
*(continued)*

.....  
IF YOU WANT *your organization's public activities listed in BYTE's Event Queue, we need to know about them at least four months in advance. Send information about computer conferences, seminars, workshops, and courses to BYTE, Event Queue, POB 372, Hancock, NH 03449.*

## The Little Board™ ...\$349\*

The world's simplest and least expensive CP/M computer



**NEW  
SCSI/PLUS™  
EXPANSION  
I/O OPTION**

**CP/M 2.2  
INCLUDED**

**\*UNDER \$200 IN  
OEM QUANTITIES**

- 4 MHz Z80A CPU, 64K RAM, Z80A CTC, 2732 Boot ROM
- Mini/Micro Floppy controller (1-4 Drives, Single/Double Density, 1-2 sided, 40/80 track)
- Only 5.75 x 7.75 inches, mounts directly to a 5 1/4" floppy drive
- 2 RS232C Serial Ports (75-9600 baud & 75-38,400 baud), 1 Centronics Printer Port
- Power Requirement: +5VDC at .75A; +12VDC at .05A/On-board -12V converter
- CP/M 2.2 BDOS • ZCPR3 CCP • Enhanced AMPRO BIOS
- AMPRO Utilities Included:
  - read/write to more than 2 dozen other formats (Kaypro, Televideo, IBM CP/MB6....)
  - format disks for more than a dozen other computers
  - menu-based system customization
- BIOS and Utilities Source Code Available
- SCSI/PLUS Adapter:
  - Mounts directly to Little Board • Slave I/O board control • Full ANSC X3T9.2
  - 16 bidirectional I/O lines • \$99/Quantity 1

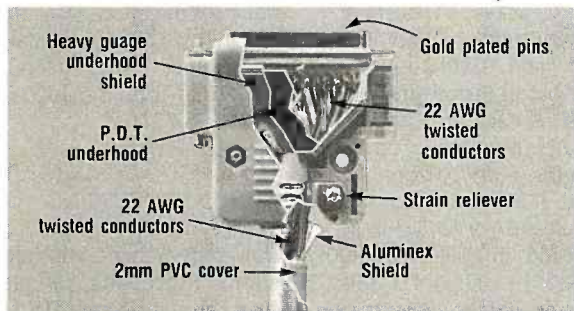
**AMPRO**  
COMPUTERS, INCORPORATED

Distributor/Dealer/Reps  
Inquiries Invited

Z80A is a registered trademark of Zilog, Inc.  
CP/M is a registered trademark of Digital Research

67 East Evelyn Ave. • Mountain View, CA 94041 • (415) 962-0230 • TELEX 4940302

## BEFORE YOU BUY CABLE ASSEMBLIES,



## CHECK UNDER THE HOOD!

DATA SPEC™ cable assemblies are the very best. Each cable is fully shielded to exceed FCC EMI/RFI emission requirements. The unique P.D.T. technique, introduced by DATA SPEC™ and employed beneath the hood shield, insures maximum integrity under the most adverse conditions. DATA SPEC™ has interface cables for all your requirements: Printers, Modems, Monitors, Disk Drives, and much more. And all DATA SPEC™ cable assemblies carry a lifetime warranty. Insist on DATA SPEC™ cables in the bright orange package. Available at better computer dealers everywhere. For more information, call or write:

**DATA SPEC™**

A Division of Alliance Research Corporation

20120 Plummer Street • Chatsworth, CA 91311 • (818) 993-1202

Copyright © 1984 by Alliance Research Corporation

Patent PND.

Management Association, various sites throughout the U.S. The American Management Association offers a wide variety of courses in such areas as information systems, office automation, and communications. A catalog outlines each course. Contact American Management Associations, 135 West 50th St., New York, NY 10020. (212) 586-8100. *December-April*

• **TRAINING IN KNOWLEDGEMAN**—Training Seminar on KnowledgeMan. Chicago, IL. A two-day training seminar on the KnowledgeMan integrated information-management system for 16-bit computers. Contact KnowledgeMan Training Coordinator, Micro Data Base Systems Inc., POB 248, Lafayette, IN 47906. (317) 463-2581. *December 10-11*

• **STRATEGIC ISSUES CONSIDERED**—The 1984/1985 Strategic Issues Conference. Americana Canyon Hotel, Palm Springs, CA. The theme for this conference is "Positioning for Success in the New Computer Market." A keynote address will be delivered by John Sculley, president and chief executive officer of Apple Computer Inc. Contact Corky Holden, Info Corp., 20833 Stevens Creek Blvd., Cupertino, CA 95014-2107. (408) 973-1010. *December 10-13*

• **COURSE COVERS C** C Programming: A Hands-On Workshop. Seattle, WA. This course explains how to design and write C programs and how to evaluate the C language for specific applications. The tuition is \$995. Contact Irene Pastermack, Specialized Systems Consultants, POB 7, Northgate Station, Seattle, WA 98125-0007. (206) 367-8649. *December 10-14*

• **FIFTH GENERATION COMPUTERS**—Fifth Generation and Super Computers: An International Symposium. Rotterdam, The Netherlands. Lectures and panel discussions will be featured. Prototypes of several Japanese machines are expected to be shown for the first time outside Japan. Contact Fifth Generation and Super Computers Symposium 1984, Rotterdam Tourist Office, Stadhuisplein 19, 3012 AR Rotterdam, The Netherlands; tel: (010) 14 14 00; Telex: 21228 vvvnl. *December 11-13*

• **DEC SHOW** DEXPO West 84, The Sixth National DEC-Compatible Industry Exposition. Disneyland Hotel, Anaheim, CA. Products and services that support Digital Equipment Corporation's machines will be displayed. Contact Expoconsul International Inc., 55 Princeton-Hightstown Rd., Princeton Junction, NJ 08550. (609) 799-1661. *December 11-14*

• **TECHNOLOGY UPDATE**—Hi-Tech Update '84, Delta Ottawa Hotel, Ottawa, Ontario, Canada. A series of presentations designed to inform senior management, engineers, and consultants. Sponsored by the Carleton University Faculty of Engineering. For further details, contact Conference Coll Inc., 1138 Sherman Dr., Ottawa, Ontario K2C 2M4, Canada. (613) 224-1741. *December 12-13*

• **EDUCATIONAL COMPUTING**—The Second Annual International Computers in Education Conference. Queen Elizabeth Hotel, Montreal, Quebec, Canada. More than 100 exhibitors and 125 speakers will participate in conferences sponsored by the McGill University Faculty of Education. For more information, contact GEMS Conference and

Consulting Services, POB 367, Snowdon, Montreal, Quebec H3X 3T6, Canada. (514) 735-1388. *December 12-14*

● **MICROS MARCH TO ATLANTA**—The Fourth Annual Southeast Computer Show and Software Exposition, Civic Center, Atlanta, GA. For details, contact CompuShows, POB 3315, Annapolis, MD 21403, (800) 368-2066; in Annapolis, (301) 263-8044; in Baltimore, (301) 269-7694; in the District of Columbia, (202) 261-1047. *December 13-16*

● **CAD/CAM SEMINAR** Carl Machover on CAD/CAM, Cathedral Hill Hotel, San Francisco, CA. Contact Carol Every, Frost & Sullivan Inc., 106 Fulton St., New York, NY 10038, (212) 233-1080. *December 17-19*

● **SOFTWARE MANAGEMENT CONTROL**—Configuration Management of Software Programs, Washington, DC. Intended to show those working in software management how to control development, maintenance, and operational costs. Familiarity with MIL-STD 480, 483, and 490 is helpful, but there is no prerequisite for this course. The cost is \$730. Contact Stod Cor-telyou, Continuing Engineering Education, George Washington University, Washington, DC 20052, (800) 424-9773; in the District of Columbia, (202) 676-8520. *December 17-19*

● **BRIEFING ON ADVANCED LANGUAGES** Structured Techniques Using Fourth Generation Languages, Dallas, TX. This seminar explains how structured techniques and fourth-generation languages can be used. The fee is \$795. Contact Software Institute of America Inc., 8 Windsor St., Andover, MA 01810, (617) 470-3880. *December 18-20*

● **BUSINESS GRAPHICS SEMINAR**—Carl Machover on Business Graphics, Cathedral Hill Hotel, San Francisco, CA. Contact Carol Every, Frost & Sullivan Inc., 106 Fulton St., New York, NY 10038, (212) 233-1080. *December 20-21*

### January 1985

● **NETWORKS MADE CLEAR**—Computer Seminars, various sites throughout the U.S. A series of seminars that covers computer databases and such applications as local-area networks and graphics. Contact Technology Transfer Institute, 741 Tenth St., Santa Monica, CA 90402, (213) 394-8305. *January-February*

● **HANDS-ON LEARNING** Hands-On Computer Seminars, Wintergreen, VA. Seminars offered are "Introduction to Personal Computing," "Word Processing/Information Management," and "Spreadsheets/Graphing." Each spans a four-day period and provides 14 hours of hands-on practice. Rates, which include lodging and ski-lift tickets, vary from \$570 to \$975, depending on accommodations. Contact Dr. M. D. Corcoran, Wintergreen Learning Institute, POB 7, Wintergreen, VA 22958, (800) 325-2200; in Virginia, (804) 325-1107. *January-March*

● **TELECOMMUNICATIONS CONFERENCES**—Telecommunications Program, various sites throughout the U.S. "Satellite Technology for the Nontechnical Manager" will be offered. Contact Phillips Publishing Inc., Suite 1200N, 7315 Wisconsin Ave., Bethesda, MD 20814, (301) 986-0666. *January-May*

(continued)

# 100% FLAWLESS COPIES . . .

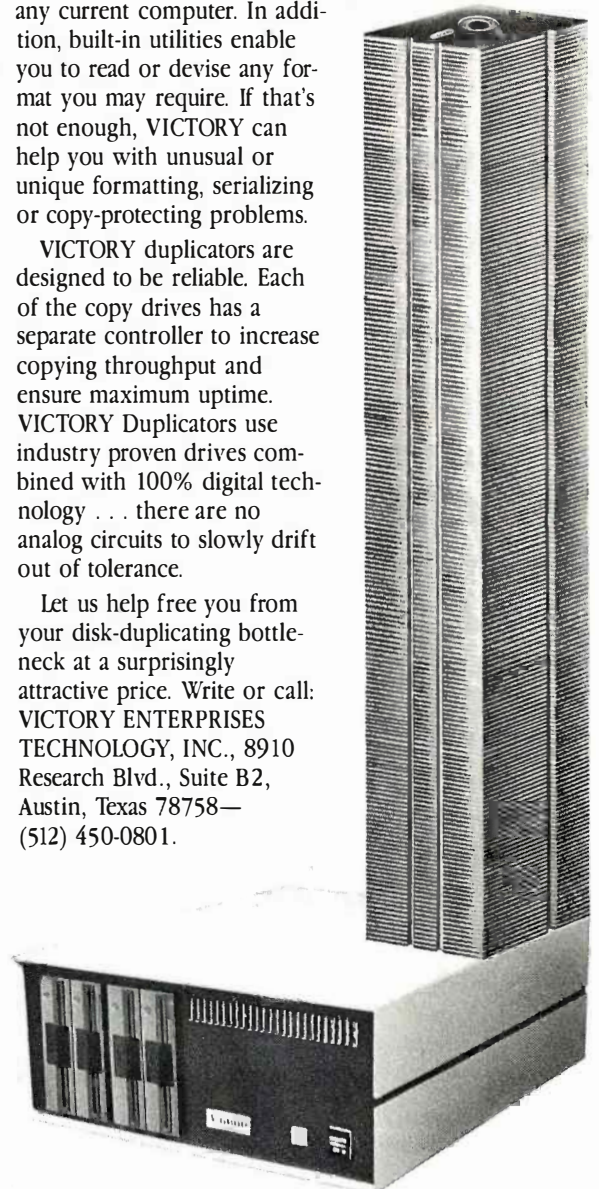
# . . . FAST!

No need to tie up your valuable computer to duplicate diskettes . . . when VICTORY can provide you with a duplicator that will do the job flawlessly, and much faster. One button operation automatically formats, duplicates and verifies up to 8 diskette copies at the same time.

VICTORY can supply you with literally dozens of standardized formats to match the protocol of virtually any current computer. In addition, built-in utilities enable you to read or devise any format you may require. If that's not enough, VICTORY can help you with unusual or unique formatting, serializing or copy-protecting problems.

VICTORY duplicators are designed to be reliable. Each of the copy drives has a separate controller to increase copying throughput and ensure maximum uptime. VICTORY Duplicators use industry proven drives combined with 100% digital technology . . . there are no analog circuits to slowly drift out of tolerance.

Let us help free you from your disk-duplicating bottleneck at a surprisingly attractive price. Write or call: VICTORY ENTERPRISES TECHNOLOGY, INC., 8910 Research Blvd., Suite B2, Austin, Texas 78758—(512) 450-0801.



## Victory Enterprises Technology, Inc.

# Now Your Computer Can See!

## \$295.00\*

A total imaging system complete and ready for plug-and-go operation with your personal computer.

The MicronEye™ offers selectable resolution modes of 256 x 128 and 128 x 64 with operating speeds up to 15 FPS. An electronic shutter is easily controlled by software or manual functions, and the included sample programs allow you to continuously scan, freeze frame, frame store, frame compare, print and produce pictures in shades of grey from the moment you begin operation.

Only the MicronEye™ uses the revolutionary IS32 OpticRAM™ image sensor for automatic solid state image digitizing, with capability for greytone imaging through multiple scans. And with these features, the MicronEye™ is perfectly suited for graphics input, robotics, text and pattern recognition, security, digitizing, automated process control and many other applications.

The MicronEye™ is available with immediate delivery for these computers: Apple II, IBM PC, Commodore 64 and the TRS-80CC (trademarks of Apple Computer Inc., International Business Machines, Commodore Corp., and Tandy Corp. respectively).

Phone for MicronEye™ information on the Macintosh, TI PC and RS232 (trademarks of Apple Computer Inc. and Texas Instruments respectively.)

\*Add \$10.00 for shipping and handling [Federal Express Standard Air]; residents of the following states must add sales tax: AK, AZ, CA, CO, CT, FL, GA, IA, ID, IL, IN, LA, MA, MD, ME, MI, MN, NC, NE, NJ, NY, OH, PA, SC, TN, TX, UT, VA, VT, WA, WI]



MicronEye™  
"Bullet"

## MICRON TECHNOLOGY, INC.

VISION SYSTEMS  
2805 East Columbia Road  
Boise, Idaho 83706  
(208) 383-4106  
TWX 910-970-5973

## EVENT QUEUE

● **SME CONFERENCES, EXPOS**—Conferences and Expositions from the Society of Manufacturing Engineers, various sites throughout the U.S. For a calendar, contact the Society of Manufacturing Engineers, Public Relations Department, One SME Dr., POB 930, Dearborn, MI 48121, (313) 271-0777.  
*January–November*

● **SYSTEM SCIENCE EXAMINED**—The Eighteenth Annual Hawaii International Conference on System Sciences: HICSS-18, Honolulu, HI. A series of conferences devoted to advances in information and system sciences. Major topic areas are hardware, software, decision-support and knowledge-based systems, and medical information processing. Contact Nem B. Lau, HICSS-18 Conference Coordinator, Center for Executive Development, College of Business Administration, University of Hawaii, 2404 Maile Way, C-202, Honolulu, HI 96822, (808) 948-7396. *January 2–4*

● **PCB MANUFACTURING** Printed-Circuit Fabrication Technical Seminar, Sheraton Twin Towers Hotel, Orlando, FL. Multilayer processing, trends in manufacturing and materials, and computer-aided manufacturing will be explored. The registration fee is \$350, which includes materials, luncheons, and admission to a trade show. Contact Laura Harrel, PMS Industries Inc., 1790 Hem-bree Rd., Alpharetta, GA 30201, (404) 475-1818.  
*January 3–10*

● **GIZMOS GALORE** Consumer Electronics Show, Convention Center, Las Vegas, NV. One of the largest shows of consumer electronics products. Contact Consumer Electronics Office, Suite 300, 2001 Eye Street

NW, Washington, DC 20006, (202) 457-8700. *January 5–8*

● **MANAGE RESOURCES WISELY**—Managing Computer Resources, Wintergreen, VA. Focuses on networking, system design, performance evaluation, and operational difficulties encountered by managers and executives. Rates include lodging and ski-lift tickets and vary from \$570 to \$769 depending on accommodations. Contact Dr. M. D. Corcoran, Wintergreen Learning Institute, POB 7, Wintergreen, VA 22958, (800) 325-2200; in Virginia, (804) 325-1107. *January 7–11*

● **STERLING COMPUTER SHOW**—The Fourth Annual Sauk Valley Computer Club Computer Show, Northland Mall, East Lincolnway, Sterling, IL. Businesses, schools, and users groups from the area will display and demonstrate computers and related services. Admission is free. Contact Sauk Valley Computer Club, POB 702, Sterling, IL 61081. *January 12–13*

● **SCSI DEVELOPMENTS** Small Computer Systems Interface (SCSI) Forum, Fort Lauderdale, FL. A seminar and exhibit devoted to SCSI controllers and peripherals. Contact Mr. J. Molina, SCSI Forum Ltd., POB 2625, Pomona, CA 91768-2625, (213) 410-3952. *January 15*

● **BUSINESS COMMUNICATIONS**—The Second Annual Business Telecommunications Exposition: BizTelCom Northeast, Aspen Hotel-Manor, Parsippany, NJ. Seminars and product displays. Preregistration is complimentary; \$10 at the door. Contact Michael C. J. Houston, T. E. G. Inc., The Exposition Group, 83 Barnegat Blvd., Barnegat, NJ 08005, (609) 698-7020.  
*January 16–18*

(continued)

## When switching or lightning cause voltage surges— is your computer safe?

Perma Power®  
Surge Suppressors  
provide the  
transient protection  
computers need

- Protects components, prevents data errors
- Eliminates both line-to-line and line-to-ground surges
- Automatic failure shutdown prevents unprotected operation
- Extended Life models have RF and EMI filters and a three-year warranty



Now at your computer store.

**PERMA POWER®**  
Electronics Inc.

# Softline

THE PROFESSIONAL'S CHOICE

## WORD PROCESSING/EDITORS

|                                     |        |
|-------------------------------------|--------|
| Easywriter II System                | \$219  |
| Fancy Font                          | \$159  |
| Final Word                          | \$189  |
| Microsoft Word                      | \$239  |
| Microsoft Word/Mouse                | \$299  |
| Multimate                           | \$269  |
| PeachText 5000                      | \$199  |
| PFS: Write                          | \$ 95  |
| Samma Word III                      | \$Call |
| Volkswriter Deluxe                  | \$169  |
| The Word Plus (Dosis)               | \$109  |
| Word Perfect (SSI)                  | \$249  |
| WordPlus-PC with The Boss           | \$319  |
| WordStar                            | \$219  |
| WordStar Professional (WS/MM/SS/SI) | \$279  |
| WordStarOptions Pak (MM/SS/SI)      | \$189  |
| XYWrite II+                         | \$229  |

## SPREADSHEETS/INTEGRATED PACKAGES

|               |       |
|---------------|-------|
| Aura 5        | \$329 |
| Electric Desk | \$229 |
| Framework     | \$369 |
| Integrated 7  | \$339 |
| Jack 2        | \$329 |
| Lotus 1-2-3   | \$309 |
| Multipan      | \$135 |
| Open Access   | \$299 |
| Smart System  | \$579 |
| SuperCalc 3   | \$219 |
| Symphony      | \$429 |
| TKI Solver    | \$269 |
| VisiCalc IV   | \$159 |

## COMMUNICATIONS/PRODUCTIVITY TOOLS

|              |       |
|--------------|-------|
| Crosstalk    | \$119 |
| Memory Shift | \$ 79 |
| Move It      | \$109 |
| Prokey 3.0   | \$ 95 |
| Relay        | \$ 99 |
| Smartcom II  | \$109 |

## DATABASE SYSTEMS

|                            |       |
|----------------------------|-------|
| Alpha Data Base Manager II | \$179 |
| Condor III                 | \$299 |
| dBase II                   | \$279 |
| dBase III                  | \$369 |
| DBplus                     | \$ 89 |
| Friday                     | \$179 |
| InfoStar+                  | \$289 |
| Knowledgeman               | \$299 |
| PFS: File/PFS: Report      | \$169 |
| Powerbase                  | \$239 |
| QuickCode                  | \$159 |
| R:base 4000                | \$269 |
| TIM IV                     | \$249 |
| Versalorm                  | \$249 |

## LANGUAGES/UTILITIES

|                             |       |
|-----------------------------|-------|
| Concurrent w/Windows        | \$219 |
| Digital Research C Compiler | \$219 |
| DR Fortran 77               | \$219 |
| Lattice C                   | \$299 |
| Microsoft C Compiler        | \$309 |
| MS Basic Compiler           | \$249 |
| MS Fortran                  | \$239 |
| Norton Utilities            | \$ 59 |

## PROJECT MANAGEMENT

|                         |       |
|-------------------------|-------|
| Harvard Project Manager | \$239 |
| Microsoft Project       | \$169 |
| Scitor Project 5000     | \$299 |
| VisiSchedule            | \$199 |

## ACCOUNTING MODULES

|                                        |       |
|----------------------------------------|-------|
| BPI Accounting                         | \$369 |
| ILUS Easy Business System              | \$319 |
| MBA Accounting                         | \$369 |
| Open Systems Accounting                | \$429 |
| Peachpak 4 (GL/AP/AR)                  | \$239 |
| Peachtree Accounting                   | \$299 |
| Real World Accounting                  | \$469 |
| Star Accounting Partner (GL/AP/AR/PAY) | \$249 |
| Star Accounting Partner II             | \$699 |

## GRAPHICS/STATISTICS

|                        |       |
|------------------------|-------|
| Abstat                 | \$279 |
| BPS Business Graphics  | \$229 |
| Chartmaster            | \$259 |
| DR Draw                | \$199 |
| Energraphics w/Plotter | \$319 |
| Execucision            | \$279 |
| Fast Graphs            | \$219 |
| Graphwriter Combo      | \$399 |
| MS Chart               | \$169 |
| PC Draw                | \$279 |
| PFS: Graph             | \$ 95 |
| Signmaster             | \$199 |
| Statpak-NWA            | \$329 |
| Statpac-Waltonick      | \$299 |

## PROFESSIONAL DEVELOPMENT

|                 |       |
|-----------------|-------|
| Management Edge | \$169 |
| Think Tank      | \$129 |

## HOME/PERSONAL FINANCE

|                      |       |
|----------------------|-------|
| Dollars and Sense    | \$119 |
| Financier II         | \$119 |
| Home Accountant Plus | \$ 99 |
| Sundex-CPA           | \$109 |

## HARDWARE/PERIPHERALS\*

|                           |        |
|---------------------------|--------|
| AST Six Pack Plus (64k)   | \$269  |
| Quadboard (0k)            | \$Call |
| Hayes 1200B with Smartcom | \$399  |
| Hayes Smartmodem 1200     | \$489  |
| Keytronic 5151 DLX IRMA   | \$209  |
| Hercules Graphics Board   | \$349  |
| Epson FX-100 Printer      | \$Call |
| Comrex II Printer         | \$Call |
| C Itoh Prowriter          | \$Call |
| Okidata 93A               | \$689  |
| Toshiba P1351 Printer     | \$Call |
| 64K Memory                | \$ 55  |

\*Call for shipping.

|                                         |                                       |
|-----------------------------------------|---------------------------------------|
| Lotus 1-2-3<br><b>\$309</b>             | Symphony<br><b>\$429</b>              |
| dBase III<br><b>\$369</b>               | FrameWork<br><b>\$369</b>             |
| Multimate<br><b>\$269</b>               | Volkswriter DLX<br><b>\$169</b>       |
| R:base 4000<br><b>\$269</b>             | WordStar Professional<br><b>\$279</b> |
| AST 6 Pak Plus<br><b>\$269</b>          | Smartmodem 1200B<br><b>\$399</b>      |
| Quad Board Expanded 64K<br><b>\$279</b> | Smartmodem 1200<br><b>\$489</b>       |

## LOWEST PRICE GUARANTEE!!

We will match current nationally advertised prices on most products. Call and compare.

**FREE!**

## Diskette Library Case

... with your order. This attractive case protects, indexes and stores 10 diskettes for quick retrieval. Normally a \$10 value, it is now available **FREE** to Softline customers



## TERMS:

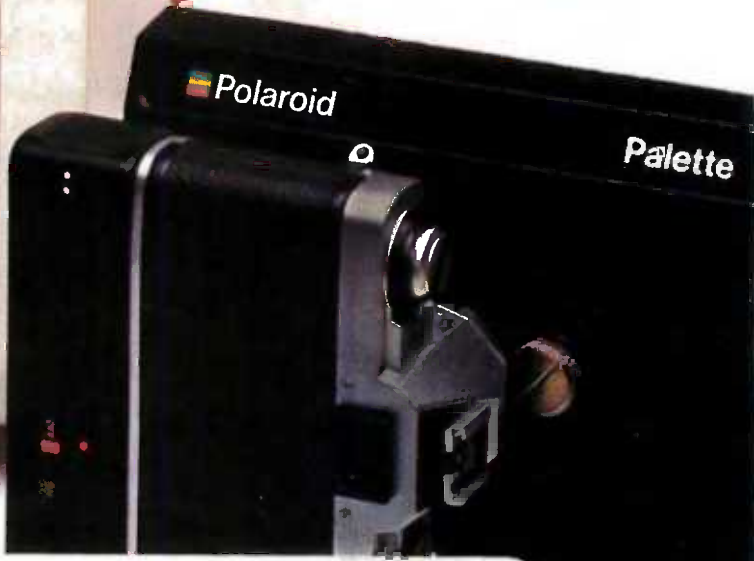
Checks—allow 14 days to clear. Credit processing—add 3%. COD orders—cash, M.O. or certified check—add \$3.00. Shipping and handling UPS surface—add \$3.00 per item (UPS Blue \$6.00 per item). NY State Residents—add applicable sales tax. All prices subject to change.



To Order call  
**1-800-221-1260**  
In New York State call (718) 438-6057

For technical support  
and information call  
(718) 438-6057

**Softline**  
Softline Corporation  
P.O. Box 729, Brooklyn, N.Y. 11230  
TELEX: 421047 ATLN UI



# Now last minute presentations can be made from your personal computer. In color. In house. In minutes.

## Introducing Polaroid Palette.

Whether your presentation is in 30 minutes or 30 days, the new Polaroid Palette Computer Image Recorder will make it easier. Priced at under \$1800\*, it lets you make Polaroid instant 35mm slides or prints from personal computer-generated data. Right at your desk. So now you can create a presentation in minutes. Without sending out for processing, paying premiums for rush service or risking the security of your confidential information.

**Works with the graphics packages of the IBM PC or XT, DEC Rainbow, Apple IIe and II+ as well as other pcs.**

The Polaroid Palette is designed to work with many graphics software packages. In fact, when using such popular programs as Graphwriter, Chart-Master, Sign-Master, DR Draw and DR Graph, Palette can virtually double both the horizontal and vertical resolution of your monitor. Plus, a

"backfill" feature reduces raster lines for a smoother, more finished appearance. The result—presentation quality slides. On-the-spot.

### **Color 35mm slides, even from a black and white CRT**

Think of it as an artist's palette. Because Palette "paints" your graphs, charts and text. You're choosing from up to 72 colors. If you don't want red, press a few keys—it's green. And if you're not the artistic-type, Polaroid has developed a menu of color sets: combinations of colors that have been specially coordinated to complement your presentations. And all of this is yours, even if you have a black and white monitor.

### **Lets you make last minute changes or add up-to-the-minute information.**

The Polaroid Palette is the fast, convenient, low-cost way to prepare slides for your presentation. And perhaps

even more important, Palette allows you to keep confidential information confidential. You won't have to send your work out to anyone again.

So why wait until the last minute to find out about Polaroid Palette? Call this toll-free number or return this coupon. Because with Palette you'll make your deadlines, in no time.

For a demonstration, call toll-free, or mail the coupon to Polaroid Corp., E. I. Marketing, Dept. 604, 575 Technology Sq., Cambridge, MA 02139.

**CALL 1-800-225-1618**

Send information.  Have representative call.

B- 12/84

Name \_\_\_\_\_ Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Telephone (\_\_\_\_) \_\_\_\_\_

PC make and model \_\_\_\_\_

 **Polaroid**

\*Suggested list price. Polaroid®

EVENT QUEUE

Third Annual Conference on  
**INTERACTIVE  
INSTRUCTION DELIVERY**

**in Education, Training  
and Job Performance**

February 13-15, 1985  
Sheraton Towers Hotel  
Orlando, Florida

Presentations cover applications in:

- Videodisc
- Microcomputers
- Software Development Methodology

Exhibitors include:

|                                    |                     |
|------------------------------------|---------------------|
| Applied Science Assoc. Inc.        | MetaMedia Systems   |
| Creative Technologies Corporation  | Pioneer Video, Inc. |
| NCR Corporation - Video Systems    | LaserVideo, Inc.    |
| Capital Video Communications, Inc. | Sony Corporation    |
| Panasonic Industrial Company       | General Electric    |
| Digital Equipment Corporation      | Creativision        |
| Raytheon Service Company           | Kinton, Inc.        |
| Online Computer Systems            | ICS-Intext          |
| 3M Optical Recording Project       | Hazeltine           |
| Digital Techniques, Inc.           | Hitachi             |

For further information contact:

**Society for Applied Learning Technology**  
50 Culpeper St., Dept. B  
Warrenton, VA 22186 (703) 347-0055

● **COMMUNICATIONS INDUSTRY CONFERS**  
COMMTEX International and The 1985 NAVA, Convention Center, Anaheim, CA. COMMTEX features audio-visual, video, and microcomputer products for business, education, and government. NAVA, the conference and convention of the International Communications Industries Association, is made up of numerous seminars, general sessions, and special-interest group meetings. Contact International Communications Industries Association, 3150 Spring St., Fairfax, VA 22031-2399, (703) 273-7200. *January 16-21*

● **MEASUREMENT SCIENCE**—Measurement Science Conference, Marriott Hotel, Santa Clara, CA. Technical sessions will explore such topics as laser and optical-fiber metrology, time and frequency measurements, and the effects of data networks on calibration. Exhibits and formal addresses highlight this event. Registration details are available from Darlene Diven, Measurement Science Conference, POB 61344, Sunnyvale, CA 94088-1344, (408) 756-0270. *January 17-18*

● **OPTICAL ENGINEERING SYMPOSIUM**—The 1985 Symposium on Optical and Electro-Optical Engineering and Instrument Exhibit, Marriott Hotel, Los Angeles, CA. This symposium, sponsored by the International Society of Photo-Optical Instrumentation Engineers (SPIE), is made up of conferences, exhibits, and tutorial short courses. Contact SPIE, POB 10, Bellingham, WA 98227-0010. *January 20-25*


● **UNIX USERS UNITE**  
The 1985 UniForum: The International Conference of UNIX System Users. Infomart, Dallas, TX. More than

400 companies are expected to exhibit UNIX-related equipment. A conference program is planned. UniForum, sponsored by the /usr/group, will be held in conjunction with the grand opening of Dallas's International Information Processing Market Center (Infomart). Contact Professional Exposition Management Co., Suite 205, 2400 East Devon Ave., Des Plaines, IL 60018, (800) 323-5155; in Illinois, (312) 299-3131. *January 21-25*



● **IN-FLIGHT COMPUTING EXPLORED**—Meeting of the Radio Technical Commission for Aeronautics, Washington, DC. An industry committee will look into the possible effects that battery-operated portable computers may have on an airplane's navigational equipment. The committee, called SC-156, meets at 9:30 a.m. Contact the Radio Technical Commission for Aeronautics, Suite 500, 1425 K St. NW, Washington, DC 20005. *January 22-23*

● **MICROS, COMMUNICATIONS, AND BUSINESS**  
Microspeak '85, San Francisco, CA. This conference will focus on ways to set up a cost-effective microcomputer communications system. The fee is \$695. Contact Stephen J. Schneiderman, Micro Communications, 500 Howard St., San Francisco, CA 94105, (415) 397-1881. *January 22-24*

● **SEMICONDUCTOR EQUIPMENT, CONFERENCE**  
Advanced Semiconductor Equipment Exposition and Technical Conference, Convention Center, San Jose, CA. Admission to the show is free with preregistration. Contact Joyce Estill, ASE '85 Show Manager, Cartledge & Associates Inc., 1101 South Winchester Blvd. #M259, San Jose, CA 95128, (408) 554-6644. *January 22-24*



## computers for Less


|                                                                                                                                                                                                                     |                                                                                                                                                                                                                                      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br><b>IBM P.C.</b><br>256K Ram, Color card,<br>Monitor, Parallel Port,<br>DOS<br><b>\$1995</b><br>call for other configurations | <br><b>IBM P.C.</b><br>256K Ram, 2-Floppy drives,<br>10 Meg. hard drive,<br>Mono card, Monitor, DOS<br><b>\$2795</b><br>call for complete details |
| <b>Printers</b><br>Brother HR-15 ..... \$365.00<br>Epson FX-80 ..... 399.00<br>Juki 6100 ..... 399.00<br>Software<br>dBase III ..... 399.00<br>PFS: Write ..... 84.00<br>Lotus 1-2-3 ..... 299.00                   | <b>Modems</b><br>Hayes 1200 ..... \$445.00<br>Hayes 1200B ..... 369.00<br>Pro-Modem ..... 310.00<br>Accessories<br>AST Six Pak Plus ..... 249.00<br>Teac 55B ..... 179.00<br>10 Meg. Internal drive 750.00                           |

Call for pricing on our complete line  
of fine computing products


YOU CAN'T BUY COMPUTERS FOR LESS

(619) 579-2730 (800) 782-4242 (CA only)

3855 Avocado Blvd., Suite 140-227 La Mesa, California 92041



Prices subject to change without notice.  
Prices reflect 2 1/2% cash discount • Quantities Limited





## EVENT QUEUE

### ● COURSEWARE TIPS

Selecting and Evaluating Instructional Courseware, Princeton, NJ. This seminar shows teachers how to identify sources and the effectiveness of educational courseware, how to evaluate courseware, and selecting and using courseware directories, clearinghouses, databases, and published reviews. Hands-on experience is provided. The fee is \$125. Contact Educational Testing Service, Princeton, NJ 08541, (609) 734-1108. *January 24*

### ● INSTRUCTIONAL COMPUTING CONFERENCE

The 1985 Florida Instructional Computing Conference, Sheraton Twin Towers Convention Center and Howard Johnson's Florida Center Hotel, Orlando, FL. This fifth annual conference will feature more than 100 sessions on instructional and administrative computing as well as general conference sessions. More than 130 companies will exhibit. Contact the Florida Department of Education, Educational Technology Section, Knott Building, Tallahassee, FL 32301, (904) 487-3104. *January 28-31*

### ● NETWORK CONFERENCE, EXPO—The

Seventh Annual Communications Networks Conference and Exposition, Convention Center, Washington, DC. Contact Communications Networks 1985, POB 880, Framingham, MA 01701, (800) 225-4698; in Massachusetts, (617) 879-0700. *January 29-31*

### ● GERMAN TRADE SHOW

Micro-Computer '85, Hall 4, Fairgrounds, Frankfurt, West Germany. More than 200 exhibitors of hardware, software, accessories, and services will display their wares. Other features in-

clude seminars, workshops, and discussions. Contact Mr. Philippe Hans, German American Chamber of Commerce, 21st Floor, 666 Fifth Ave., New York, NY 10103, (212) 974-8856. *January 29-February 3*

### ● PAN AMERICAN CONFERENCE—The First International Information Management Congress

Pan American Conference, Caribe Hilton International Hotel, San Juan, Puerto Rico. Seminars and product exhibits on advanced micrographics and office automation. Contact IMC, Pan American Conference, POB 34404, Bethesda, MD 20817, (301) 983-0604. *January 30-31*

## February 1985

### ● OEM CONFERENCES

OEM-Only Regional Invitational Conference, various sites throughout Europe. For a schedule, contact Beatrice Labbe, Conference Director—Europe, B. J. Johnson & Associates, 3151 Airway Ave. #C-2, Costa Mesa, CA 92626, (714) 957-0171. *February-March*

### ● AUTOMATED FACTORY EXPLORED—Automated

Manufacturing, Don CeSar Hotel, St. Petersburg, FL. Contact Eleanor Bernet, Frost & Sullivan Inc., 106 Fulton St., New York, NY 10038, (212) 233-1080. *February 4-5*

### ● TECHNOLOGY AND THE OFFICE—The 1985 Office

Automation Conference, Georgia World Congress Center, Atlanta, GA. The theme for the sixth annual Office Automation Conference is "Today's Partnership: People and Technology." More than 45 technical sessions are planned.

(continued)

High performance to cost ratio...

# Programming Chips?

Projects develop profitably with development hardware/software from GTEK.



**MODEL 7956** .....  
(with RS232 option) . . . \$1099.  
**MODEL 7956 (stand alone)** \$ 879.  
GTEK's outstanding **Gang Programmer** with intelligent algorithm can copy 8 EPROMS at a time! This unit is used in a production environment when programming a large number of chips is required. It will program all popular chips on the market through the 27512 EPROMS. It also supports the Intel 2764A & 27128A chips. It will also program single chip processors.



**MODEL 7228 - \$549**  
This model has all the features of Model 7128, plus *Intelligent Programming Algorithms*. It supports the newest devices available through 512Kbits; programs 6x as fast as standard algorithms. Programs the 2764 in one minute! Supports Intel 2764A & 27128A chips. Supports Tektronics, Intel, Motorola and other formats.

EPROM & PAL

## PROGRAMMERS

—These features are standard from GTEK—

Compatible with all RS232 serial interface ports • Auto select baud rate • With or without handshaking • Bidirectional Xon/Xoff • CTS/UTR supported • Read pin compatible ROMS • No personality modules • Intel, Motorola, MCS86 Hex formats • Split facility for 16 bit data paths • Read, program, formatted list commands • Interrupt driven — program and verify real time while sending data • Program single byte, block, or whole EPROM • Intelligent diagnostics discern bad and/or erasable EPROM • Verify erasure and compare commands • Busy light • Complete with Textool zero insertion force socket and integral 120 VAC power (240 VAC/50Hz available) •



**MODEL 7324 - \$1199**  
This unit has a built-in compiler. The Model 7324 programs all MMI, National and TI 20 and 24 pin PALs. Has non-volatile memory. It operates stand alone or via RS232.



**MODEL 7128 - \$429**  
This model has the highest performance-to-price-ratio of any unit. *This is GTEK's most popular unit!* It supports the newest devices available through 256Kbits.

**MODEL 7316 Pal Programmer** ..... \$ 599  
Programs Series 20 PALs. Built-in PALASM compiler.

## DEVICES SUPPORTED

by GTEK's EPROM Programmers

| NMOS  |        | NMOS  |       | CMOS   | EEPROM |        | MPU'S |       |
|-------|--------|-------|-------|--------|--------|--------|-------|-------|
| 2758  | 2764A  | 2508  | 68764 | 27C16  | 5213   | 12816A | 8748  | 8741H |
| 2716  | 27128  | 2516  | 8755  | 27C16H | 5213H  | 12817A | 8748H | 8744  |
| 2732  | 27128A | 2532  | 5133  | 27C32H | 52B13  |        | 8749H | 8751  |
| 2732A | 27256  | 2564  | 5143  | 27C64  | X2816  |        | 8741  | 68705 |
| 2764  | 27512  | 68766 |       | 27C256 | 48016  |        | 8742H |       |

## UTILITY PACKAGES

GTEK's PGX Utility Packages will allow you to specify a range of addresses to send to the programmer, verify erasure and/or set the EPROM type. The PGX Utility Package includes GHEX, a utility used to generate an Intel HEX file.

PALX Utility Package — for use with GTEK's Pal Programmers — allows transfer of PALASM<sup>®</sup> source file or ASCII HEX object code file.

Both utility packages are available for CPM<sup>®</sup>, MSDOS<sup>®</sup>, PC DOS<sup>®</sup>, ISIS<sup>®</sup> and TRSDOS<sup>®</sup> operating systems. Call for pricing.

## AVOCET CROSS ASSEMBLERS

These assemblers are available to handle the 8748, 8751, Z8, 6502, 68X and other microprocessors. They are available for CPM and MSDOS computers. When ordering, please specify processor and computer types.

## ACCESSORIES

|                        |                   |                  |
|------------------------|-------------------|------------------|
| Model 7128-L1, L2, L2A | XASM (for MSDOS)  | \$250.           |
| (OEM Quantity) \$259.  | UV Eraser DE-4    | \$ 80.           |
| Model 7128-24          | RS232 Cables      | \$ 30.           |
| Cross Assemblers       | 8751 Adapter      | \$174.           |
| SIM48 Simulator        | 8755 Adapter      | \$135.           |
| PGX Utilities          | 48 Family Adapter | \$ 98.           |
| PALX                   | 68705 Adapter     | Call for pricing |



Development Hardware/Software  
P.O. Box 289, Waveland, MS 39576  
601/467-8048  
, INC.

GTEK, PALASM, CPM, MSDOS, PC DOS, ISIS, and TRSDOS are all registered trademarks.

## KMA "DISCOUNT" SOFTWARE MOST ORDERS SHIPPED NEXT DAY

### BUSINESS/HOME/UTILITIES

|                              |           |
|------------------------------|-----------|
| Accounting Partner           | 267 50    |
| Accounting Plus GL/AP/AR/INV | ea 256 75 |
| Bank Street Writer           | 55 95     |
| Blacks Law Dictionary        | 85 97     |
| Bookkeeper III               | 65 98     |
| BPI GL/AR/AP/PAY/INV         | ea 267 50 |
| Ctнал GL/AR/AP/PAY           | ea 180 00 |
| DBase II                     | 395 00    |
| DGraph                       | 189 00    |
| Disk Drive Analyzer          | 35 95     |
| Dollar & Sense               | 129 00    |
| Federal Official Forms       | 65 00     |
| Friday                       | 199 00    |
| Home Accountant              | 61 97     |
| Infostar                     | 280 00    |
| Landlord                     | 387 75    |
| Multiplan                    | 147 00    |
| Peachtree AP/AR/GI/INV/PAY   | ea 450 00 |
| Peach Text                   | 256 75    |
| Personal Investor            | 117 50    |
| PFS Writer/File/Rep/Graph    | ea 93 75  |
| Prof'n                       | 199 75    |
| Quick Code                   | 189 00    |
| Stock Portfolio System       | 138 75    |
| Tax Advantage                | 56 97     |
| Tax Break Annual             | 108 00    |
| Tax Break Planner            | 138 00    |
| Tax Decisions                | 167 40    |
| Tax Preparer                 | 175 00    |
| Westware GL/AP/AR/PAY/INV    | ea 315 00 |
| Wordstar                     | 280 00    |
| ETC ETC ETC                  |           |

### RECREATION/EDUCATIONAL

|                            |          |
|----------------------------|----------|
| Adventureland              | 33 98    |
| Algebra 1-4                | ea 33 97 |
| Alphabet Circus            | 27 97    |
| Biology Facts              | 27 97    |
| Coast to Coast America     | 43 97    |
| Computer Prep for Gre      | 73 97    |
| Crypto Cube                | 33 97    |
| Dinosaurs                  | 33 97    |
| Dinosaur Dig               | 43 97    |
| Elementary Science Facts   | 33 97    |
| Fleet Feet                 | 33 97    |
| Injured Engine             | 33 97    |
| Jungle Hunt                | 32 67    |
| Lucky's Magic Hat          | 33 97    |
| Matchmaker Grammar         | 33 97    |
| Math Blaster               | 43 97    |
| Moon Patrol                | 32 67    |
| Ms Pac Man                 | 32 67    |
| Dwicat Sat (15 Hr)         | 73 97    |
| Pole Position              | 32 67    |
| Sat - Math/Verbal          | ea 33 97 |
| Sea Horse Hide & Seek      | 30 97    |
| Shapes & Colors Rodea      | 27 97    |
| Speed Reader II            | 61 97    |
| Spelling Grade 2-8         | ea 33 97 |
| Summer Games               | 34 00    |
| Teach Yourself Apple Basic | 30 97    |
| Typing Instructor          | 35 97    |
| Webster The Word Game      | 30 97    |
| Word Master                | 30 40    |
| Zaxxon                     | 33 97    |
| ETC ETC ETC                |          |

CALL FOR PRODUCTS NOT LISTED  
NY RESIDENTS ADD APPLICABLE TAX  
ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE AND AVAILABILITY

KMA SOFTWARE  
P.O. BOX 14  
FRESH MEADOWS, N.Y. 11365

ORDERS: (800) 332-0429

INFORMATION: (212) 591-2772

## EVENT QUEUE

Full-conference preregistration fees are \$100, which includes admission to the exhibit area. Student, one-day, and exhibit-only rates are \$10, \$40, and \$30, respectively. Full-conference registration at the door is \$125. Contact OAC '85, American Federation of Information Processing Societies Inc., 1899 Preston White Dr., Reston, VA 22091, (703) 620-8952. February 4-6

● **SHOW AND CONFERENCE—Mini/Micro** West-85, Hilton Hotel, Anaheim, CA. A computer conference and exhibition. Contact Electronic Conventions Management, 8110 Airport Blvd., Los Angeles, CA 90045, (213) 772-2965. February 5-7

● **MANUFACTURING EXPO** Florida Computer Manufacturing Expo, Centroplex Expo Center, Orlando, FL. Hardware, software, peripherals, and accessories will be displayed. A seminar program is planned. Contact Great Southern Computer Shows, POB 655, Jacksonville, FL 32201, (904) 356-1044. February 5-8

● **STRIDE TO FAIRE** Stride Faire '85, MGM Grand Hotel/Casino, Reno, NV. This is the second annual technical trade fair sponsored by Stride Micro, formerly known as Sage Computer. Contact Laura Smith, Stride Micro, 4905 Energy Way, Reno, NV 89502, (702) 322-6868. February 8-10

● **SOFTWARE MANAGEMENT CONTROL—Configuration Management of Software Programs**, San Diego, CA. See December 17-19 for details. February 11-13

● **COMPUTERS FILL EDUCATORS' TALL ORDER** The Fifth Annual Conference

of the Texas Computer Education Association, Hyatt Regency Hotel, Austin, TX. The theme for this conference is "New Directions for Education Using Modern Day Technology." Contact TCEA Conference, POB 2573, Austin, TX 78768. February 13-16

● **COCO CONVOCATION** Rainbowfest, Irvine Marriott, Irvine, CA. A show for users of the Radio Shack TRS-80 Color Computer. More than 50 exhibitors are expected. Contact Falsoft Inc., POB 385, Prospect, KY 40059, (502) 228-4492. February 15-17

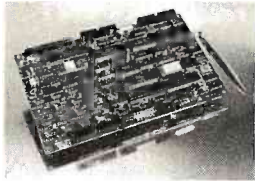
● **SOFTWARE UPDATE** The Second Annual International Software Update, Waiohai Resort Hotel, Kauai, HI. An international lineup of speakers will focus on domestic and international marketing concerns and future trends in microcomputer software. Attendance is limited. Contact Raging Bear Productions Inc., Suite 175, 21 Tamal Vista Dr., Corte Madera, CA 94925, (800) 732-2300; in California, (415) 924-1194. February 16-20

● **MICROS FOR EDUCATORS—Association of Teacher Educators National Conference, Riviera Convention and Resort Hotel, Las Vegas, NV.** Exhibits and demonstrations of microcomputers, microcomputer products, and communications equipment will be featured. Contact Peter C. West, Learning Center, College of Education, Gabel Hall 8, Northern Illinois University, DeKalb, IL 60115, (815) 753-1241. February 18-19

● **MANAGE YOUR COMPUTER—Managing Computer Resources**, Wintergreen, VA. See January 7-11 for details. February 18-22

(continued)

### Powerful Single Board Computer Includes CP/M Plus™ on Disk



**\$599**  
Assembled, Tested  
Includes CP/M 3.0 on disk

**Mountain Side Computer**  
**MSC-1CO**  
Video, 128Kb, CP/M Plus™, and more

#### New Items:

- MSDC's Coprocessor
- 68000 Coprocessor
- 80X24 LCD Driver
- HardRAM Disk
- 3 1/2" Singleboard

#### Z80CPU

MSC-1CO uses the most popular microprocessor, the Z80, as its main CPU. MSC-1CO runs at 4 MHz without any wait states. The whole system is incorporated into a high quality four layer PCB board measuring only 145mm X 250mm (10" X 6"). The system requires only 1.2 Amps at +5 Volts and 0.1 Amps at ±12 Volts.

#### Banked CP/M Plus Included

CP/M Plus (3.0 Banked) is included on disk with all manuals. CP/M Plus is upwardly compatible with CP/M 2.2 and includes the SID debugger, the MAC and RMAC macro assemblers and the LINK-80 loader. MSC-1CO's custom BIOS provides support for multiple disk formats and I/O device control. System specific software for disk formatting, disk copying, defining function keys and modifying screen attributes is also included.

#### 128Kb RAM

One 64K bank of memory is devoted to CP/M and its disk cache blocks, while the other 64K bank is devoted to applications programs. The arrangement not only provides more memory for programs, but it significantly increases the speed of disk I/O.

#### Internal Floppy Disk Controller

MSC-1CO handles Shugart/ANSI standard floppy disk drives in a variety of sizes and formats:

- 8" **SSDD, 243Kb**
- 8" **DSDD, 1.2Mb**
- 5-1/4" **DSDD, 320Kb**
- 5-1/4" **DSDD, 800Kb**
- 5-1/4" **QFD, 1.2Mb**

Up to four drives of any density or size can be connected to MSC-1CO. Both 5 1/4" and 8" inch connectors are on-board to make disk drive connections easy.

#### High Speed CRT Controller

MSC-1CO controls an 80 x 24 line memory mapped CRT controller. Video output is composite or separate to match any monitor. Attributes such as insert and delete line, reverse video, and semigraphics are supported. Cursor escape sequences are an extension of DEC's VT52 and can be easily reprogrammed to emulate most standard terminals.

CP/M Plus™ of Digital Research, Inc.

#### Two RS232C Ports

MSC-1CO communicates with printers, modems, plotters, and other standard RS232C devices through its two serial ports. These ports are independently programmable for baud rates, stop bits, data format and parity. Synchronous communication on Port A is jumper selectable.

#### Centronics Parallel Port

A standard Centronics parallel port allows MSC-1CO to communicate with printers and other parallel devices.

#### Parallel Keyboard Port

MSC-1CO connects to any ASCII parallel keyboard of positive or negative polarity with a negative strobe. A type-ahead buffer and programmable function keys are provided by MSC-1CO's custom BIOS.

#### 16 Bit TTL I/O Port

This port allows you to access printers, relays, LEDs, DACs, ADCs, switches, EPROM programmers and many other devices.

#### Clock Calendar

The battery backed up clock/calendar provides time and date information to CP/M for file stamping. The clock can also be accessed from applications programs.

#### External Bus

MSC-1CO's 50 pin bus connector provides expansion for a hard disk controller, RAM disk, graphics or a 68000 system. Please call or write for more information on these options.

#### MSC-1CO Saves Time and Money

With MSC-1CO's low cost and quality workmanship, why spend time, energy and money to design, debug and test your own system? Whether you require single units or large volume quantities we can meet your needs. Order your evaluation unit today!

Manufactured by  
**Southern Pacific Limited**  
1-3-18 Tsurumichuo Tsurumi, Yokohama, JAPAN 230  
☎ 045-501-8842, Telex 3827230 SPACIF J  
USA Distributor:  
**ARTISOFT, Inc.**  
P.O. Box 41436, Tucson, Arizona 85719 ☎ (602) 327-4305

# Powerful CP/M® Software.

For Apple, Osborne, Kaypro, Rainbow, NEC, Epson, Heath, Xerox and others.

Now only **\$39<sup>95</sup>** each!

## NEVADA COBOL™

- When we introduced Nevada COBOL in 1979, it was loaded with innovations. Today's, Edition 2.1 is even better!
- Extremely Compact. You can compile and execute up to 2500 statements in 32K RAM, 4000 statements in 48K, etc.
  - It's based upon the ANSI-74 standards with level 2 features such as compound conditionals and full CALL CANCEL.
  - You get a diskette, 165-page manual with lots of examples and 16 complete COBOL source code programs.

Also available: COBOL Application Packages, Book 1 \$9.95

## NEVADA PASCAL™

- This newest addition to the 8-bit Nevada product line has many advanced features:
- 14-digit precision, BCD Math, no round-off errors with decimal arithmetic for business and floating point +63 -64 for scientific.
  - A very nice TRACE style debugging.
  - Arrays up to 8 dimensions and 64K strings.
  - External procedures and functions with dynamic auto-loading.
  - One-step compile, no assembly or link required.
  - No limits on size of procedure, nesting levels, recursion.
  - Requires 60K RAM and one disk drive with at least 90K storage.
  - You get a 184-page manual and diskette rev. 4.1.

## NEVADA FORTRAN™

- FORTRAN IV based upon ANSI-66 standards with some 1977 level features.
- IF . . THEN . . ELSE constructs.
- A very nice TRACE style debugging.
- 150 English language error messages.
- You get a diskette, including an 8080 assembler and Nevada FORTRAN rev 3.2, 214-page manual and five sample programs. Requires 48K RAM.

## NEVADA BASIC™

- This interpreter has a built-in full-screen editor.
- Single- and Multi-line functions.
- BCD Math—no round-off errors.
- Full Matrix operations.
- Requires 48K RAM.
- You get 220-page manual and diskette rev. 2.5.

## NEVADA EDIT™

- A full-screen video display text editor rev. 3.1 designed specifically to create COBOL, PASCAL and FORTRAN programs.
- See the review in May 1983 Microcomputing.

## NEVADA PILOT™

- See review in January 1983 MICROCOMPUTING.
- You get a diskette rev. 6.1, 131-page manual and ten useful sample programs.



This is a limited time offer, so order yours today!

### ELLIS COMPUTING, INC.

3917 Noriega Street  
San Francisco, CA 94122 Phone (415) 753-0186

The CP/M Operating System, an 8080, 8085 or Z-80 microprocessor, and 32K RAM are required, unless stated otherwise above.

Diskette format:

8" SSSD (Standard CP/M IBM 3740)

5 1/4" Diskette for:

Apple CP/M

DEC VT 180

DEC Rainbow

Epson QX-10

Heath Hard Sector (Z-89)

Heath Soft Sector (Z-90, Z-100)

IBM-PC (Requires Z-80, CP/M-80 card)

Kaypro Double Density (NCR)

Micropolis Mod II

NEC PC 8001

North Star Double Density

North Star Single Density

Osborne Single Density

Sanyo 1000, 1050

Superbrain DD DOS

3.X (512 byte sec)

Televideo

TRS-80 Model I Base

0 mapper

Xerox 820 Single Density

Satisfaction is guaranteed—or your money back. If for any reason you're not completely satisfied, just return the package—in good condition with the sealed diskette unopened—within 30 days and we'll refund your money.

Please send me: Software Packages

COBOL  FORTRAN  EDIT  PASCAL  BASIC  PILOT

Send my order for \_\_\_\_\_ packages @ \$39.95 each Total \_\_\_\_\_

COBOL Applications Package @ \$9.95 each Total \_\_\_\_\_

California deliveries add 6% or 6.5% sales tax \_\_\_\_\_

Outside North America, add \$6.00 per package for shipping. (Postage paid within North America.) \_\_\_\_\_

Checks must be in U.S. Dollars and drawn on a U.S. Bank.

Check enclosed

COD if COD add \$4.00

MasterCard

VISA

**TOTAL** \_\_\_\_\_

Card # \_\_\_\_\_ Exp. \_\_\_\_\_

Signature \_\_\_\_\_

Ship to: Name \_\_\_\_\_

Street \_\_\_\_\_

City/St/Zip \_\_\_\_\_

CP/M is a registered trademark of Digital Research, Inc. Microsoft is a registered trademark of Microsoft Corp. TRS-80 is a registered trademark of Tandy Corp. Apple II is a trademark of Apple Computer, Inc. Osborne is a registered trademark of Osborne Computer Corp. Xerox 820 is a trademark of Xerox Corp. Kaypro is a trademark of Non-linear Sys. Heath/Zenith is a trademark of Heath Corp. IBM is a registered trademark of International Business Machines, Corp. Nevada BASIC, Nevada COBOL, Nevada FORTRAN, Nevada PILOT, Nevada EDIT, Nevada PASCAL, and Ellis Computing are trademarks of Ellis Computing, Inc. © 1984 Ellis Computing, Inc.

## COMPETITIVE EDGE

P.O. BOX 556 • PLYMOUTH, MI 48170 • (313) 451-0665

### Featuring Multi-User Business Systems LOMAS DATA PRODUCTS INC.

Thunder 186™, 256K, CCP/M® -86, 4 Slot, 2-5" DRS SU ..... \$1995  
 S-100 PCTM 8086, 256K, CCP/M® -86 Single User System ..... 2396  
 S-100 PCTM 8086, 256K, CCP/M® -86 10 MByte Harddisk ..... 3695  
 S-100 PCTM 8086, 512K, CCP/M® Multi-User 10MB HD ..... 4795  
 S-100 PCTM 286, 256K, CCP/M® 86 Single User System ..... 3095  
 S-100 PCTM 286, 256K, CCP/M® 86 10 MBYTE Harddisk ..... 4395  
 S-100 PCTM 286, 512K, CCP/M® Multi-User 10 MB HD ..... 5195  
 Up to 40 Megabyte Hard Disk, 1024K Main Memory Available.  
 286 — \$1116, Hazitall — \$275, LDP72 — \$220, 256K DRAM ..... 636

### CompuPro® Components Systems by Competitive Edge

Single User 85/88, 64K, CP/M® 2.2, 2-8" Floppy 10 Slt ..... 2995  
 Multi-User 85/88, 256K, CCP/M® 8-16™, 2-8" Flpy, 10 Slt ..... 4095  
 M-User 9 Ser, 85/88, 512K, CCP/M, 1-8" 40MB HD, 10 Slt ..... 6595  
 286, 128K, CP/M® -86™, 2-8" Floppy, I/O-410 Slt ..... 3799  
**ULTRA HIGH SPEED 8 BIT & 16 BIT SYSTEM BELOW**  
 Macrotech 286/Z80H, 1024K, 12 Serial, 40MBHD, 20 Slt ..... 13695  
 Macrotech 286/Z80H in place of 85/88 ADD ..... 779  
 RAM 22™ — \$995, RAM 23™-128 — \$555, Disk IA™ ..... \$459  
 I/O-4 — \$297, 286/287 CPU™ — \$1276, CPU 68K™ ..... \$459  
 CPU 8086™ — \$495, I/O-3 ..... 459

### MACROTECH

286/Z80H Direct Replacement for 85/88, Cash Price ..... 1095  
 512K Static RAM Board to I2MHz List \$2895 ..... 1975

### TELETEK

Systemmaster®, Z80A, 64K, 2-8" Single Sided Drives ..... 1695  
 Systemmaster®, Z80A, 64K, 2-8" Double Sided Drives ..... 2195  
 Two User Turbodos® System 2 Z80A Slaves 2-8" DSDD ..... 3595  
 Four User 10MB HD Turbodos System 4 slaves 1 8" ..... 4999  
 Up 255 Megabyte Hard Disk & 16 Slaves 8 or 16 Bit  
 Systemmaster II 8MHz — \$875, SBC 86 128K 8MHz ..... 1035  
 SBC 8MHz 8086, 8MHz 8087, 128K — \$1595, SBC 86/87 5MHz ..... 1195

### ALL PRICES SUBJECT TO CHANGE AND GOODS ON HAND

Thunder 186, S-100 PC trademarks of Lomas Data Products, Inc. Systemmaster registered trademark of Teletek Enterprises. CP/M, CCP/M-86 are registered trademarks of Digital Research, CCP/M 8-16, CPU 286, Interfac 3 & 4, RAM 22, RAM 23, CPU 68K, Disk IA, CPU 8086, trademarks of CompuPro a Godbout Company. Turbodos is a registered trademark of Software 2000 Inc.

When You Want The Best, Call...

# nbs inc.

## National Business Software and Supplies

| \$ + SENSE                               | SARGON II | TRIVIA                 |
|------------------------------------------|-----------|------------------------|
| MULTIMATE                                | \$295     | FLIGHT SIMULATOR \$ 30 |
| PFS FILE                                 | 84        | MULTIPLAN 125          |
| PFS REPORT                               | 80        | KNOWLEDGEMAN 329       |
| PFS WRITE                                | 84        | BANKSTREET WRITER CALL |
| dBASE II                                 | 319       | CROSSTALK 125          |
| dBASE III                                | 415       | VOLKSWRITER 169        |
| FRAMEWORK                                | 415       | PRO KEY 89             |
| WORDSTAR                                 | 229       | NORTON UTILITIES 55    |
| WORDSTAR PRO +                           | 415       | R BASE 4000 274        |
| TEAC MODEL #55-B DRIVES FOR IBM PC \$139 |           |                        |

**NEW!!! Ribbons and Printwheels  
call for prices**

... HAPPY HOLIDAYS!!! ...

**(602) 967-5681**  
 P.O. Box 3163  
 Tempe, AZ 85281

VISA

MasterCard

**Mon-Fri  
8AM-5PM**

No cash refunds—all sales final. 20% restocking fee. Add \$5 for credit card purchases. AZ residents add 6%. Prices subject to change, product subject to availability. Allow two weeks for personal/company checks to clear. All items are new with manufacturers warranty. Software not warranted for suitability of purpose. Shipping and handling add \$5 per order. Minimum order \$50.

## EVENT QUEUE

### ● DIGITAL USERS MEET

DECUS Canada Spring Symposium, L'Hotel, Toronto, Ontario, Canada. This symposium covers a variety of topics of interest to Digital computer users. Contact Jeanne McNeish, DECUS, 100 Herzbug Rd., POB 13000, Kanata, Ontario K2K 2A6, Canada, (613) 592-5111, ext. 2782. February 19-22

### ● COMMUNICATIONS FOR

EXECS—Info/Central, O'Hare Exposition Center, Chicago, IL. This show and conference on computers and communications is tailored to the needs of executives and data-processing managers. Mainframes, microcomputers, telecommunications systems, and micrographics are a few of the areas to be addressed. Contact the Show Manager, Info/Central, 999 Summer St., Stamford, CT 06905, (203) 964-8287. February 20-22

### ● COMPUTERS IN

EDUCATION—The Role of the Computer in Education 5, Arlington Park Hilton, Arlington Heights, IL. A range of topics of interest to educators will be presented. Contact Rick Nelson, Micro-Ideas, 2701 Central Rd., Glenview, IL 60025, (312) 998-5065. February 20-22

### ● BUSINESS GRAPHICS

Computer Business Graphics, Bonaventure Intercontinental Hotel, Fort Lauderdale, FL. Contact Carol Every, Frost & Sullivan Inc., 106 Fulton St., New York, NY 10038, (212) 233-1080. February 20-23

### ● COMPUTER FAIRE

The Fourth Annual IEEE Computer Faire, Huntsville, AL. Sponsored by the Institute of Electrical and Electronics Engineers Inc. For more information, contact Terry Mizell, POB 5188, Huntsville, AL 35805, (205) 532-2036. February 22-23

### ● FARM AUTOMATION

Agri-Mation, Palmer House Hotel, Chicago, IL. This conference and exposition will focus on the role of automation in agriculture. Contact the Society of Manufacturing Engineers, One SME Dr., POB 930, Dearborn, MI 48121, (313) 271-1500. February 25-28

### ● COMPUTING IN

ANESTHESIA—Computing in Anesthesia 85, The Third International Seminar, Miramar Sheraton, Santa Monica, CA. Medical and computer specialists will describe their research and use of computers in data acquisition and display, monitoring, education, database management, and knowledge-based systems. The fee is \$300. Contact the Program Chairman, Computing in Anesthesia 85, Anesthesiology Education Foundation, Federal Building, POB 24230, Los Angeles, CA 90024, (213) 825-7561. February 25-March 1

### ● AUTOMATION FOR

ELECTRONICS—Automated Design and Engineering for Electronics, Anaheim Hilton and Towers, Anaheim, CA. A conference and exposition covering the design of electronic circuitry. Contact Michael Indovina, Cahners Exposition Group, Cahners Plaza, 1350 East Touhy Ave., POB 5060, Des Plaines, IL 60018, (312) 299-9311. February 26-28

### ● BETTER DOCUMENTATION

—Writing Better Computer Software Documentation for Users, Atlanta, GA. A course to help you write clearly understood computer documentation. The fee is \$475. Contact Elaine Hadden Nicholas, Department of Continuing Education, Georgia Institute of Technology, Atlanta, GA 30332-0385, (404) 894-2547. February 26-28 ■

# INTRODUCING: THE NEW OEM STANDARD FOR IBM PC/XT COMPATIBILITY

## The ACS-1000 SuperComputer

- 1 Megabyte On-Board
- Built-In Disk Controllers
  - Up To 4 Floppies
  - SASI Hard Disk Interface
- 32 KB User Definable ROM
- Switchable: 4.77 or 8 MHZ
- Built-In Multifunction Board
  - Parallel Printer Port
  - 2 Serial Ports
  - Time-Of-Day Clock

### Seize Control of Your Hardware Destiny

If you are one of the many companies using board level microcomputers as a part of your own products, you can increase profits and improve reliability by using the ACS-1000 single board SuperComputer.

The ACS-1000 is compatible with both software and hardware designed for the IBM PC/XT. It even has the same mounting holes and the same power supply connections. The difference is that the ACS-1000 offers a much higher level of integration and — costs less than \$500 in OEM quantities.

### Save Your Expansion Slots for Expansion

Disk controllers, I/O ports and extensive memory are already built-in, simplifying production and freeing the 6 expansion slots to take on the specialized work of your process control, CAD/CAM or office automation applications. There's even a special port for a low cost piggyback modem.

### See For Yourself

For a limited time, we are offering a system evaluation kit to qualified OEM's for \$695. The 128K system includes bios, documentation, and an XT compatible power supply. To order call 214-934-8239 or write:

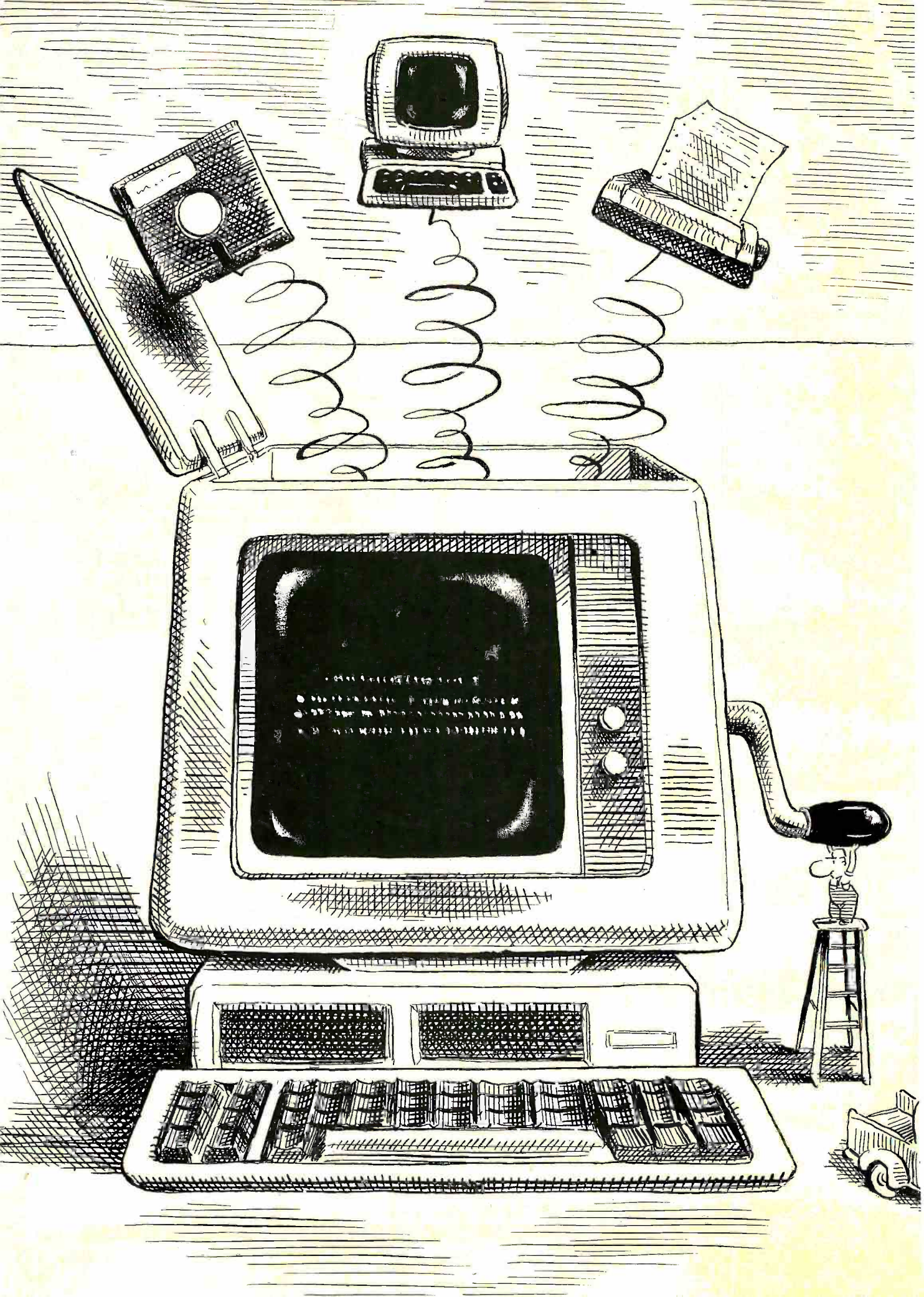
ACS International, Inc.  
13720 Midway Rd. Suite 209  
Dallas, Texas 75244



IBM, PC, XT & PC DOS are registered trademarks of IBM Co.

**ADVANCED COMPUTER SOLUTIONS  
INTERNATIONAL, INC.**

13720 MIDWAY, SUITE 209 • DALLAS, TEXAS 75244 • 214-934-8239



# Features

---

|                                                                                                  |     |
|--------------------------------------------------------------------------------------------------|-----|
| <b>THE TANDY 1000</b><br><i>by G. Michael Vose</i> .....                                         | 98  |
| <b>CIARCIA'S CIRCUIT CELLAR:<br/>BUILD THE POWER I/O SYSTEM</b><br><i>by Steve Ciarcia</i> ..... | 105 |
| <b>C-LANGUAGE DEVELOPMENT TOOLS</b><br><i>by G. Michael Vose</i> .....                           | 119 |
| <b>AN INTRODUCTION<br/>TO FIBER OPTICS, PART I</b><br><i>by Richard S. Shuford</i> .....         | 121 |
| <b>SOFTWARE FRAMEWORKS</b><br><i>by Gregg Williams</i> .....                                     | 124 |

---

BYTE'S FAVORITE STORIES concern new technology and the extension of real computing power to more and more people. This month's features include articles in both categories. The Tandy 1000 doesn't break through any technological barriers—though it does make clever use of gate arrays to handle multiple graphics modes—but this new machine provides remarkable computing power at a surprisingly low price. The price seems even better when you've tried the software that Tandy bundles with the machine. Building on the ideas in the Model 100, Tandy has provided useful and friendly applications that work well with one another and present a consistent face to the user. The Tandy 1000 will give a lot of homes the advantages of a fully functional 16-bit machine.

Steve Ciarcia writes one article each month for BYTE. Writing the article is the easy part. The hard part is inventing the device that the article will describe. This month's invention is a 64-channel power I/O system. It can extend a computer's reach into the real world, even to the point of becoming an industrial-grade, closed-loop control system. If you'd like to make some changes in the way the universe operates, Steve's power I/O control system is a good place to start.

Despite its strengths, the C programming language doesn't always make things easy for the programmer. Now that C is popping up almost everywhere, programmer's aids are beginning to appear to help those of us who haven't had access to UNIX systems for the past 10 years. Mike Vose gives us a preview of three such aids: the Safe C Compiler/Profiler, which discovers run-time errors; the Instant-C interpreter, which reduces the need to cycle through the whole process of compilation; and the C Source Debugger, which permits debugging in C instead of in machine language.

Fiber optics promises to increase communications bandwidth and transmission speeds to such a degree that the community of personal computer users in North America will come closer together even as it grows more populous. There are already some local-area networks that use fiber optics. This new technology, which encompasses the fascinating phenomenon of total internal reflection, is one that we all need to understand better. To that end, Richard Shuford offers an introduction to fiber optics.

Finally, Gregg Williams examines another approach to software development, the world of software frameworks. A software framework is a program that defines much of an application program's standard operating environment, freeing the programmer to concentrate on the application. The result should be increased programmer productivity. Gregg takes a close look at the software framework embodied in Apple's Toolkit/32.

—Phil Lemmons, Editor in Chief

P·R·O·D·U·C·T  
D·E·S·C·R·I·P·T·I·O·N



*An  
IBM PC-compatible  
with a PCjr price*



BY G. MICHAEL VOSE

# THE TANDY 1000

*Editor's note: The following is a BYTE product description. It is not a review. We provide an advance look at this new product because we feel it is significant. We plan to provide a complete review in a subsequent issue.*

THE TANDY 1000, Tandy Corporation's latest addition to its Advanced Technology Series (ATS), is fully compatible with the IBM Personal Computer (PC) and has a price (\$1358.95) comparable to that of the IBM PCjr. In its minimum configuration of 128K bytes of memory, single 360K-byte disk drive, and monochrome monitor, the Tandy 1000 will run Flight Simulator and most other IBM PC and PCjr software.

The price of upgrading the Tandy 1000's memory and storage capacity is in keeping with a low-cost philosophy. Adding color involves simply attaching a color monitor; both monochrome- and color-monitor adapters are standard, as are many other features. The price of the Tandy 1000 includes MS-DOS 2.11, GW-BASIC, and a new integrated software package called DeskMate.

## THE LINEUP

The Tandy 1000 (the word "Model" and the moniker "TRS-80" will no longer appear in the names of Tandy computers) carries a base price (without monochrome monitor) of \$1199. This price includes a keyboard that is identical to the Tandy 2000's; a system unit containing an Intel 8088 microprocessor that runs at 4.77 MHz; 128K bytes of RAM (random-access read/write memory); monochrome- and color-monitor adapters; a television interface, which requires a separate RF (radio frequency) adapter; a double-sided double-density 5¼-inch disk drive (360K-byte capacity); a three-voice sound generator; a built-in speaker and audio output jack; a parallel printer adapter; twin joystick ports; a PCjr-compatible light-pen interface; and three expansion slots that accept Tandy or other maker's IBM PC expansion boards (as long as they are 10 inches or less in length). A dealer-installed second disk drive costs \$299.95; user-installable options include a 128K-byte memory-expansion board with DMA (direct memory access) for \$299.95; a 300-bit-per-second internal modem for \$179.95; an RS-232C interface for \$99.95; and the TRS-80 Touch Pad for \$59.95. ATS monitors sell for \$159.95 (monochrome) and \$549.95 (color). Table 1 is a feature/price comparison of the Tandy 1000, the IBM PC and PCjr, and the Sanyo MBC-550.

## THE TANDY APPROACH

The technology behind the Tandy 1000 breaks little new ground. The machine's engineering goals were low cost and IBM PC compatibility. To achieve these goals, some trade-offs and innovations were necessary.

The trade-offs involved making RS-232C circuitry optional and providing DMA circuitry only above 128K bytes of memory. Eliminating DMA hardware (hardware that enables direct transfer of data within memory or to and from peripherals, bypassing the microprocessor) from the circuitry on the Tandy 1000's motherboard (see photo 2) saves money at a minimal sacrifice in performance, particularly since DMA becomes crucial primarily for memory-hungry applications. Similarly, RS-232C circuitry is no longer essential in a world dominated by parallel *(continued)*

G. Michael Vose is a BYTE senior technical editor. He can be contacted at POB 372, Hancock, NH 03449.

printers and internal modems—it now falls into the category of special equipment.

The Tandy 1000's major innovation is a video-circuit redesign, which lowers costs and provides compatibility with the IBM PC and PCjr (see "Tandy Talks About the 1000" on page 103).

### THE VIDEO CIRCUITRY

The engineering design of the Tandy 1000 incorporates a revamped video circuit that combines the techniques used to build the circuitry in the PC and PCjr. This design provides compatibility with both IBM machines but overcomes the inherent speed deficiencies of the PCjr video-circuit design. This is accomplished by a video gate array integrated circuit (IC) that works in conjunction with a Motorola 6845 CRT (cathode-ray tube) controller. The video gate array helped Tandy reduce costs by replacing a number of other ICs.

The video subsystem works in either color or monochrome mode. It drives either a monitor or, with an added RF modulator, a standard television set.

In alphanumeric mode, the video circuit displays characters in 80 or 40 columns by 25 rows. Sixteen foreground and background colors are available, except with character blinking, which reduces available background colors to eight.

In graphics mode, low resolution provides 16 colors and 160 by 200 pixels, medium resolution provides 4 colors and 320 by 200 pixels, and high resolution offers 2 colors and 640 by 200 pixels.

Like the PCjr's, the video subsystem of the 1000 shares RAM with the central processing unit. In the PCjr, this memory sharing requires that the central processor sit idle for as many as two out of every three microprocessor clock cycles. The Tandy 1000 design shares central-processor time more efficiently and seldom idles the microprocessor for more than a single clock cycle. The result is a faster display update rate, comparable to that of the PC, without sacrificing PCjr compatibility.

The custom video array in the Tandy 1000 also contains a 2K-byte ROM (read-only memory) character generator similar to the PC's. While many of the video's functions are susceptible to software control, this code is displayable only and cannot be read or written to by software.

### IBM PC COMPATIBILITY

The Tandy 1000 is compatible with the IBM PC, with some exceptions, most of which will be important to system programmers but not to users. Some of these exceptions have been taken care of by the 1000's BIOS (basic input/output system), licensed from Phoenix Software (Norwood, Massachusetts), a purveyor of PC-compatible BIOS software.

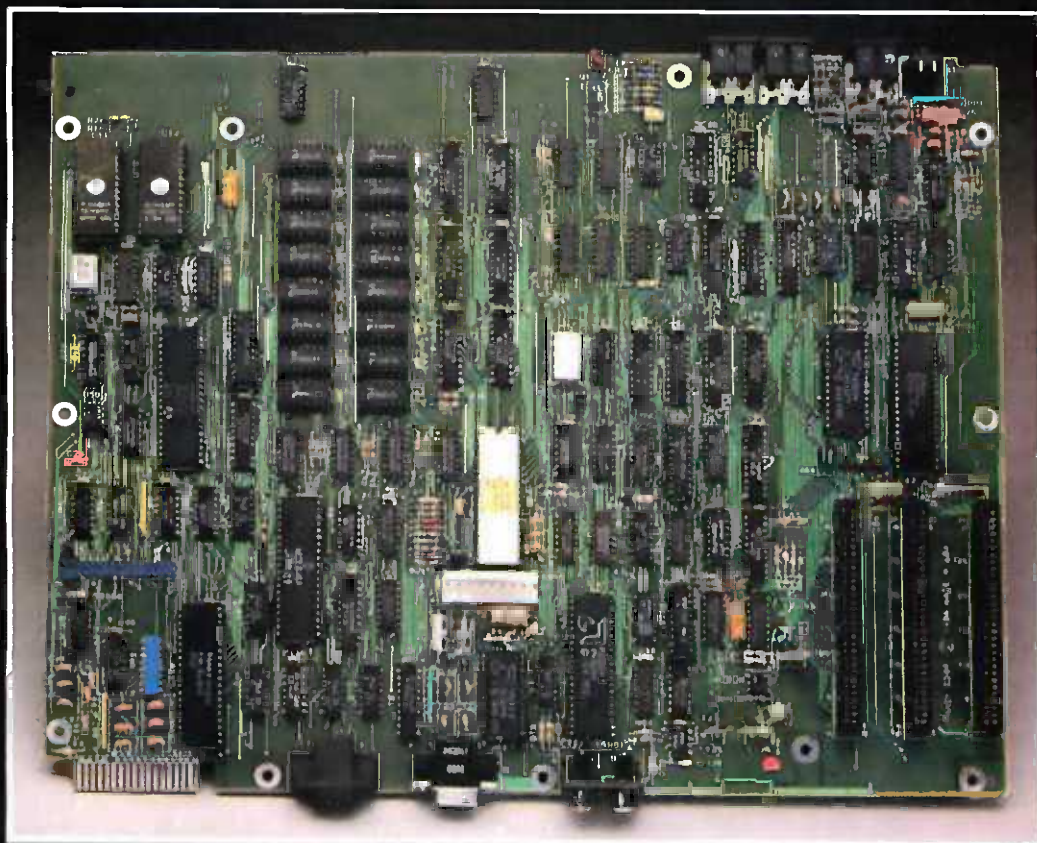
The Tandy 1000 keyboard, for example, is identical to that of the Tandy 2000. (See the product description "The Tandy TRS-80 Model 2000: A Powerful New MS-DOS Machine" on page 306 of the March BYTE; also see the system review "The Tandy Model 2000" on page 239 in this issue.) This keyboard produces scan codes at the hardware-interrupt level that are different from IBM's. Therefore, PC software that accesses keyboard ports directly will not function on the Tandy 1000. At the BIOS level, however, Tandy's ASCII (American Standard Code for Information Interchange) and extended ASCII codes are the same as those the PC generates, with a few exceptions; since the 1000/2000 keyboard has 90 keys, it generates all 83 PC scan codes plus a few of its own.

Because the Tandy 1000's video circuitry is substantially different from that of the IBM PC, software written for the monochrome adapter on the PC requires modification to run on the 1000. The underline attribute, for example, is not available for the monochrome monitor.

Like the PCjr, the Tandy 1000 uses 16K to 32K bytes of RAM for video memory, while the IBM PC stores video memory on the monochrome or color/graphics adapter board. And while BASIC resides in ROM in the PC, it is fully memory-resident in the 1000. Thus, the Tandy 1000 has less available RAM and will require more memory than the PC to run some PC applications.

As mentioned before, the Tandy 1000 gains DMA capability with the addition of the 128K-byte memory-expansion option. Therefore, applications that require DMA, such as serial communication or programs that require direct access to the floppy-disk controller, will require this memory upgrade.

IBM provides hardware switches that must be set to configure the PC for memory size and other functions. Such switches are absent from the Tandy 1000, which has ROM routines that determine the system's configuration on (continued)



The two screens  
at top display DeskMate, Tandy's integrated  
package that includes six software applications.  
The bottom photo shows the motherboard  
of the Tandy 1000.

boot-up and store this data in locations known to the BIOS. Software that reads IBM's switches rather than using BIOS calls for this purpose will require modification.

The Tandy 1000 joysticks are software-compatible with the PC (even though they remain hardware-compatible with the TRS-80 Color Computer). However, PC joystick programs may require a software timer and therefore may not run without modification on the 1000.

Some chip port addresses map into more than one memory location on the IBM PC. There are no dual mapped ports on the Tandy 1000. To run successfully on the 1000, software should address ports as documented in the IBM technical reference manual.

The Tandy 1000 is as compatible with the PCjr as it is with the PC. The major incompatibilities are similar to the PC incompatibilities listed earlier. Another difference is that the 1000 has no cassette interface. While not a compatibility issue, the 1000's sound-chip signal is available to both the internal speaker and the external audio jack, which means that sound-generating PCjr software can run without needing an external speaker.

Interestingly, the Tandy 1000 is less compatible with its larger brother, the Tandy 2000, than it is with the IBM PC. Put another way, the Tandy 1000 and the IBM PC are compatible with the Tandy 2000 in the same way; that is, the 2000 can read and write to Tandy 1000 disks, but the 1000 cannot use Tandy 2000 disks (nor can the IBM PC). The key to software compatibility at this level is the use of MS-DOS function calls.

## SOFTWARE

Since it is an IBM PC-compatible computer, the Tandy 1000 uses MS-DOS (version 2.11) for its operating system. Tandy indicated it plans to offer its own versions of approximately 40 initial software packages for the 1000, including Lotus 1-2-3, Multiplan, Microsoft Word, DR Graph, Friday!, the PFS family, Finance Manager, and accounting and communications software.

Because the Tandy 1000 will not read Tandy 2000 disks, 2000 software will not run as is on the 1000. IBM PC programs will run, but with the exceptions noted earlier. In addition, the 1000 runs Microsoft's GW-BASIC and applications written in it, although it will not run PC-BASIC, a superset of GW-BASIC. Several educational packages are being readied for the 1000, many of which will be available by Christmas, including Facemaker, Kindercomp, and Alphabet Zoo.

The most popular software offering for the Tandy 1000, however, may prove to be DeskMate, an integrated software package that comes bundled with it. This package provides six main applications, including text editing, spreadsheet, file management, communications, calendar, and electronic mail, in a single system patterned after the TRS-80 Model 100's built-in software. DeskMate also provides several functions that are available at any time—even within its main applications—including help, a four-function calculator, an alarm keyed to the calendar, auto-dialing of any phone number in any file, printer formatting, and access to the system date.

DeskMate is an introduction to productivity software, envisioned as an offering that will provide usable software without additional expense. As such, the individual applications do not provide the same functionality as stand-alone products. The spreadsheet, for example, offers only 99 rows by 99 columns. Written partly in C and partly in assembly language, DeskMate provides what might be described as "executive-level" performance. Tandy apparently expects users who require high-powered applications to purchase those separately.

The design of DeskMate emphasizes integration and simplicity. A central display area lets you share files among applications (see photo 1). Also, the applications make heavy use of the 1000's function keys, and they use the same keys for similar functions, regardless of the application.

The DeskMate text editor offers standard insert/delete/overtyping functions plus rudimentary block operations, including block move and block delete. You can merge files, but the editor limits the formatting of files to control of the left and right margin size, page size, and a choice of single- or double-spacing of lines.

The DeskMate spreadsheet provides average, summation, maximum and minimum value, and transcendental functions. You can specify portions of the spreadsheet as text, within which you can use text-editing functions. Format commands provide integer, dollar, and decimal formats plus right and left justification. You can embed an input request in a spreadsheet cell using a question mark followed by a prompt string so that during a subsequent calculation, the pro- (continued)

**A**t Tandy Corporation headquarters in Fort Worth, Texas, we spoke with people involved with the Tandy 1000 project, including John Patterson, vice president for research and development; Bill Wilson, director of computer development; Dale Chattam, manager of computer design; and Ed Juge, director of computer marketing.

**BYTE:** *What did your engineering team do to enable you to build, essentially, an IBM PC and sell it for substantially less than IBM does?*

**TANDY:** First of all, we started off with very strict goals for costing. Our target price was lower than we wound up at but, as with most projects, we kept adding features and ended up with a little higher price point. We are also friends with the designers of the Color Computer and they have a technology of low-cost design that's evolved over time. Beyond that, frankly, we borrowed some ideas from IBM. We took a look at the PCjr and the PC, and it turned out that there's not a lot of difference in the cost of the electronics between the PC and the PCjr. We basically took the best features of both products, from a cost standpoint. We also have all of our logic circuitry on one board, compared to the PCjr, which has a main logic board, a memory board, and a floppy board. The PC has a main logic board, a floppy board, and a video board. Going to one board as opposed to three was a major cost advantage.

**BYTE:** *Was the decision to leave DMA off the main CPU board done for cost reasons?*

**TANDY:** Sure. We felt that most 128K-byte programs would be PCjr-type programs, and the PCjr didn't have the DMA. It's only when you are running a certain class of program—programs that need 256K bytes of memory, the real PC programs—that you need DMA. So you only pay for it when you need it.

**BYTE:** *That's a clever idea.*

**TANDY:** It's actually a straightforward thing to do, we'd just never done it before. We don't know if anyone else has or not.

**BYTE:** *Another design decision that you made to save money was to offer RS-232 circuitry as a separate optional board.*

**TANDY:** That was a trade-off. The choice there was to go with the parallel interface for the printer as opposed to RS-232, since all of our printers are parallel printers. People that are using an RS-232 are basically going to be using a modem, and these days modems are less often something you buy and plug into an

# TANDY TALKS ABOUT THE 1000

RS-232 port—they tend to be built in and so forth. So the decision not to build in an RS-232 was a matter of volume for the machine, not a technical problem.

**BYTE:** *Is there anything else that you've done from an engineering standpoint that contributes to your ability to make this machine at a significantly lower cost?*

**TANDY:** Well, for one thing, the project started off with the concept that we had to design some custom parts in order to make it acceptable from a cost standpoint. The video circuit that we designed, for example, is a custom part. You get an awful lot of function out of it for low cost. We designed another custom part for the printer interface. We took about a dozen ICs [integrated circuits] and rolled them into one small custom IC. We've also been aggressive about forecasting high volumes and going after our vendors to buy the parts at the right price.

**BYTE:** *Are you dealing with any major component shortages?*

**TANDY:** As a matter of fact, we've seen a recent turnaround. Availability is improving on memory parts and on some of the 8088-series parts. We've seen some better pricing in the last month or two. The whole industry appears to be loosening up a bit.

**BYTE:** *Is this machine built so that you can take advantage of economies of scale, and perhaps drop the price if you have to, to stay competitive?*

**TANDY:** We would never have designed a computer without that in mind. If you do, you're just not going to be in business for long. On the other hand, there's nothing outrageously unusual done to accomplish that. For example, we are taking more and more advantage of custom circuit design, which is the way the industry is going. We're pursuing an aggressive cost-reduction program on this machine already, as well as on our Tandy 2000, so that we'll have the option to do what we want to in the future.

**BYTE:** *Compare the 1000 to the IBM PC and PCjr for us. What's different?*

**TANDY:** Well, the video circuitry, for one thing. That design is the heart of the machine. We managed to overcome some of the problems the PCjr has. The basic architecture of the two machines is the same, but the implementation is different.

IBM advertises in its manual, for example, that the PCjr has two wait states on the memory accesses. But by our measurements, it is more on the order of six wait states. We wound up with between

one and two wait states. We basically had a chance to take their approach, see the flaws in it, and reengineer it. You can always reengineer something and do a better job. So our machine is quite compatible with the PC, and yet it is more like the PCjr in terms of the architecture.

**BYTE:** *Did your design both increase speed and decrease cost?*

**TANDY:** Well, it decreased cost over the PC and increased the speed over the PCjr. The architecture conceptually is similar to the PCjr in the way the video's set up. Basically, they need to do two video accesses in a fixed period of time, 1.1 microseconds. We went in and designed the memory circuitry just a little bit tighter to provide for four accesses in that same time frame. What we did was to give the video every other access and the CPU every other access so that now you get the CPU in there twice during the same time period. Thus the average wait to get to the CPU memory goes down from a maximum of 1.1 microseconds to half of that.

We ran some benchmarks and found that a BASIC program running out of ROM on the PCjr is slower than the same program running entirely out of video memory on the 1000. In fact, the PC was benchmarked at 24 seconds, the 1000 was benchmarked at 23 seconds, and the PCjr was benchmarked at 29 running out of its ROM BASIC. So we think we're comparable in speed to the PC.

**BYTE:** *Was that with or without DMA?*

**TANDY:** That was without it. Now, when we added the extra memory in, that increased our speed and we were benchmarked at 21 seconds. So with 256K bytes of memory or more, I think we may run slightly faster than the PC. The PC, as you may know, has one fixed wait state in every memory access. They designed that several years ago when memory parts weren't quite as fast as they are today.

**BYTE:** *Is there anything else about the Tandy 1000 that makes it technologically different from the PC?*

**TANDY:** Well, since we were after compatibility, we didn't get a lot of freedom. We do have the Tandy 2000 keyboard, which is a very good keyboard, technologically—we put a lot of money into it to make it better. There are also a few minor improvements in the video. For example, in text mode, our video gives you slightly better separation between lines and characters. That's a minor thing, but it will make the text more readable on

the color monitor. We also have more colors than the PC does, 4 colors in the 640 by 200 resolution mode and 16 colors in 320 by 200. We did leave out the hires, hi-dot-rate mode, however.

We think we did a slightly more clever design in how we took advantage of the memory circuits and so forth. Also, there were some limitations on the PCjr that there was no reason for. But then, we didn't have to worry about knocking off one of our other machines when we designed the 1000, so we didn't put any restrictions on it. Still, if somebody is going to knock off your machine, it's probably better to do it yourself than to have somebody else do it. IBM apparently didn't reason that way.

**BYTE:** *How hardware-compatible is the 1000 with the IBM PC?*

**TANDY:** If there are expansion cards, for example, that are compatible with the IBM PC, and they are not over 10 inches long, they can be plugged into the 1000.

**BYTE:** *Including IBM PC serial cards?*

**TANDY:** We have tested IBM serial cards, in fact, the card we are going to offer is basically 100 percent PC-compatible. Of course, the cards we offer would also plug into an IBM if anyone wanted to buy them for that purpose.

**BYTE:** *Did you consider a higher clock speed for the CPU board to give you a performance advantage over the PC?*

**TANDY:** That's a compatibility issue, too. To get the maximum compatibility, you have to run at the same clock speed. The 2000 is our high-performance system. If people want high performance, that's what they ought to be buying. With the 1000, we've been trying to get equivalent performance. There's another complicated issue here. Our video timing and our CPU timing is tightly interwoven in order to share memory. So even if you were to run the CPU faster, you wouldn't be able to take full advantage of that higher clock speed. It would probably be a lot more difficult to design it that way, also.

**BYTE:** *Did what you learned in building the 2000 contribute significantly to the 1000's design? Namely, did you save any money?*

**TANDY:** The design methodology of the 2000 helped us determine how to set up the program, how to staff it, how long it would take to get the design done, and some things about working with custom-IC vendors. But the two designs are not architecturally very similar. The 2000 uses a lot of new technology.

| <b>PRICES</b>       |                  |                  |                  |                  |
|---------------------|------------------|------------------|------------------|------------------|
|                     | Tandy 1000       | IBM PC           | IBM PCjr         | Sanyo MBC-550    |
| Base unit           | \$1199.00        | \$1995.00        | \$999.00         | \$999.00         |
| 128K-byte expansion | \$299.95         |                  | \$325.00         | \$240.00         |
| Color adapter       | standard         | \$244.00         | standard         | standard         |
| Parallel port       | standard         | \$75.00          | \$99.00          | standard         |
| Serial port         | \$99.95          | \$100.00         | \$45.00*         | \$100.00         |
| MS-DOS              | standard         | \$65.00          | \$65.00          | standard         |
| BASIC               | standard         | standard         | \$75.00          | standard         |
| Power adapter       |                  |                  | \$150.00         |                  |
| <b>Total</b>        | <b>\$1598.90</b> | <b>\$2479.00</b> | <b>\$1758.00</b> | <b>\$1339.00</b> |
| <b>FEATURES</b>     |                  |                  |                  |                  |
| Monochrome graphics | standard         | optional         | standard         | standard         |
| Color graphics      | standard         | optional         | standard         | standard         |
| DOS                 | standard         | optional         | optional         | standard         |
| BASIC               | standard         | standard**       | standard**       | standard         |
| Bundled software    | one***           | none             | none             | six              |
| Expansion slots     | three            | five             | none             | none             |
| Hard disk           | optional         | optional         | none             | optional         |
| Parallel port       | standard         | optional         | optional         | standard         |
| Serial port         | optional         | optional         | optional*        | optional         |

\* The PCjr's serial port requires a \$45 adapter cable.  
 \*\* IBM's standard BASIC is in ROM and cannot write to disk.  
 \*\*\* The Tandy 1000's one bundled software package includes six applications.

*Table 1: A comparison of the prices and features of the Tandy 1000 with the IBM PC, the IBM PCjr, and the PC-compatible Sanyo MBC-550. The base prices include a system unit with 128K bytes of RAM (except the IBM PC, which comes with 256K bytes of RAM) and a single 360K-byte disk drive. Note that the IBM PCjr requires a power-supply adapter if both the 128K-byte memory expansion and the parallel port are installed.*

gram will wait for data input before proceeding.

The list manager, called the Filer, is a screen-oriented database manager, at least in terms of forms creation. You title fields within the first 20 characters of a screen line and can use the rest of the line for the data portion of the field. You can add more lines, up to a maximum of 255 characters per field. The total number of single-line fields (or fields plus extra lines within fields) is 21. You can also specify the field for automatic sorting of the file so that when new records are added, they are inserted in proper sort order.

You can display or print the data in a Filer data file in horizontal format, showing only part of each record, according to any criteria specified by the Find command's parameters. You can copy data from a Filer data file into a text file.

Electronic mail capability lets you create messages for transmission to other DeskMate machines by the Telecom application.

## CONCLUSIONS

The DeskMate software adds sufficient value to the Tandy 1000 to make the computer a significant offering, regardless of configuration. The PC clones have not come bundled with software except in a few cases, such as the Seequa Chameleon or the Sanyo MBC-550. This software generally is an amalgam of moderately successful programs from years past. An integrated application designed for limited workstation-like tasks seems a better approach than giving away full-blown applications to a buyer who probably prefers to choose his own word-processing or spreadsheet software.

In appearance and feel the Tandy 1000 closely approximates its larger brother, the Tandy Model 2000, but it is not identical to the previously announced PC/XT-like Tandy 1200 (see page 42 of the What's New section in the November BYTE). Like most IBM pretenders, the Tandy 1000 is not 100 percent compatible; however, it appears to be as close as any other compatible, plus it offers more PCjr compatibility than even a PC.

Since Tandy tightly controls the making of its computers, it should be able to respond to future IBM price drops for the PC series. Tandy's electronics line is diversified enough to guarantee that the company will be around to provide service for its products—a consideration not to be overlooked. ■

# BUILD THE POWER I/O SYSTEM

BY STEVE CIARCIA

*Controlling the power to the real world  
with your computer*



If you've been reading the Circuit Cellar for any period of time, you've probably noticed that I have a definite prejudice toward computer control. You'll never read about the merits of various DOS (disk operating system) utilities in a Circuit Cellar project, but it is conceivable that you'll come across a computerized, time-of-day-activated dog feeder.

Seriously, though, over the years I've presented a variety of sensors, monitors, and controllers that could turn your computer from a mild-mannered games machine into the HAL 9000 of the neighborhood. These capabilities, be they menacing or beneficial, are directly the result of making the computer aware of the real world.

I define "real world" as conditions that occur external to the computer. A 100-watt table lamp next to your computer is in the real world. The computer is unaware of the lamp's presence because the computer is not connected to the real world. Unless something happens within the address and memory space of the computer, however, it is unaware that anything else exists.

To remedy this condition of ignorance, we must construct an interface that allows the computer to recognize the occurrence of real-world activities and respond according-

ly. This real-world interface is a translational device of sorts: the computer sees it as simply another addressable peripheral device, such as a cassette recorder or printer, yet the information communicated comes from the real world or is directed to the control of real-world events, such as turning on the lamp.

In the case of the lamp, the appropriate control element would be an electronic substitute for the mechanical switch to turn the light on and off. However, is the light really on? Of course we can see it, but, unless we provide additional sensing capability, the computer knows only that it has turned the light on, not that it is on.

Additional real-world conditions must be monitored to know this with certainty. One way is to physically read the 115 volts (V) AC applied to the bulb or monitor a thermostatic sensor attached to the bulb.

All this might sound absurd, but that is because we take for granted that it is easy to turn a light on and see that it is in fact on. In critical control situations, more than simple on/off activation is required. Fre-

*(continued)*

Steve Ciarcia (pronounced "see-ARE-see-ah") is an electronics engineer and computer consultant with experience in process control, digital design, nuclear instrumentation, and product development. He is the author of several books about electronics. You can write to him at POB 582, Glastonbury, CT 06033.

quently, as in industrial applications, both the actions and the results must be monitored to produce reliable control conditions. (Open-loop control systems such as the BSR X-10 are generally unsuitable for industrial applications.)

One of the prime components of any real-world interface is discrete-bit AC/DC power input and output, which is on/off control and monitoring of

115-V AC or 5- to 48-V DC devices. With an AC/DC power I/O (input/output) interface, we can control and monitor motors, lights, high-voltage AC systems, and process-control and monitoring devices.

This month's project is a discussion of the design and construction of an AC/DC power I/O (power I/O hereafter) interface with particular emphasis on the internal configuration of the solid-

state relays (SSRs) and receivers. The emphasis is on an industrial quality-control interface that meets the needs of both the experimenter and the industrialist. Beyond the homebrew relays and receivers that you can build, I'll describe a true closed-loop power I/O control system using the Circuit Cellar Z8-based computer system (which I've described and used numerous times) and commercially available components.

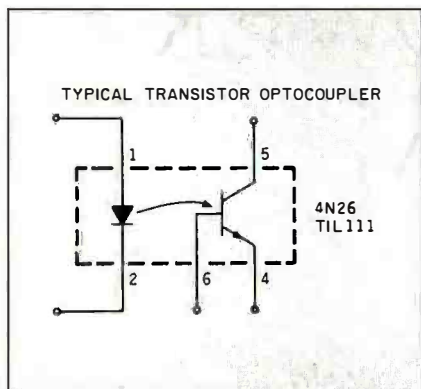


Figure 1: A typical transistor optocoupler.

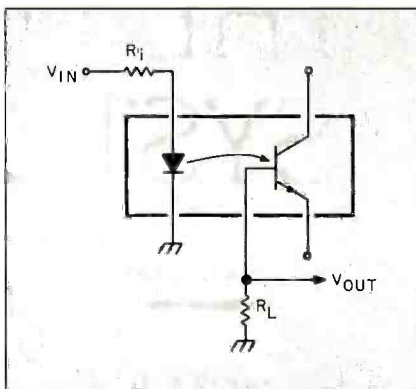


Figure 2: Figure 1 used as a high-speed diode-diode optocoupler.

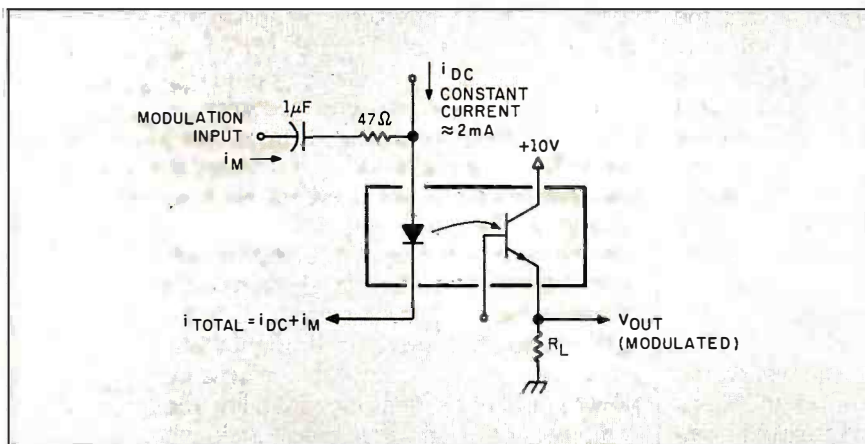


Figure 3: Figure 1 used as an analog-signal optocoupler.

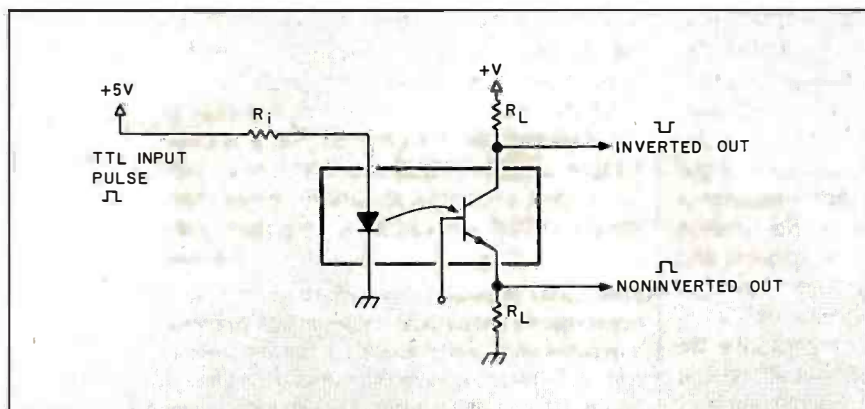


Figure 4: Figure 1 used as a digital-signal optocoupler.

## A DISCRETE-BIT INTERFACE

Generally speaking, most computers are parallel in function. If you are using an Apple II or IBM PC, communication between the processor and its peripheral devices is handled 8 bits at a time presented in parallel. A parallel printer, for example, receives its character data as a 7- or 8-bit parallel word and sends its status and operating conditions back in a similar manner.

Most peripheral devices use all 8 bits at a time because they are most often communicating 8-bit data or ASCII (American Standard Code for Information Interchange) characters. Externally connected devices such as a light and a thermostatically controlled switch are single-bit devices. However, since the internal function of the computer is word rather than bit wide, each bit of the 8-bit word is used to separately receive or control an external event. If it were a 16-bit computer such as the 68000, each word would have 16 discrete bits of I/O.

Within the computer, one or more memory locations (or I/O port locations if it's a Z80 or 8080) are set aside and the addresses decoded as parallel I/O ports. If configured for output, each bit in a port is then connected to a discrete module that converts the TTL (transistor-transistor logic) level presented to it to a high/low, on/off voltage-level output. If the module is for AC control, it will convert a TTL high to 115 V AC and a TTL low to 0 V AC. DC output modules function as simple contact closures with the voltages dependent upon your proposed application.

When the addressed location is an input port, each bit is attached to an input receiver that converts a high-voltage input level to a TTL logic 1 and a low-voltage input level to a logic 0. The exact range and switch point



of the module have to be selected for the application, and there are differences depending on whether the applied voltage is AC or DC.

With a single parallel I/O location (port), eight separate devices can be controlled and eight discrete events monitored. To properly coordinate the activity, bit rather than word manipulation becomes essential.

The I/O modules provide level conversion and isolation between the computer and the external device. Depending upon the components employed, I/O interfacing need not be a prodigious task.

### ISOLATION IS THE KEY

The most important factor in I/O interfacing, especially with AC line voltages, is isolation. The computer you are using most likely operates on 5 V. If 115 V AC is applied to an unisolated input port, you are definitely going to produce smoke! High-voltage inputs must be safely converted to 5 V, and output devices must have no way to inadvertently

feed 115 V AC back into the computer.

The simplest isolation device is the electromechanical relay. You can easily attach a reed relay to each output bit and the isolated contacts used to switch the AC line. Similarly, you can connect the external voltage to a relay whose contacts are attached to an input bit. When the input level is high enough (determined by series

resistors), the contacts close and the computer senses the condition.

There is nothing wrong with using relays. For many years, this was the only method available, and it still works, to a point. However, relays are large, expensive, slow, electrically noisy, and subject to wear. They have been replaced with solid-state optoelectronic components that are small,

(continued)

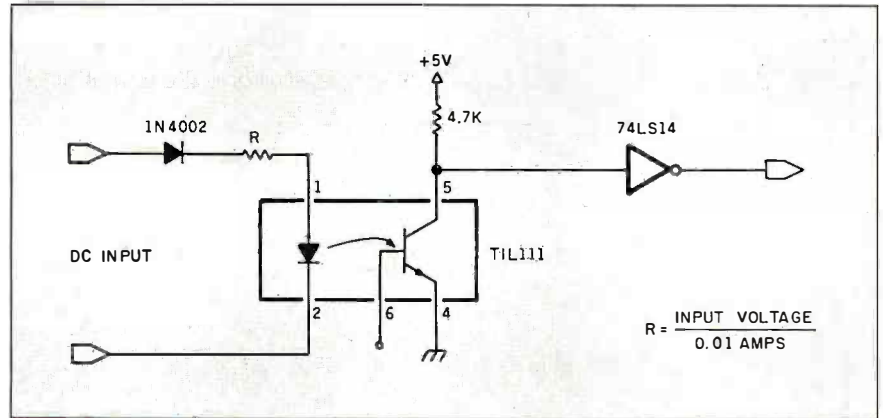


Figure 5: A DC input receiver.

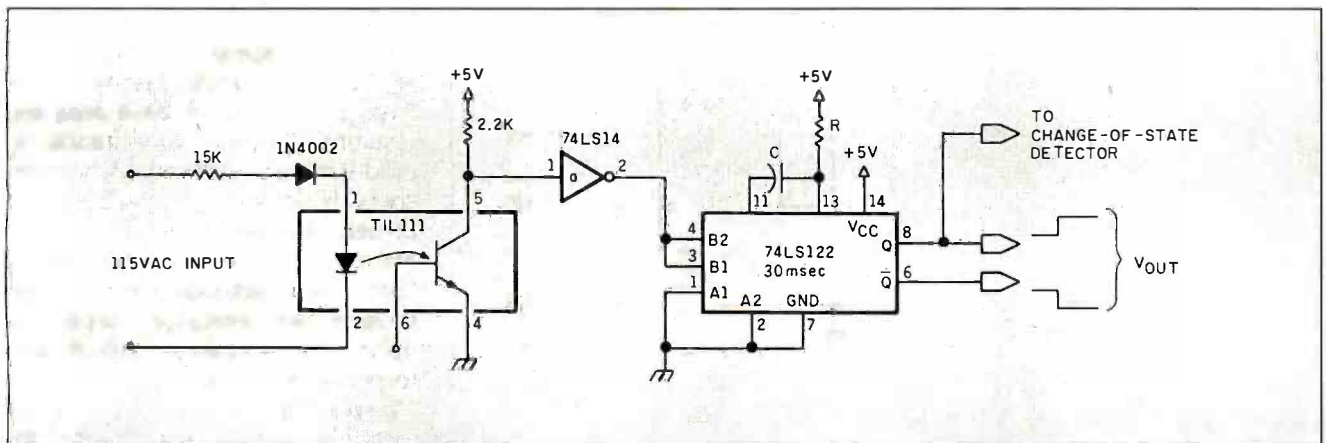


Figure 6: A half-wave AC input receiver with constant-level output.

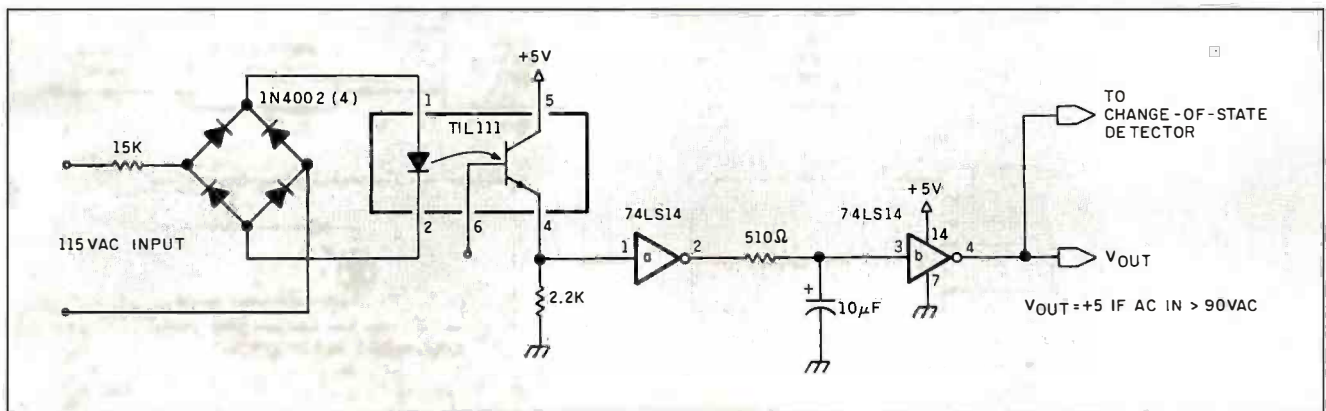


Figure 7: A full-wave AC input receiver with constant-level output.

Generally speaking, optocouplers are not tremendously fast due to the large photosensitive base area and the resulting junction capacitance.

inexpensive, fast, optionally noiseless, and have no wear in proper use.

### INSIDE AN OPTOCOUPLER

The essential ingredient in this project is the optoisolator and its use as an I/O control device for AC and DC voltages. With it, we can configure high-performance solid-state relays and solid-state input receivers. The exact configuration, as I will explain, depends upon the application and the excitation source.

The simplest and most frequently used optoisolator is the transistor op-

tocoupler. It consists of a GaAs (gallium arsenide) infrared LED (light-emitting diode) and a silicon NPN phototransistor separated by a glass partition. The thickness of the glass determines the isolation level of the component. A typical isolation value is 1500 V. This means that the potential difference between the input and output sides of the optocoupler must be less than 1500 V, or it will break down and expose the computer to hazardous voltages. (While this seems unusually high, remember that these relays often switch inductive loads that produce high-voltage transients. Proper "snubbing" and transient suppression must be employed or these limits can be exceeded.)

Figure 1 is the typical transistor optocoupler. A current is applied to the LED, which induces a base current in the phototransistor proportional to the light radiated by the LED. This in turn allows current to flow between the collector and emitter of the transistor. A typical LED current is 10 to 50 milliamperes (mA). A 10-mA current greatly extends component life, however.

Generally speaking, optocouplers are not tremendously fast due to the large photosensitive base area and resulting junction capacitance. In solid-state-relay applications, however, speed is not an issue, and it will not present any problems for us. As a matter of education, though, various connection methods for the optocoupler are available, depending upon the excitation signal and response required.

If speed is a consideration, the optocoupler should be connected for

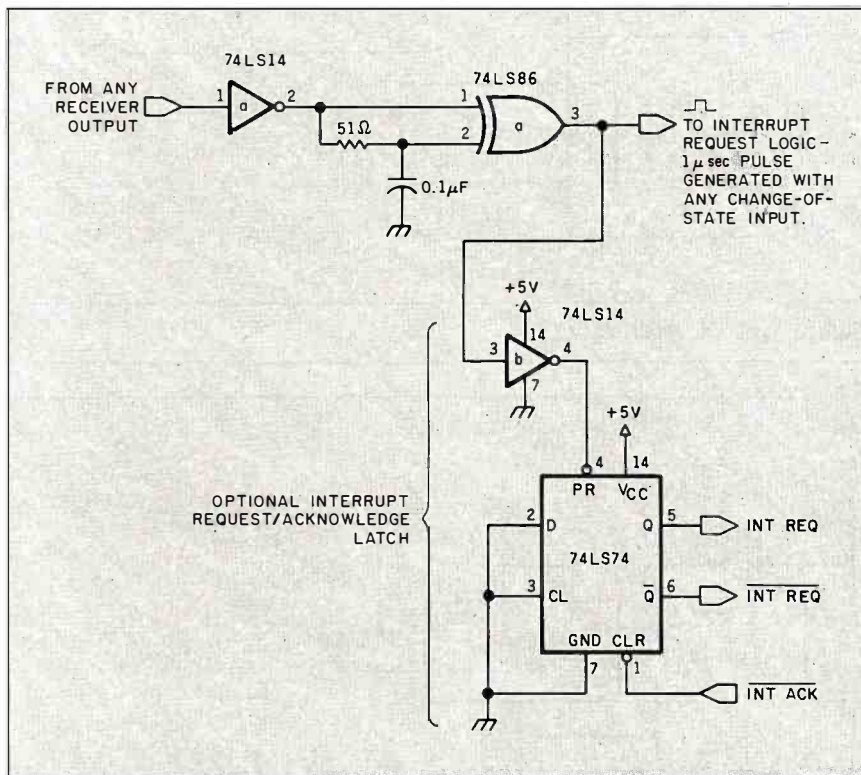


Figure 8: The change-of-state detector and interrupt-request latch.

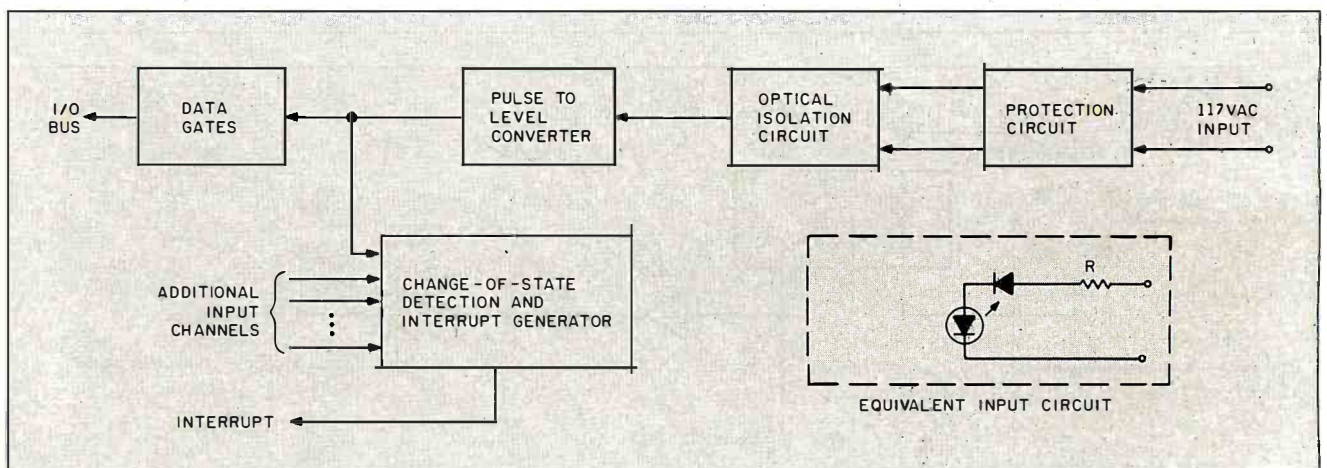


Figure 9: The block diagram of an optoisolated input circuit.

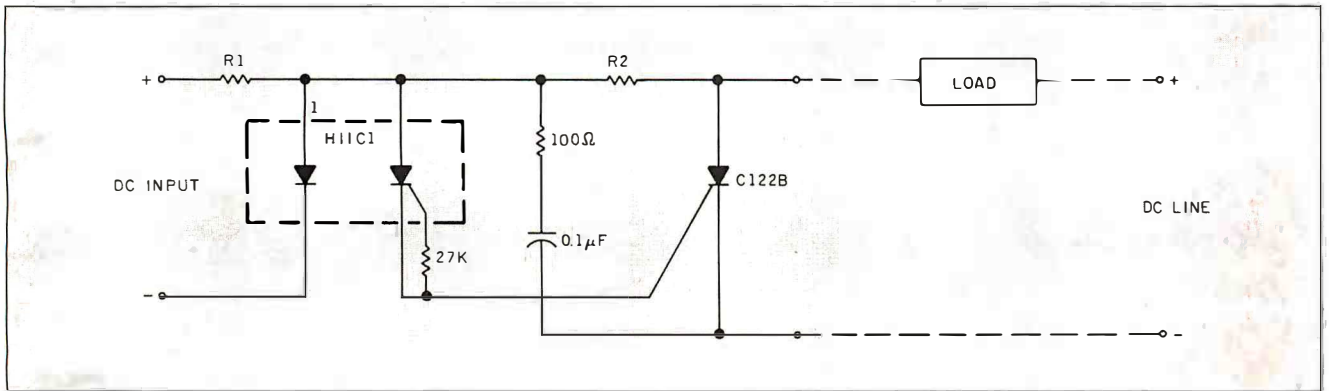


Figure 10: A simple DC output module.

Table 1: Resistor values for figure 10.

| DC INPUT VOLTAGE | R1   | R2   |
|------------------|------|------|
| 5                | 390  | 200  |
| 12               | 1.1k | 200  |
| 24               | 2.4k | 470  |
| 48               | 4.7k | 1k   |
| 120              | 12k  | 2.2k |

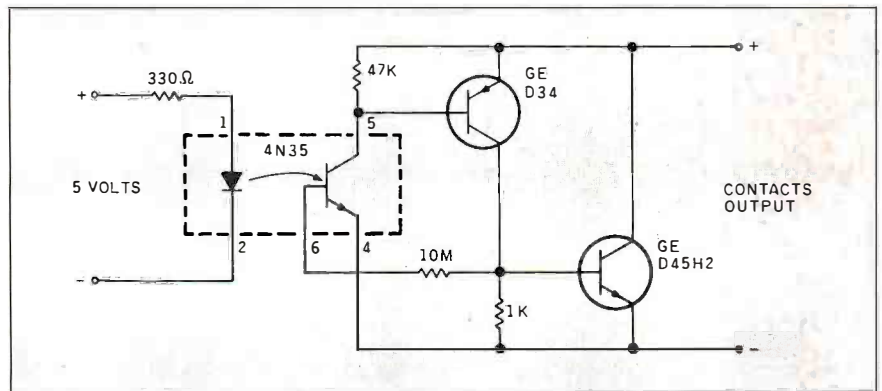


Figure 11: A normally open DC output module.

diode-diode operation, as in figure 2. The output signal is directly received at the base connection. Typical response time is 2 to 5 microseconds ( $\mu s$ ) as a diode-transistor coupler but only 50 to 100 nanoseconds as a diode-diode coupler. The one disadvantage is the much lower output current, which must be amplified.

While most experimenters think of optocouplers as digital devices, a transistor optoisolator can also be used with analog signals, as shown in figure 3. A constant bias current is applied to the LED to turn the transistor on enough to be within its linear range. Next, an analog input signal (modulation voltage) is also applied to the LED, which varies its light output proportionally to the modulated input. The emitter current in the phototransistor similarly follows this variation.

Most optocouplers are used for digital isolation, as shown in figure 4. A 10-mA LED current simply turns the transistor on or off with the inverted and noninverted responses available at the collector and emitter, respectively.

While the transistor optocoupler is the one I've chosen to describe, optocouplers are available with transistors, silicon-controlled rectifiers

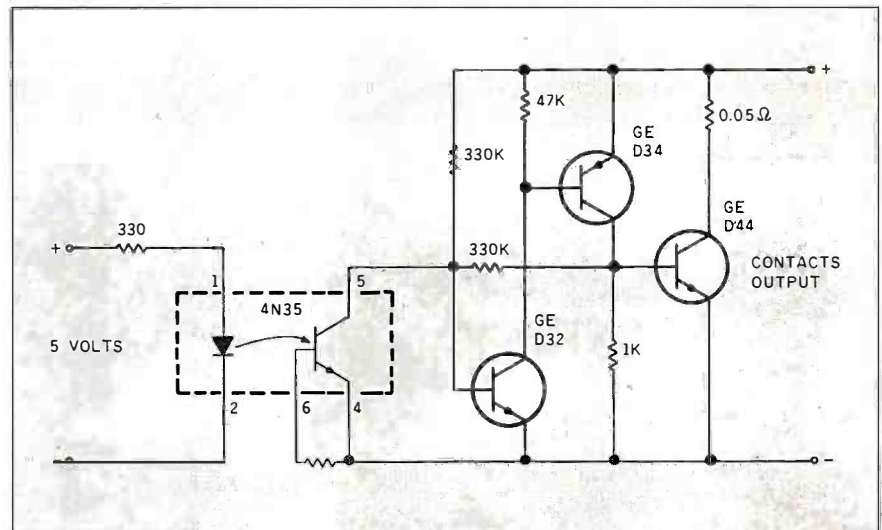


Figure 12: A normally closed DC output module.

(SCRs), and Triacs as output devices. In some applications, the latter devices are more appropriate.

### DISCRETE-INPUT AC/DC RECEIVERS

The discrete-input DC receiver is by far the easiest module to construct. As demonstrated in figure 5, it is nothing more than an LED and a cur-

rent-limiting resistor. I have added a series-blocking diode to protect the optocoupler from reverse connection and a 74LS14 Schmitt trigger to provide cleanly switched levels to the computer.

DC input receivers are generally preset as 5-, 12-, 24-, 36-, or 48-V detectors. The series-input resistor

(continued)

Due to the sinusoidal properties of the signal, acquiring AC inputs is somewhat more complicated.

sets the range, which is selected to allow a current of 10 to 20 mA through the LED at the desired DC sense point. While various input-protection methods exist, the resistor should be selected for a single high-level input rather than a range of inputs. When the input is at the desired input voltage, the output will be an LSTTL (low-power Schottky transistor-

transistor logic) logic 1; otherwise, it will be a logic 0.

Due to the sinusoidal properties of the signal, acquiring AC inputs is somewhat more complicated. Unlike relays, which are too slow to be seriously affected, optocouplers are fast enough to respond to every cycle of the input producing a pulse rather than a constant-level output. Proper reception by an even faster computer requires that these signals be integrated to an on/off steady-state level, as described in figures 6 and 7. Figure 6 is a half-wave detector that uses a 30-millisecond (ms) retriggerable one-shot; figure 7 is a full-wave detector that employs a simple RC (resistor-capacitor) circuit to integrate the pulse output. In either case, a logic 1 output signifies that a 115-V AC input is present.

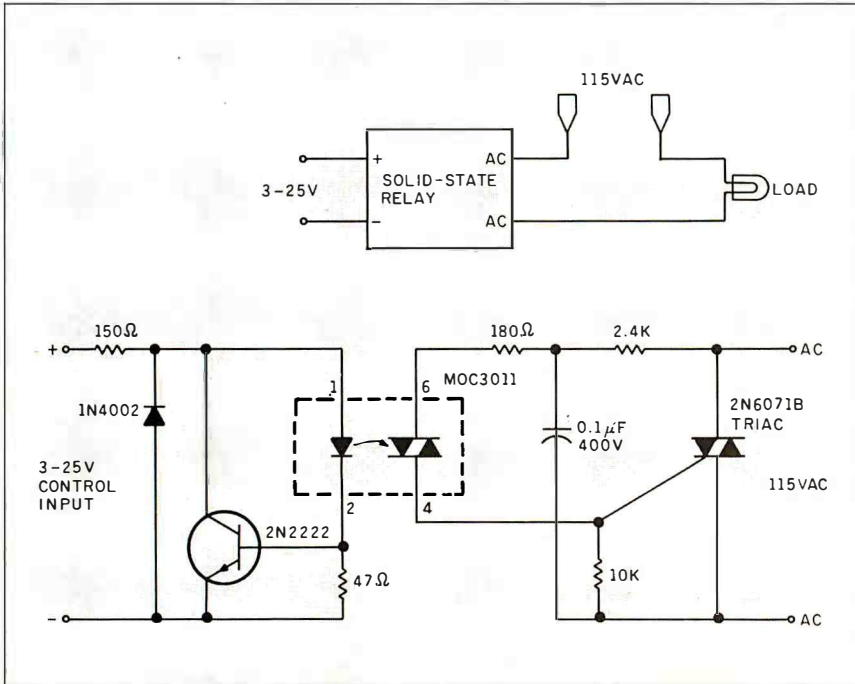


Figure 13: A discrete-component non-ZVS solid-state relay.

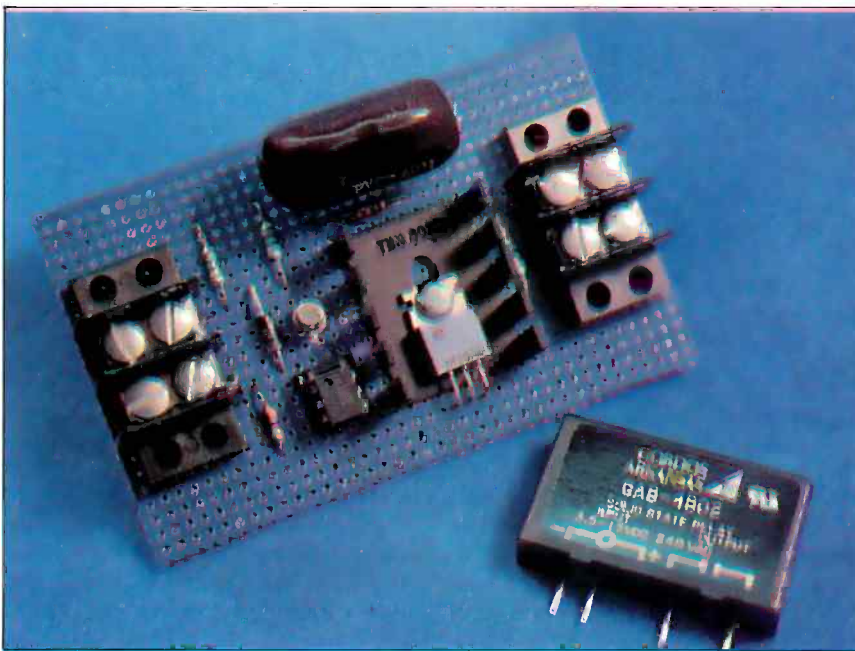


Photo 1: The circuit board is a prototype of a typical non-ZVS solid-state switch like the one described in figure 13. A simpler alternative is to use the solid-state relay shown to the right of the board.

### CHANGE-OF-STATE DETECTION

One infrequently mentioned but important issue regarding discrete-input receivers is change-of-state detection. "Change of state" means simply that a receiver has changed its input level since the last time you looked at it. This might seem trivial if you have only one input module but is quite essential if you are monitoring 64 devices.

The change-of-state condition can be determined and indicated either through hardware logic or software programming. Figure 8 is a hardware change-of-state detector. Whenever the input module's level goes from 0 to 1, or 1 to 0, a 1- $\mu$ s pulse is generated at the output of the 74LS86 exclusive OR gate. This signal can be used to directly interrupt the processor or set a change-of-state flip-flop, as shown. The flip-flop retains its set condition until reset by the interrupt program. If eight input modules are used, there would be eight sets of this hardware with the outputs combined to generate a single "someone changed" interrupt. Figure 9 diagrams this approach. The advantages of the hardware change-of-state detection are that it is transparent to the user and requires little processor overhead.

An alternative approach is to scan the inputs in software periodically and compare the old and new readings to find changed states. In sophisticated control systems, a background interrupt routine periodically scans the in-

put channels. Any changed states are represented as a byte in a table available to the application program. More on this technique later in our real application.

### DC POWER OUTPUT CONTROL DEVICES

As previously mentioned, mechanical relays have been and can still be used in power-control applications. In new designs, however, the cost-effective approach is to use SSRs.

Solid-state relays come in a variety of flavors, depending upon the application. Unlike mechanical relays, which are nonpolarized, SSRs can be either polarized or nonpolarized. DC SSRs are normally polarized; AC SSRs are not.

Figures 10, 11, and 12 illustrate three kinds of DC output control modules. While they technically are SSRs, polarized switches such as DC output control modules are quite different in component configuration and are generally referred to as DC output units rather than SSRs. Figure 10 is a very simple DC module using an *H11C1* photo SCR, which in turn triggers a higher-current SCR. Because it uses an SCR, this type of circuit simulates a latched-output relay. A voltage level applied to the LED input turns on the SCR and allows current to flow through it. The amount of voltage that will turn on the SCR is determined by  $R_1$  and  $R_2$ , as shown in table 1. Both the LED input signal and the external load current must be removed to turn off the SCR.

This seems to be an absurd situation if the purpose of the DC output module is in fact to control the external current. Because of this, SCR relay devices are not normally used for DC resistive loads and are reserved in-

(continued)

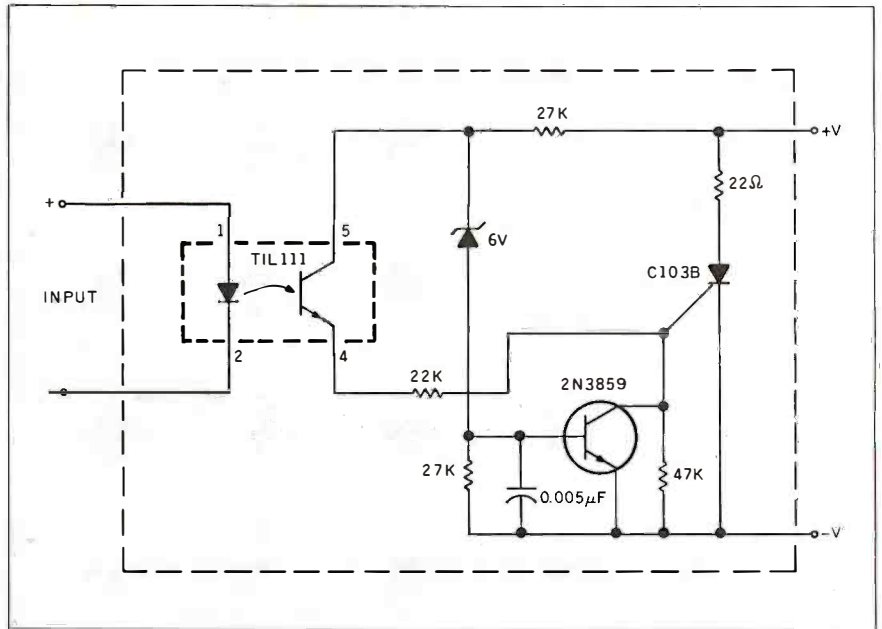


Figure 14: A normally open ZVS circuit.

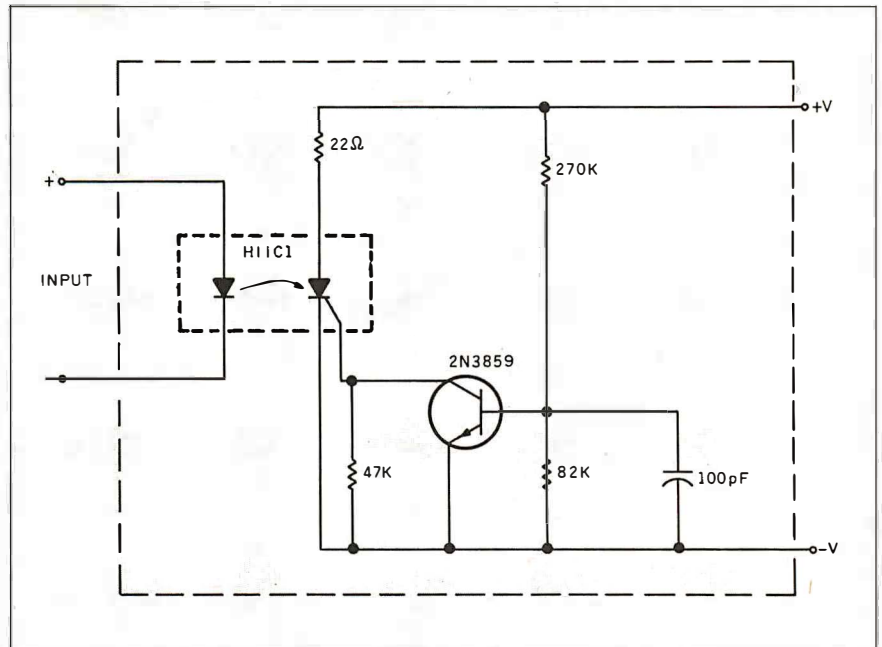


Figure 15: Another normally open ZVS circuit.

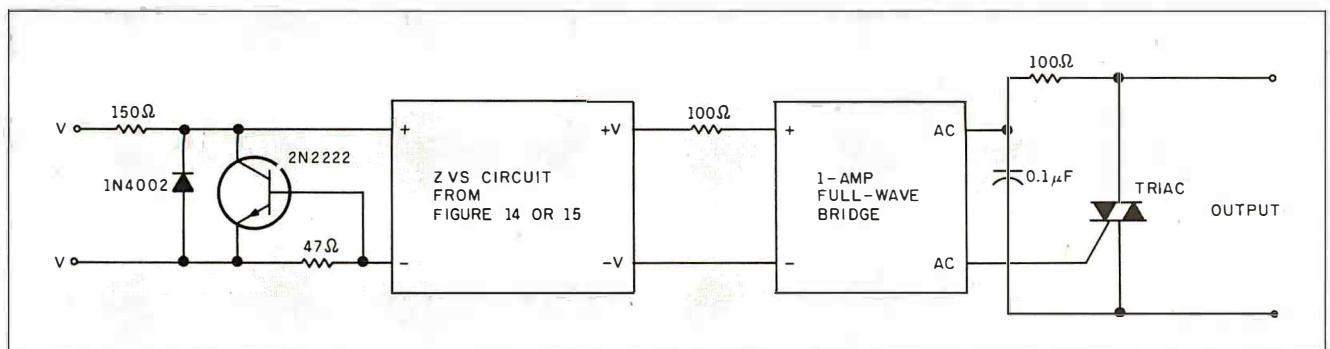


Figure 16: A ZVS stand-alone SSR.

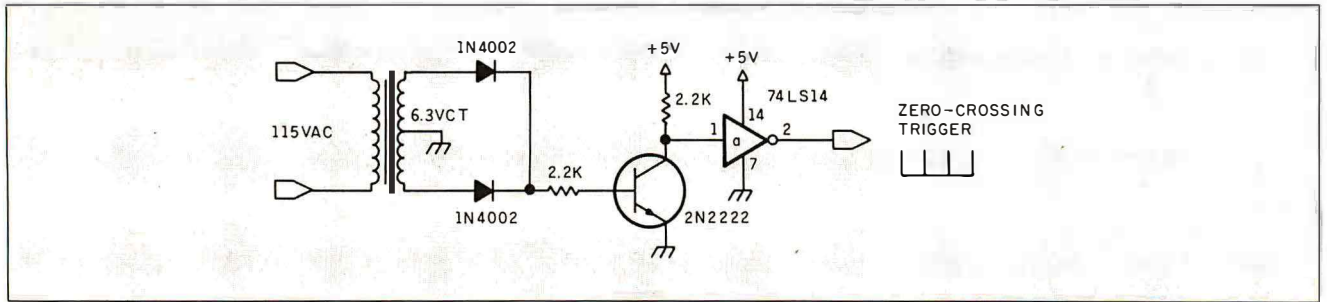


Figure 17: An isolated zero-voltage sensor.

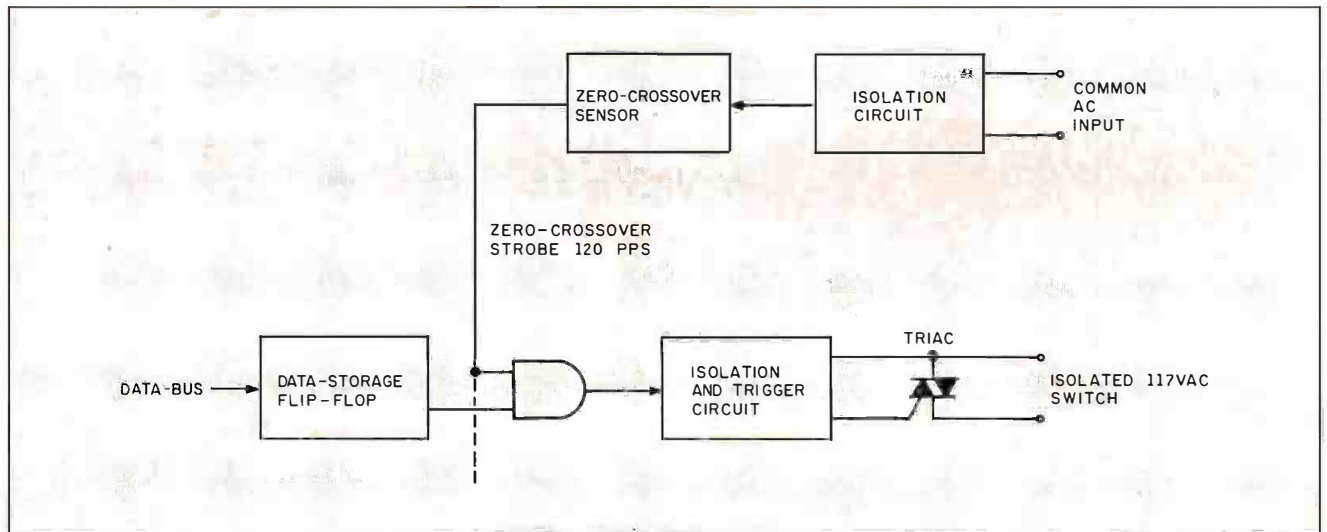


Figure 18: The block diagram of a typical externally controlled zero-crossover AC output circuit.

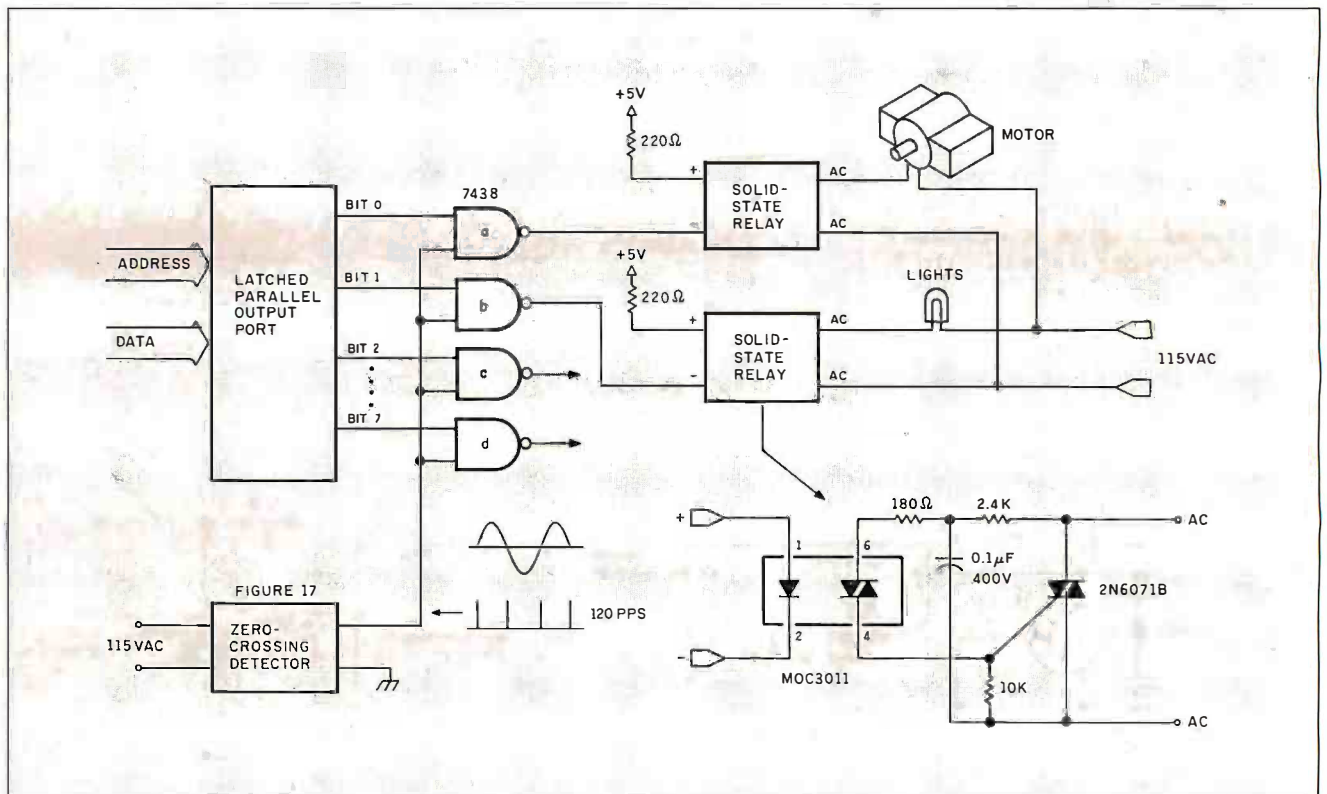


Figure 19: The typical computer-controlled SSR output with ZVS.

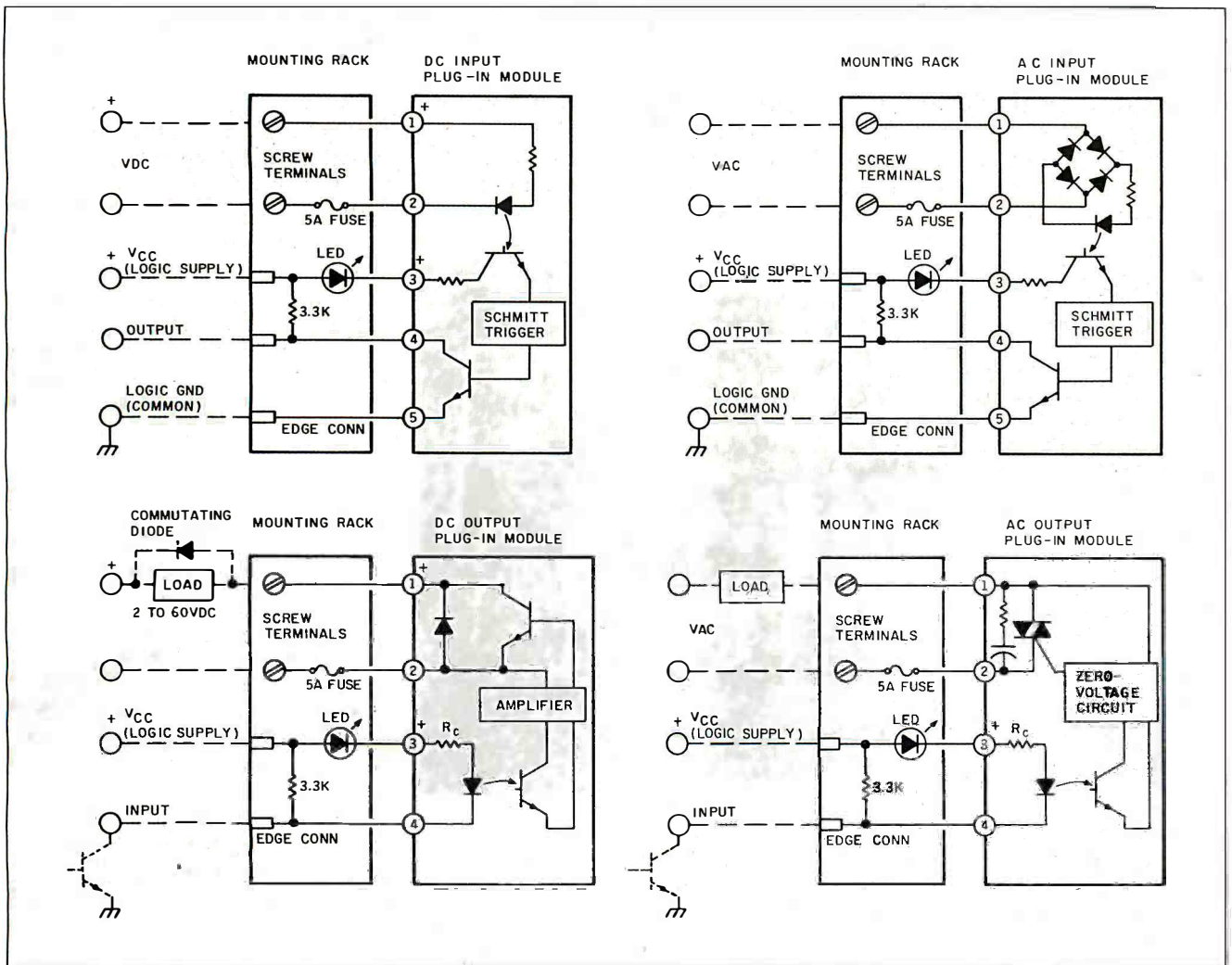


Figure 20: Mounting-connection diagrams of four Gordos Arkansas power I/O interface modules.

stead for commutating loads such as motors. With a DC commutating motor, the output current is interrupted many times a second as the motor shaft turns, allowing the SCR to turn off when the LED is extinguished.

All other DC control applications rely on transistor control elements, which exhibit fewer peculiarities but involve more components. Figures 11 and 12 demonstrate two typical 25-V DC output-module designs. Figure 11 is configured to have a normally open output; figure 12 has a normally closed output. These units are non-latching and can be turned on or off in direct response to the logic levels from a parallel output port.

### AC POWER OUTPUT CONTROL DEVICES

When we use the term "solid-state relay," we are generally talking about AC power output devices. These SSRs are nonpolarized and intended for

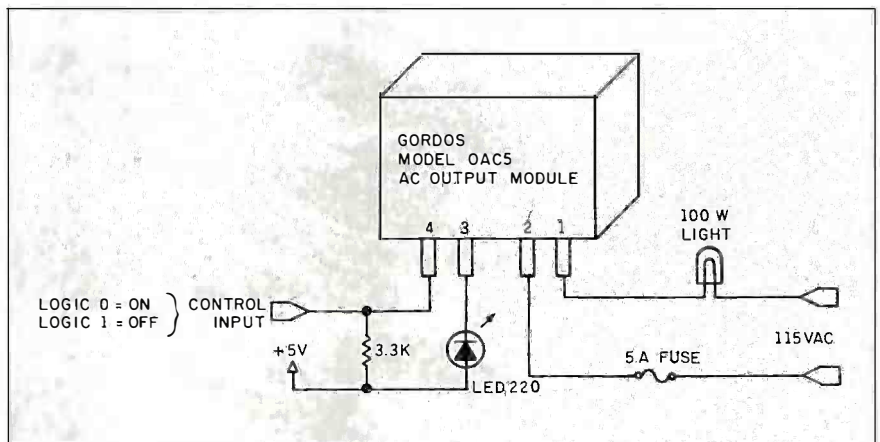


Figure 21: The connections for a Gordos AC output module.

use only with AC loads.

Figure 13 and photo 1 show the circuit of a general-purpose off-the-shelf component-configured SSR module suitable for control of lights and light-load appliances. The circuit employs an MOC3011 photoisolated Triac that

in turn controls a power-output Triac. Input-protection circuitry has been added to the LED side of the module so that it can be used within a 3- to 25-V input range. (This input circuit can be added to any of the opto-

(continued)

isolators. However, if it is going to be attached only to a computer's parallel output port, you can dispense with this extra circuitry and use the simple resistor-input configuration of figure 9.) The additional resistors and capacitors form a "snubber" network that dissipates the transients produced

when the Triac is connected to inductive loads.

As with any relay function, line transients are produced when a voltage is suddenly applied to an inductive load. While snubber networks, varistors, and transient suppressors offer some relief, the solution is to

minimize the cause. If the Triac or SCR can be turned on only when the load voltage is at or near zero, no transients will be produced. The circuit that senses this condition is a zero-voltage switch (ZVS) or zero-crossover trigger network.

The ZVS may be built into the individual SSR (increasing its cost considerably if done with discrete components) or applied as a synchronous trigger to noninternal ZVS solid-state relays. Figures 14 and 15 are opto-isolated discrete-component zero-voltage switches that, when individually combined with the circuit in figure 16, produce a stand-alone ZVS output relay. Generally speaking, most commercial relays contain internal ZVS switching to improve performance. To keep costs down, these SSRs are constructed using hybrid technology rather than discrete components.

If you are building an AC I/O interface with commercial modules that include ZVS, it need be of no further concern. If you are building this interface from scratch, however, you can either build each relay module with internal ZVS or provide an external ZVS signal that is routed to an AND gate along with the control signal from the computer and applied to a non-ZVS switch, such as the one in figures 14 and 15. A circuit that detects zero crossing is demonstrated in figure 17, and a block diagram of this synchronous switching concept is presented in figure 18.

Figure 19 is the circuit for a computer-controlled AC output interface using the devices I've described thus far. To turn on the individual output channels, you merely set a logic 1 output at that bit position. This is most easily accomplished with an OUT command in BASIC. Once the bit is set, the SSR will turn on at the next zero crossing of the AC line.

### NOT THROUGH YET

Ordinarily, the project would end here. I've demonstrated how to build the I/O modules. A two-line BASIC program with INP and OUT instructions is all that it takes to control them. Unfortunately, knowing how to build a solid-state relay is different from assembling a practical control system.

Rather than leaving these practical matters as an exercise for you, I'd like to describe the 64-channel power I/O

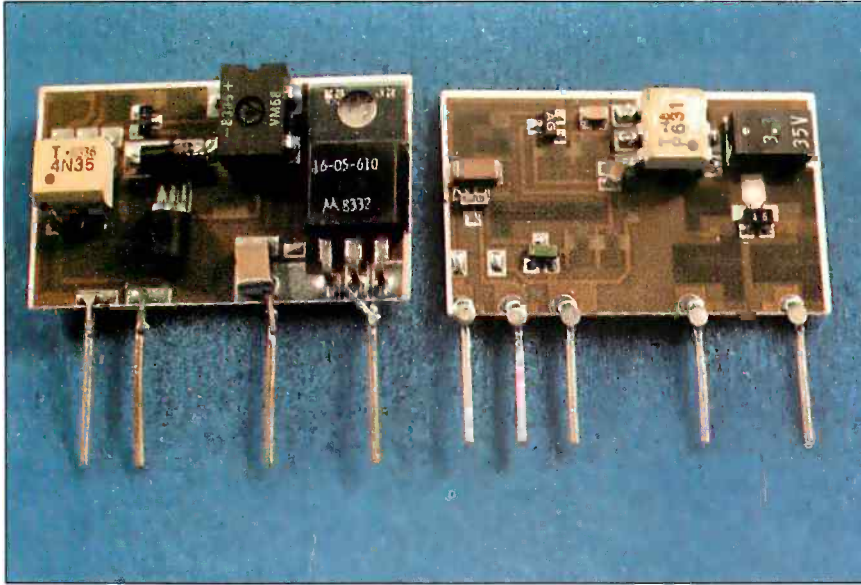


Photo 2: The commercial I/O modules used in this project are hybrid circuits containing laser-trimmed resistors as well as discrete and integrated components. Two Gordos Arkansas Inc. modules are shown unpotted to demonstrate their complexity. The module on the left is an AC output (type OAC 5) and the unit on the right is an AC input (type IAC 5).

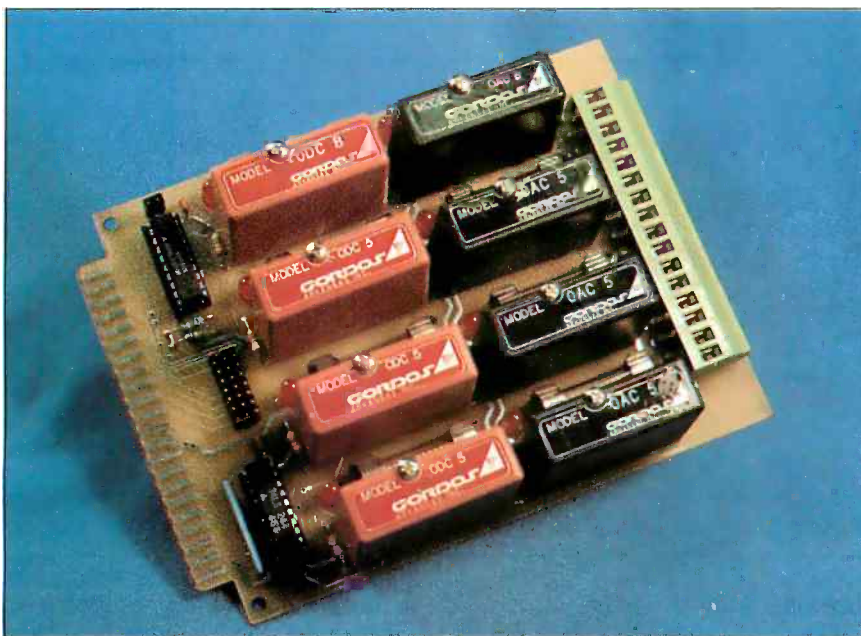


Photo 3: Eight of these I/O modules can be mounted together on a single board. Individual boards can be separately configured as AC-DC output or AC-DC input. The Circuit Cellar Z8 Power I/O prototype board in the photo has four AC outputs (black modules) and four DC outputs (red modules).



system I ultimately configured. The description, though somewhat complex in detail, is intended to provide a basic understanding of the system software necessary to implement a reliable high-performance industrial-grade closed-loop control system. Utilizing the basic concept but substituting commercially available power I/O modules and a dedicated computer, a rather sophisticated programmable power I/O control system can be configured.

The commercial modules I chose are made by Gordos Arkansas Inc. Shown in photo 2, these potted modules are designed using thick-film hybrid technology for high-density packaging. Figure 20 is a diagram of the contents and connections of four typical Gordos power I/O interface modules. Figure 21 demonstrates the physical connections for an AC output module.

The computer I chose is the Z8 system/controller, which I've used in many Circuit Cellar projects. Based on a project presented in July and August 1981, the Z8 system/controller is a 4-by 4½-inch single-board computer with on-board tiny BASIC or FORTH, 6K bytes of RAM (random-access read/write memory) or EPROM (erasable programmable read-only memory), two parallel ports, and one serial port. To the Z8 computer, I've added the Micromint BCC33 memory and parallel I/O expansion board, which adds 8K bytes of memory, three parallel ports, and a cassette-storage interface, to interface to the power I/O modules.

(If you have either built the original Z8 computer/controller and wish to update it to the system/controller configuration or would like to build the memory and I/O expansion board for your existing system, just send me a preaddressed 9-by 12-inch envelope with \$2.30, postage [overseas, just send name and address and \$4 in international mail coupons] and I will send you the schematics and manuals for the two boards.)

The three parallel ports on the expansion board are configured as an I/O bus with input, output, and control capability. The power I/O modules are separated by function (input or output) and arranged eight modules per I/O card. Both AC and DC modules may be on one card, but only if they are all the same function. Up to 16

boards (64 input and 64 output modules, addressed as input boards 0 through 7 and output boards 0 through 7) can be accommodated with a single BCC33 expansion board. (Eight expansion boards can be put in the system if you are trying to control a small city.)

The computer communicates with the I/O cards through the expansion-board parallel ports. Port A functions as an 8-bit input bus, port B as an 8-bit output bus, and port C as the control lines for the individual I/O cards. Each power I/O card has a set of eight two-position jumpers, a 74LS374 output latch, and a 74LS244 input buffer (see photo 3 and the schematic in figure 22). Photo 4 shows some of the cards mounted in a card cage.

A single jumper selects board address and function. The eight output lines of port C are attached to the center position of the eight jumpers (boards 0 through 7). Only one of these lines is active low at a time; all others are at logic 1. The line that is low enables the power I/O card jumpered to it. Within that enabled card, a jumper installed to the center and left side (O) will enable the LS373. If installed between the center and the right side (I), it selects the LS244. A second jumper Tri-states the LS373 when the board is configured for input. If the jumper were in the #31 posi-

*The process of interfacing with the power I/O cards is relatively simple and can be accomplished directly in BASIC if speed is not a critical factor.*

tion, this would be addressed by bit 3 on port C, and it would be an input-only card.

Figure 23 shows a detailed block diagram of the power I/O system. It can be all AC input, DC input, AC output, DC output, or a mixture (in groups of eight similar functions). When you want to set the eight output modules on board 2, you merely set the bit pattern on port B and then strobe bit 1 on port C (board 2 enable line) to latch that data into the LS373. Conversely, to read the eight input channels on board 3, you would set bit 3 of port C low, read and store the data input to port A, and set bit 3 of port C high again.

The process of interfacing with the power I/O cards is relatively simple and can be accomplished directly in

*(continued)*

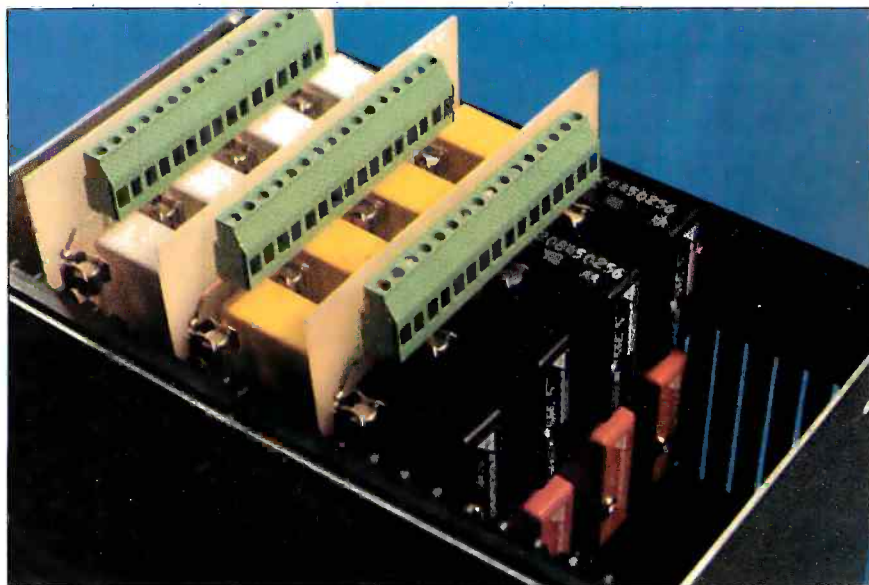


Photo 4: Up to 16 boards (8 input and 8 output) can be supported from each I/O expansion board in a Z8 system. Up to 4 expansion boards can be mounted in a card cage. The photo shows 3 expansion boards installed. The green connector protruding out of the cage is for external wiring connections.

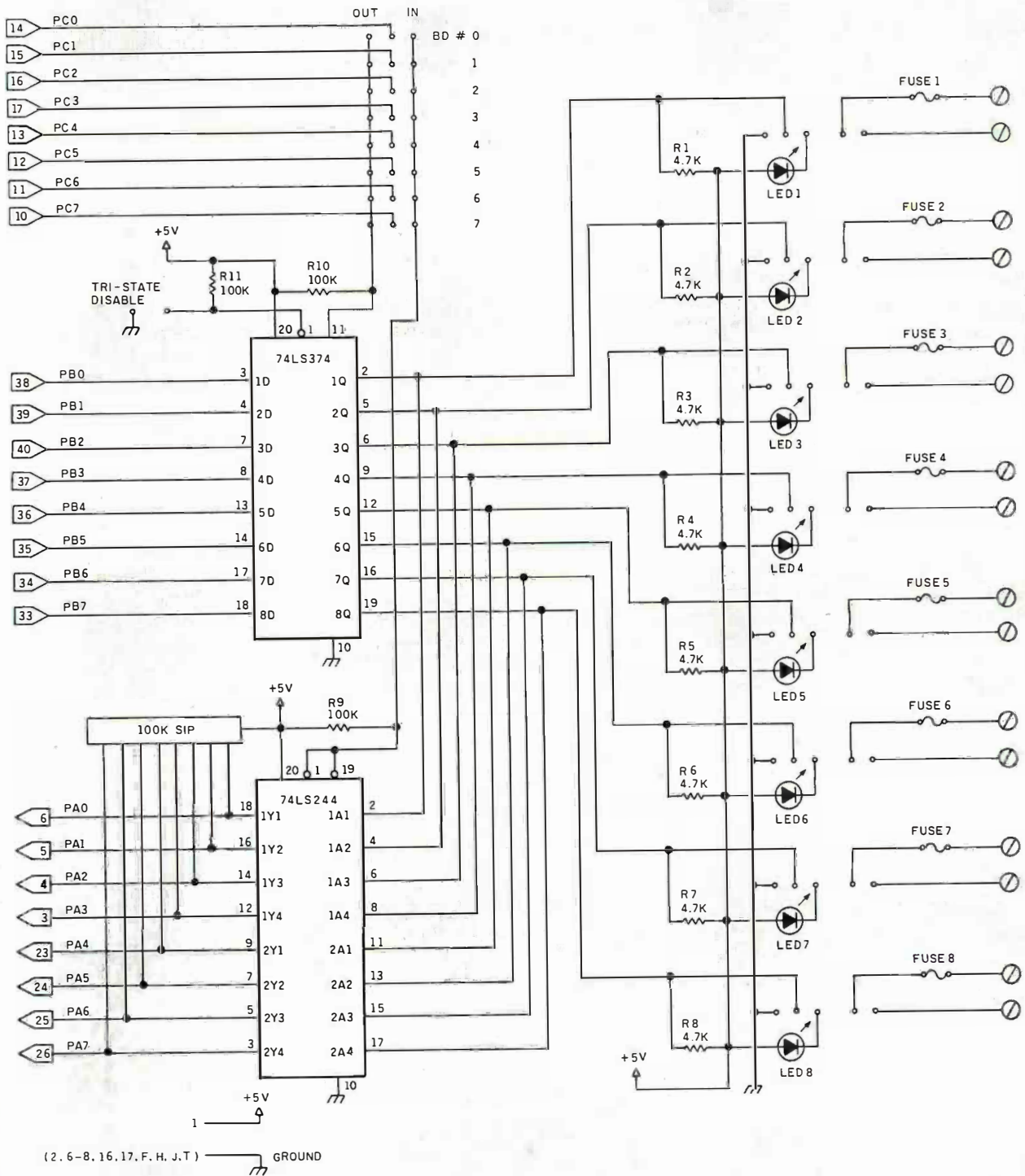


Figure 22: The schematic of the Z8 power I/O card, as shown in photo 3.

BASIC if speed is not critical. With 8 or 10 modules, it is not a problem to scan and record change of state, read the real-time clock, and still meet the requirements of the application.

While the simplified hardware for the power I/O system is important, it takes more to produce an industrial-grade control system. It is counter-productive to run time-consuming, repetitive tasks in BASIC that can be done more quickly in assembly language. For that reason, I've added a set of interrupt-driven utilities that greatly simplifies the interaction between user and power I/O system and allows the use of BASIC (unless you prefer assembly language), even with 64 active I/O channels.

These Z8 assembly-language routines, flowcharted in figures 24 and 25, operate as background tasks to any user application programs and are completely transparent. In addition to real-time clock functions, they allow the user to interact with the I/O system through a table of 64 input and output values rather than setting and reading expansion ports. To turn output channel 16 on, we simply load a value greater than 0 into table location 16. To turn output channel 1 off, we load 0 into table location 1.

Conversely, all inputs are con-

tinuously scanned and the present values loaded into a similar channel table for examination. In addition to the present value, a separate indication of change of state by board and channel number is also produced. The change-of-state indication is maintained until the user reads the affected channels. The result is a simple BASIC single-byte read-and-compare to find any input channels that have changed and a single-byte write to make a corresponding control output.

The user can drive seven subroutine calls in dealing with the power I/O system. They are

1. System initialization.
2. Read an input channel's change-of-state flag (1 bit).
3. Read an input channel's data bit and reset change-of-state flag.
4. Set an output-channel data bit (1 on or 0 off).
5. Read an input board's change-of-state flags (8 bits).
6. Read an input board's data bits and reset change-of-state flags.
7. Set an output board's data word (8 bits, 1 on or 0 off).

In addition to these subroutines called by the user, other routines

*By the time you read this, the Circuit Cellar could be rewired. But I might experiment with my new home-control system.*

under interrupt control update the clock/calendar values and the power I/O boards and data/change tables.

The completed software fits on a 2716 EPROM on the I/O expansion board. Unfortunately, I don't have room enough here for a complete program listing, but I will send you one if you write to me.

### IN CONCLUSION

What started out as a very simple solid-state-relay project got a little carried away. I use all the devices I design, and this is no exception. By the time you read this, the Circuit Cellar could be completely rewired. On the other hand, I might wait a month and experiment a little more with the new Circuit Cellar Home Control System that's in the works. Com-

*(continued)*

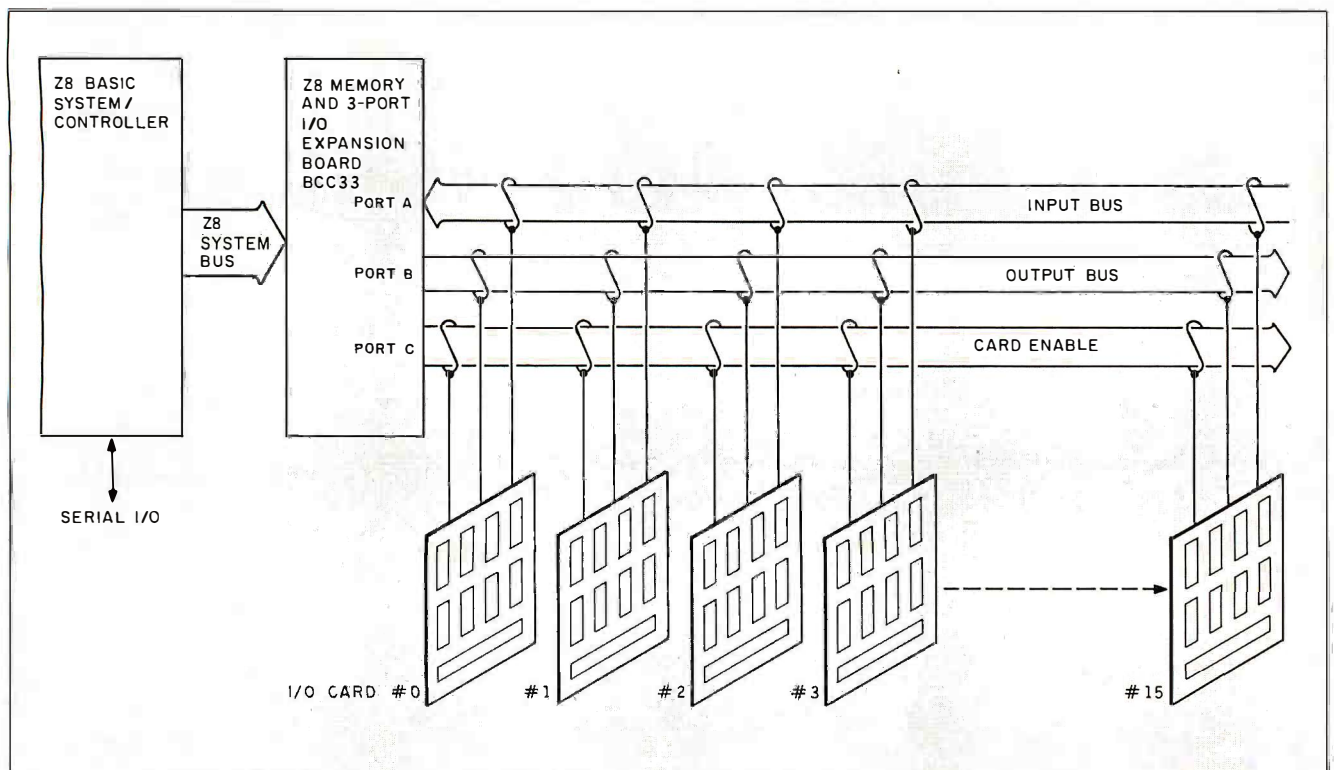


Figure 23: The block diagram of the Z8 power I/O system.

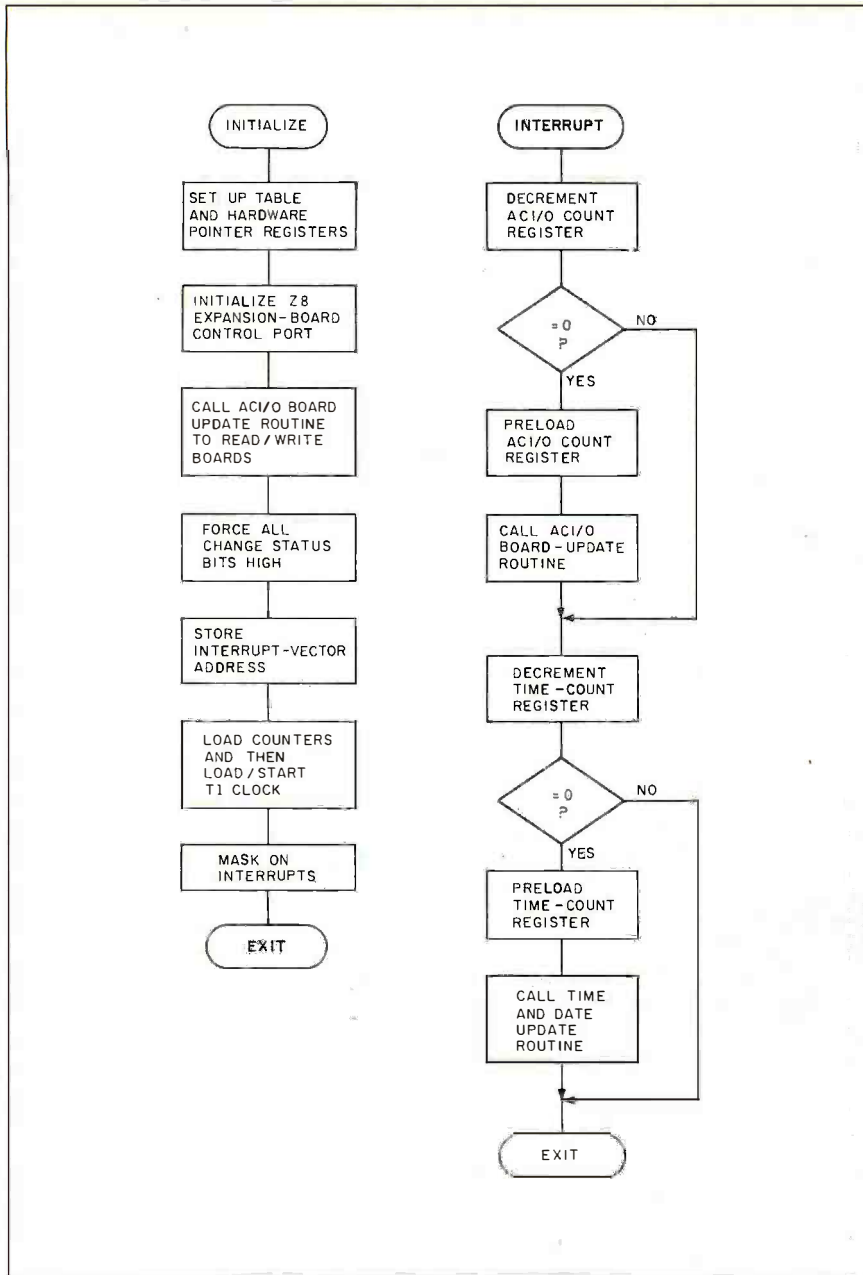


Figure 24: A flowchart of the Z8 AC I/O system initialization and interrupt-handler assembly-language routines.

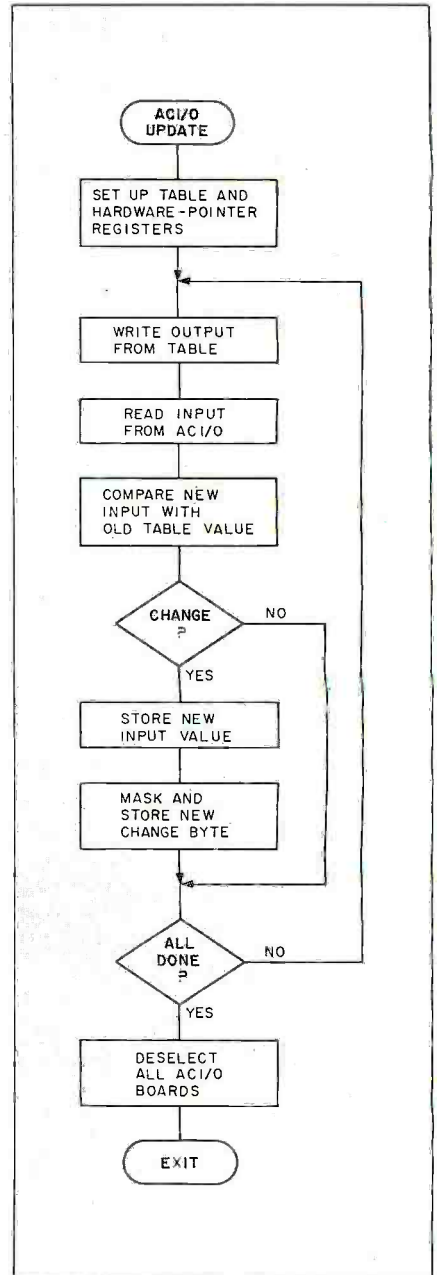


Figure 25: A flowchart of the Z8 AC I/O board update routine.

puter control fanatics, hold on to your hats, I've just begun.

### CIRCUIT CELLAR FEEDBACK

This month's feedback begins on page 375.

### NEXT MONTH

Tired of weak power supplies? Tune in next month, when I talk about linear power supplies. ■

*Special thanks to Bill Curlaw for his software expertise. Diagrams of Gordos modules reprinted courtesy of Gordos Arkansas Inc.*

The following are available from

The Micromint Inc.  
561 Willow Ave.  
Cedarhurst, NY 11596  
(516) 374-6793 for information  
(800) 645-3479 for orders

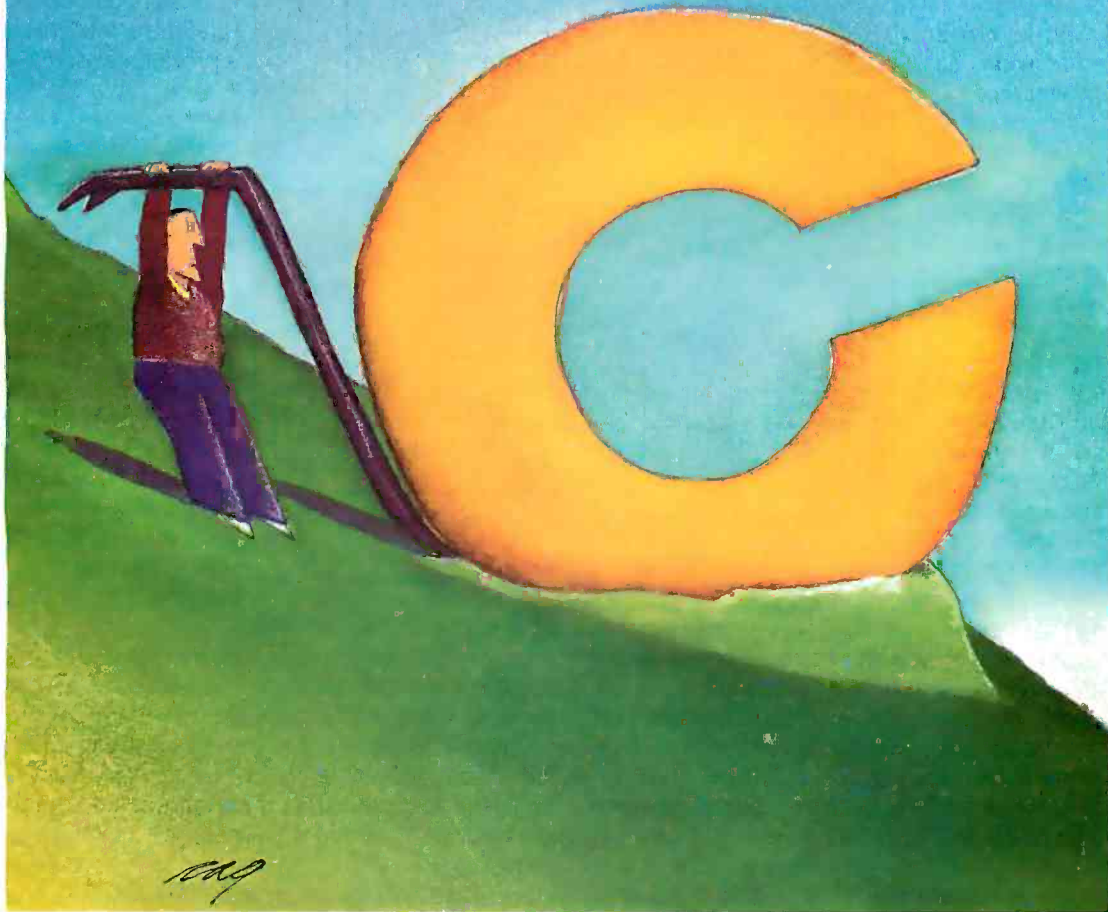
1. Assembled and tested Z8 power I/O board without power I/O modules . . . . . \$159
2. AC input or output modules, types IAC5, IDC5, OAC5, and ODC5 . . . . . \$15 each
3. Eight-slot motherboard and card cage usable for I/O boards or Z8 . . . please call
4. Z8 system controller . . . . . \$149

Please include \$4 for shipping in the continental United States, \$10 elsewhere. New York residents please include 8 percent sales tax.

Editor's Note: Steve often refers to previous Circuit Cellar articles. Most of these past articles are available in reprint books from BYTE Books, McGraw-Hill Book Company, POB 400, Hightstown, NJ 08250.

Ciarcia's *Circuit Cellar, Volume I* covers articles that appeared in *BYTE* from September 1977 through November 1978. *Volume II* covers December 1978 through June 1980. *Volume III* covers July 1980 through December 1981. *Volume IV* covers January 1982 through June 1983.

To receive a complete list of Ciarcia's Circuit Cellar project kits, circle 100 on the reader-service inquiry card at the back of the magazine.



# C-LANGUAGE DEVELOPMENT TOOLS

G. MICHAEL VOSE

*Editor's note: The following is a BYTE product description. It is not a review. We provide an advance look at these new products because we feel they are significant. We plan to provide complete reviews in subsequent issues.*

BASEMENTS AND GARAGES may have been the birthplace of the technology that has evolved into the modern microcomputer, but researchers at one of the world's largest corporations created the C programming language. In the eighties, C has evolved into the software development tool of choice for many serious programmers. Bell Labs' UNIX-driven

language has been adapted for use with other operating systems and used to create a multitude of significant personal computer programs, including VisiCorp's Visi On, Microsoft Windows, and the outline processor, MaxThink.

C falls into the mid-level language category—higher than CPU (central processing unit) register- and memory-manipulating, low-level assembly languages but lower than machine-isolating, high-level lan-

*(continued)*

G. Michael Vose is BYTE's senior technical editor for themes. He can be contacted at POB 372, Hancock, NH 03449.

languages like Pascal and Ada. Mid-level languages provide easy access to memory and the CPU while retaining the control and data structures of classic high-level languages. This access enables bit shifting and manipulation using a rich set of operators for incrementing, decrementing, and performing Boolean operations.

While C grew in popularity, many programmers agonized over its complexity and the lack of debugging tools like the monitors

for tracking errors in assembly-language programs, utilities that enable you to set breakpoints in the code and use single-step execution. Outside of the UNIX realm, where C debugging facilities are part of the operating system (which is itself written in C), programmers faced a barren landscape.

In microcomputerdom, however, where entrepreneurial fervor thrives, vacuums do not exist for long. Recent months have brought forth a number of new C-language development tools and debugging aids. Many of these tools were created specifically for the microcomputer programmer.

In this product description I'll look at three of these products: the Safe C Compiler and Profiler from Catalytix Corporation of Cambridge, Massachusetts; the Instant-C interpreter from Rational Systems Inc. of Newton, Massachusetts; and the C Source Debugger from Mark Williams Company of Chicago.

### SAFE C COMPILER/PROFILER

One of the more significant problems a C programmer faces is run-time error detection. Running a C program in the early stages of its life cycle resembles a Cessna pilot trying to land a 747—he might know how to fly but isn't sure which are the right controls.

Unlike Pascal compilers, C compilers do not provide extensive run-time error checks during compilation. C compilers cannot check for array indexing errors, divide-by-zero, and similar run-time errors. C programmers have no tool to verify the correctness of argument data types passed to functions or to detect the existence of a stray pointer. Dangling pointers can cause system crashes on many microcomputer implementations of C.

The Safe C Compiler/ Profiler is a checkout compil-

er designed to uncover run-time errors. It is not a production compiler; it is simply a development tool designed to increase programmer productivity (while decreasing the programmer's frustration level).

Safe C adds a source-to-source preprocessing pass to the normal C compile cycle (see figure 1). Safe C inserts checkout code into the original source file and then compiles the resulting file. The checkout code swells the original source in size

by a factor of two or three.

As the compiler compiles the modified source file, the checkout code prompts the generation of error messages for every possible run-time error encountered. Multiple errors generate a stream of error messages. Safe C error messages are warnings only—the compiled code is executable, and the programmer must decide whether to heed the warnings generated.

The error conditions detected by Safe C include

- out-of-bounds array indexes
- arithmetic overflow and division by zero
- overflow in standard string routines
- mismatch of actual and formal function parameters
- misuse of standard I/O (input/output) routines
- indirection through and stack corruption by stray pointers

The compiler also reports standard syntax errors.

Probably the most important function the Safe C Compiler provides is detecting mismatches in function parameters. C's main strength derives from its modularity. Ideally, C programmers write their programs as small, individual units that are later linked together. The potential for error among the interacting parts is high, mostly due to the passing of arguments of the wrong data type.

The Safe C Profiler is a dynamic software development tool that provides both function and statement execution counts. When a programmer needs to know where a program spends most of its time, the Profiler provides a count of the times a function is called and, within functions, the number of times a

(continued on page 382)

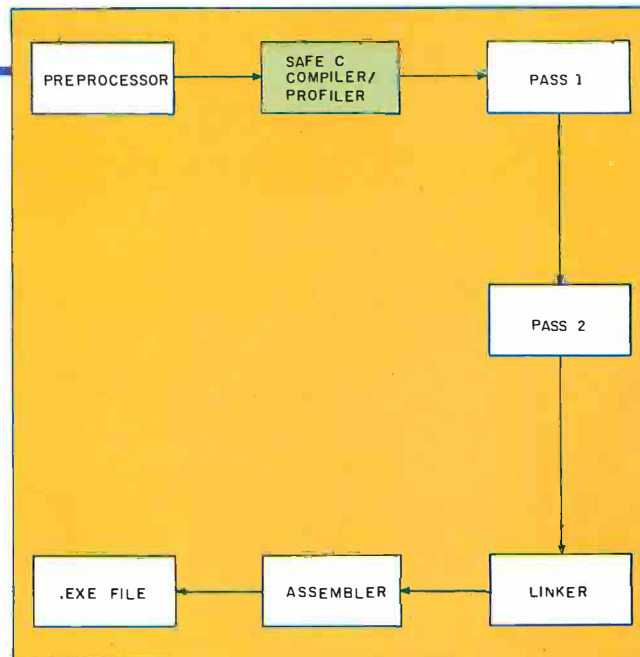
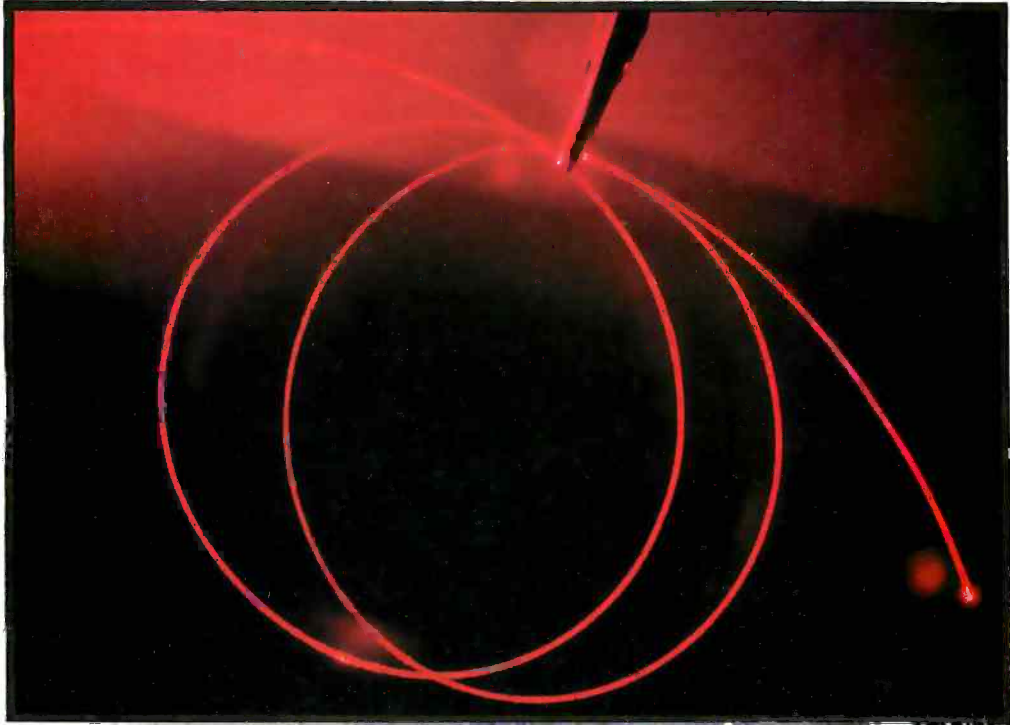


Figure 1: Adding a preprocessing pass to a typical C compile cycle.

## PART I

# AN INTRODUCTION TO FIBER OPTICS



*Light tamed by glass waveguides  
offers wide communication bandwidth*

BY RICHARD S. SHUFORD

Alexander Graham Bell's many inventions included the photophone. In this device, which he demonstrated in 1880, a beam of sunlight was reflected off a shiny diaphragm mounted on an acoustic horn. The light beam was aimed at a distant selenium photocell connected to a speaker; speech could be understood at a distance of 700 feet.

But the photophone's short-haul line-of-sight communication was practical in few instances, so lightbeam transmissions were shelved for the better part of a century until another field of research caught up and furnished a means whereby information-bearing light could be channeled and directed where it was needed.

In the mid-1960s, C. K. Kao and G. A. Hockham at ITT's Standard Telecommunication Laboratories in England suggested an idea for directing light waves where they were needed. By 1970, scientists at the Corning Glass Works had made the concept work. Pieces of silica glass stretched as thin as a human hair became easily bendable and could serve as practical *waveguides* for light waves—and the field of fiber optics was born. At the same time, semiconductor technology made possible the fabrication of efficient light sources that

*(continued)*

Richard S. Shuford is BYTE's special-projects editor. He can be contacted at POB 372, Hancock, NH 03449.

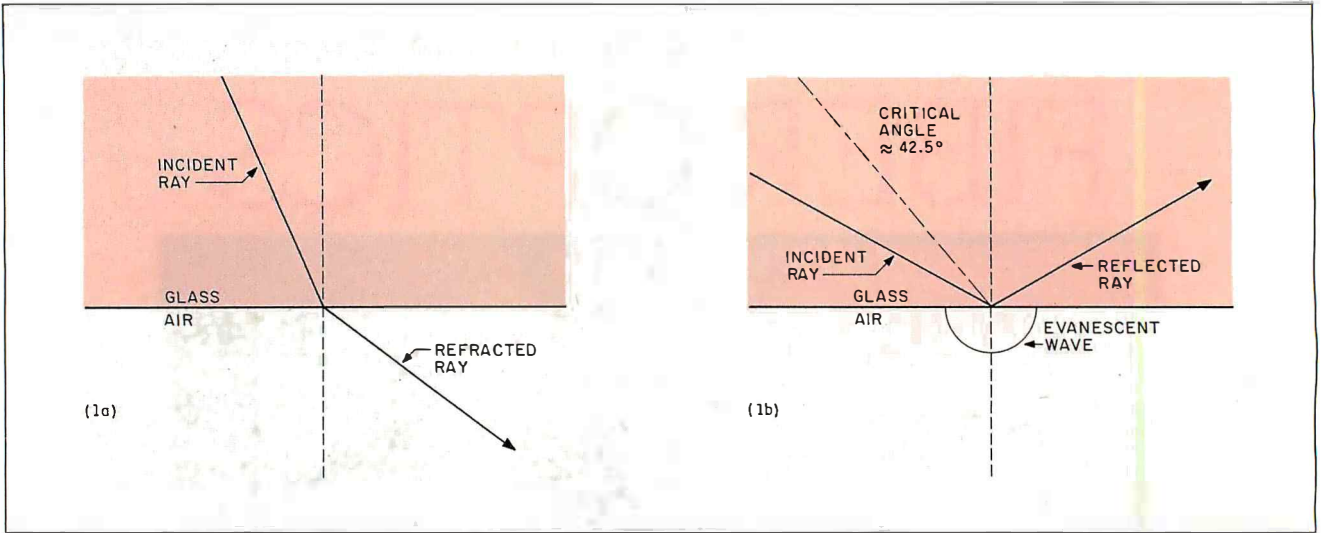


Figure 1: When a ray of light hits the boundary between two media with different indices of refraction, one of two things can happen. In figure 1a, where the angle of incidence is rather steep, the path of the ray is bent as it enters the second medium. But in figure 1b, the angle of incidence is below the critical angle, so the beam is reflected back into the first medium.

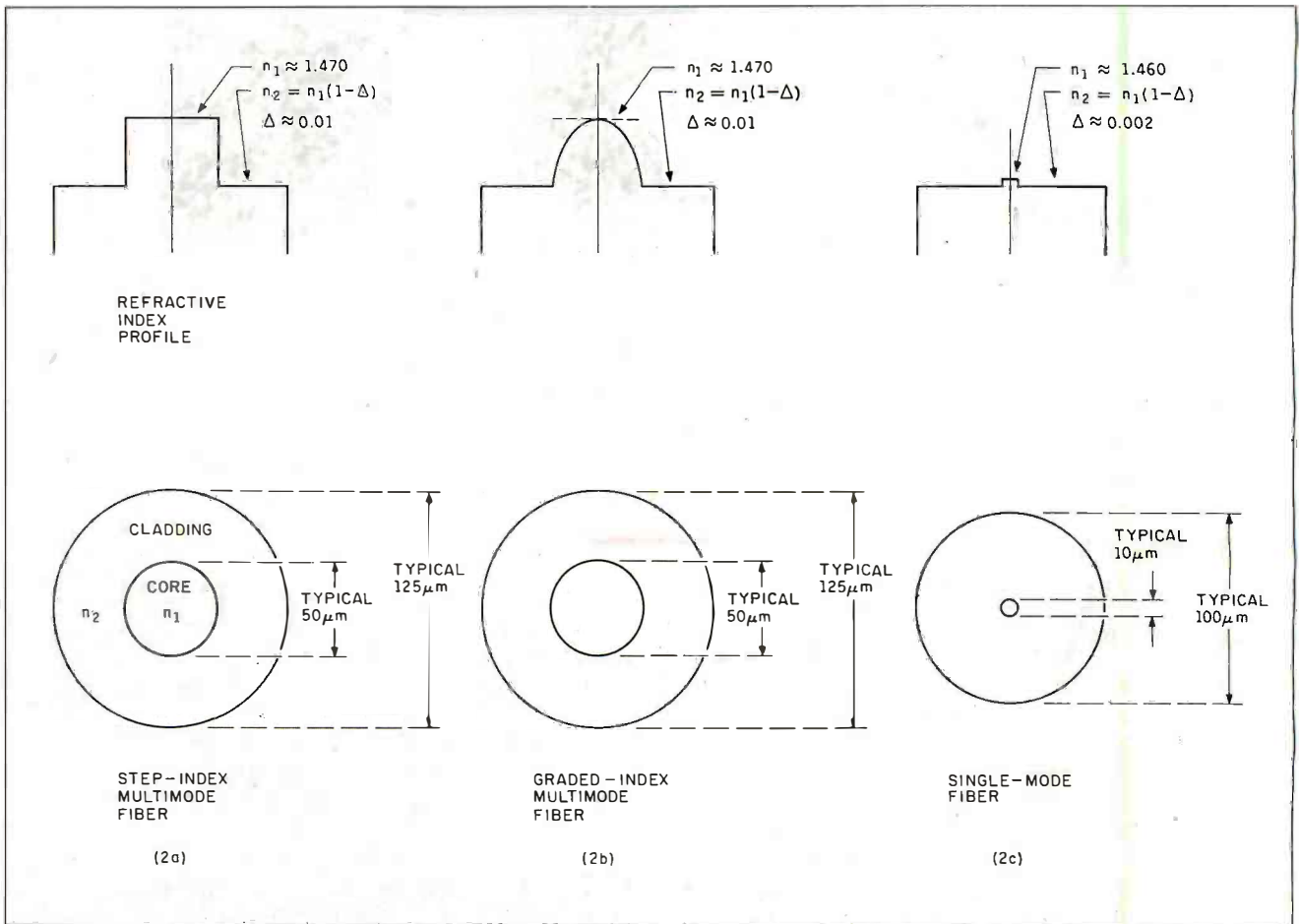


Figure 2: The three types of optical fibers. The step-index multimode fiber (2a) has a sharp transition of refraction index  $n$  at the core/cladding boundary. The graded-index multimode fiber (2b) features an index that gradually changes across the axis of the core. The single-mode fiber (2c) has a much smaller core that supports the propagation of only a single ray of light moving along the core's axis.



could be modulated with an external signal.

## FIBER OPTICS: PROS AND CONS

The greatest attraction of fiber-optic technology is the bandwidth of light transmission. Light in the visible and near-visible spectrum has characteristic frequencies so high that they are rarely discussed as such: hundreds of gigahertz (GHz), or billions of cycles per second. According to theory, a carrier wave composed of these high frequencies can transmit meaningful information at a tremendous rate; the Nyquist limit for the fastest-changing signal a carrier wave can convey in a perfect medium is one-half of the carrier's frequency. Light, tamed by a fiber-optic waveguide, offers the great communication capacity modern technology increasingly demands.

Optical fibers have other good qualities. The wide bandwidth is accompanied by low loss, compared with metallic media. Fiber-optic cables are immune to interference from electric and magnetic fields; a fiber can be installed in an electrically noisy engine room without shielding. Conversely, no radiation escapes the fiber cable to interfere with its environs. Fiber-optic links may be tested in highly accurate ways that can locate imperfections, including any surreptitiously installed taps in networks carrying confidential data. The nonconducting fiber never plagues electronic equipment with voltage leaks or ground-current loops—in fact, you can think of the fiber-optic link as just an extremely long optoisolator. Furthermore, fiber cables are small and lightweight and fit where copper wires won't.

But there ain't no such thing as a free lunch. Optical fibers do have some disadvantages.

The most obvious drawback lies in the physical handling and installation of fiber-optic cables. The techniques for dealing with a communication channel made of glass differ radically from those for dealing with copper wire; a technician skilled in soldering conventional coaxial cables may blanch when shown the unfamiliar tools used to splice and install connectors on optical fibers. And the con-

nectors themselves come in bewildering, proprietary variety (although a few standards are emerging).

Another drawback is the complex interface equipment fiber-optic cables require to make use of all that bandwidth. The circuitry that forms the "funnel into the fiber" must operate in two discrete realms: electronics and photonics. It must be of high quality for the most efficient transfer of the signal and must compensate for the quirks that appear in any apparatus that blends two kinds of technology. The simplicity and economy of the fiber-optic waveguide itself are offset to some degree by the expense of the interface equipment.

But because fiber optics is a new field, researchers are making rapid progress in solving or reducing the seriousness of the problems involved, and costs are being driven down. Fiber-optic cables have already shown their cost-effectiveness in long-distance telecommunication applications, where their low loss enables telephone companies to employ fewer repeaters over long, continuous runs than with conventional cables. And certain other applications that demand one of the qualities at which optical fibers excel have also reached the break-even point in competition with copper.

Fiber-optic communication is now finding its place in computer systems, especially in wideband links within multiprocessor arrays and in high-performance or high-security distributed networks. And even small-scale microprocessor-based equipment can use optical fibers to good advantage because of their immunity to interference.

## HOW OPTICAL WAVEGUIDES WORK

In an optical fiber, light goes in one end and comes out the other, no matter how many twists and turns the fiber makes along its length. This defies our everyday experience that light travels in straight lines. The fiber can perform this feat because its designers have carefully applied a phenomenon that is a cousin to refraction: total internal reflection.

Refraction occurs because light moves faster through some materials

than through others. (It moves at its well-known 186,280 miles-per-second speed only in a vacuum.) In the simple case of a glass-to-air interface, a light wavefront within the glass (represented in figure 1 in simplified form as a ray) approaching the boundary at a relatively steep angle has its direction changed as it suddenly encounters a region where it can travel at a faster speed. The amount of change in the refracted angle varies as a function of the incident angle up to a certain *critical angle* (about 42.5 degrees for glass/air). If the angle at which the incident ray approaches the boundary is lower than this critical angle, the light is *reflected* back into the glass at an angle of reflection equal to the angle of incidence.

An optical fiber consists of a cylindrical inner *core* and an outer concentric shell, the *cladding*. (The cladding is usually enveloped by protective outer layers, but these play no functional role.) The core is made of transparent glass (or sometimes plastic) with a relatively high index of refraction; the cladding, of glass with a relatively lower index. Light enters from one end, and internal reflection occurs at the core/cladding interface, just as at the glass/air boundary in the example, letting the light emerge from the other end as if the fiber were a pipe. (A typical core/cladding critical angle is 8.5 degrees.)

## TYPES OF OPTICAL FIBERS

Optical-fiber waveguides are made in two major classifications, one of which is subdivided into two varieties. The major division is between fibers that convey light in single or multiple modes, where a mode can be thought of as a group of rays bouncing through the waveguide at a given incidence/reflectance angle. The multimode fibers are differentiated by the profile of the refraction index across the fiber's diameter.

Figure 2 shows the three kinds of fibers. The *step-index multimode* fiber (2a) features an abrupt transition of refraction index at the core/cladding boundary. The *graded-index multimode* fiber (2b) exhibits an index of refraction that reaches a peak in the center of the core and gradually tapers off to

(continued on page 388)

# SOFTWARE FRAMEWORKS

*Software "toolkits" save programming time*

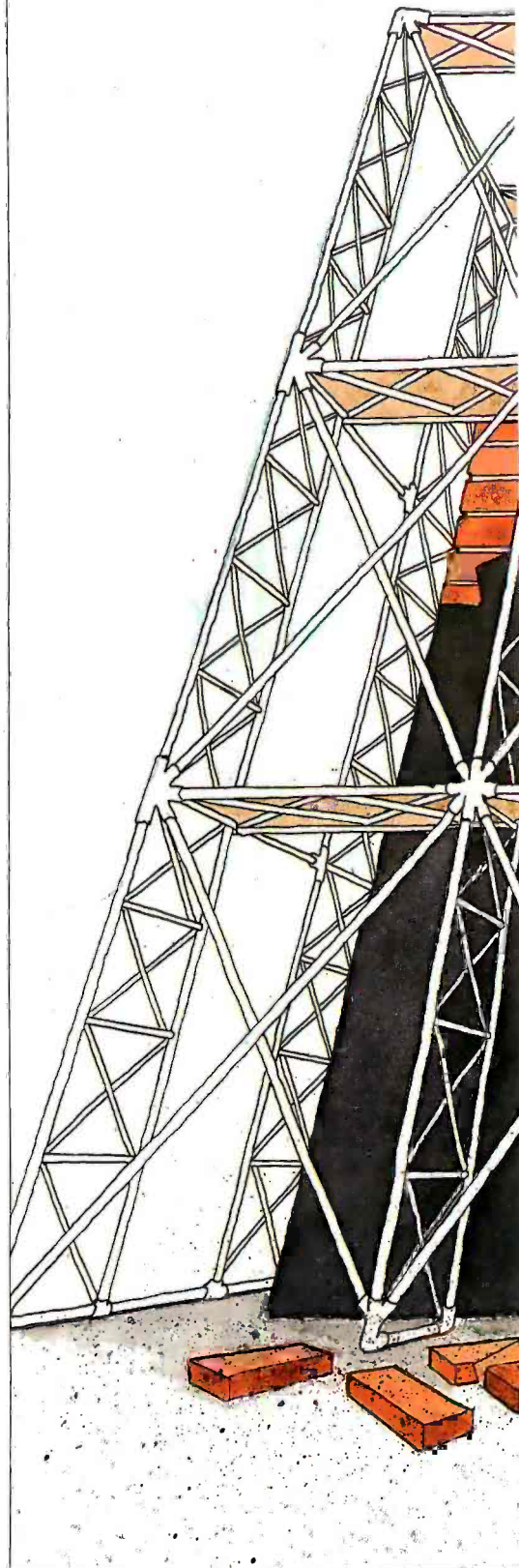
**W**e are certainly beginning to see some wonderful software—fast, useful programs that give us color graphs, windowed information, and mouse-

based cursors. Unfortunately, such software involves a tremendous amount of programming. Since more time at the programmer's computer usually translates to more dollars at the software store's cash register (in a market where software prices are high enough as it is), both you and the software publisher are part of a two-sided dilemma. On the publisher's side, the dilemma has to do with choosing between producing the more complicated software and raising its price, or *not* producing it because he believes he will not be able to sell it profitably. On the user's side, you can either buy the software you see or not—you have little direct influence on what software gets developed. Unless we can all improve our standard of living so that we won't mind spending \$1200 for a spreadsheet, it looks like it's up to the software publisher to come up with an answer to this problem.

There is one sure way to keep a product's price from rising—reduce manufacturing costs. You can be sure that software publishers are looking at every phase of their operations for places to cut costs, and since development represents the largest percentage of that cost, why not start there? The quest for lower development costs has given us such things as new programming languages, productivity tools, and program generators. A promising solution being used by several software developers is that

*(continued)*

*Gregg Williams is a senior technical editor at BYTE. He can be reached at POB 372, Hancock, NH 03449.*





*A software framework defines much of an application's operating environment so that the programmer can concentrate on the application itself.*

of the *software framework*, a program (often enhanced by a programming language and/or environment) that defines much of an application's standard operating environment so that the programmer can concentrate on implementing the application itself. In this article, we will look at Apple Computer's Toolkit/32 as a representative example of this type of software. Toolkit/32 significantly reduces the time needed to create an application that runs in the Lisa's desktop-metaphor environment.

(You should not confuse my concept of "frameworks" with the Framework integrated-software package from

Ashton-Tate, which was announced after I had finished writing this article.)

## CONVENTIONAL PROGRAM DESIGN

Software has too often been cobbled together on an entirely custom basis—that is, each program is created without making use of any previously written code. Sometimes, a software designer who has a number of similar programs to write will create a library of useful subroutines that can be copied as needed into programs. In some cases, as with the Macintosh Application Toolbox in which a 64K-byte ROM (read-only memory) of routines is built into Apple's Macintosh computer, these routines can be quite powerful and can eliminate a large amount of needless programming. In such cases, the programmer will write a main program that makes heavy use of their own subroutines as well as those supplied (see figure 1).

What is wrong with this setup? Nothing—it's just that it often isn't enough. Much of the main program is merely program "glue" that coordinates the calling of the supplied subroutines. When a program is sophisticated enough, though, even the coordinating software is complicated. Consider the Lisa applications, all of which use the same user interface. The application program must interact quickly with user input (keyboard, mouse, and mouse button) to create complicated output in the form of graphics, text, and windows. In addition to performing its dedicated function (e.g., drawing graphs, maintaining a spreadsheet), an application must do many things that do not change from application to application: update the video cursor when the mouse is moved; display a pull-down menu when a menu title is selected (cursor on title, mouse button pressed and held); execute a given task when a menu item is selected (cursor on item, mouse button released); move a window when it is being dragged (cursor on window title, mouse button pressed and held); resize a window when its "grow box" is pulled (cursor on box, mouse button pressed and held); receive characters when they come in from the keyboard; redraw hidden parts of a window when it is

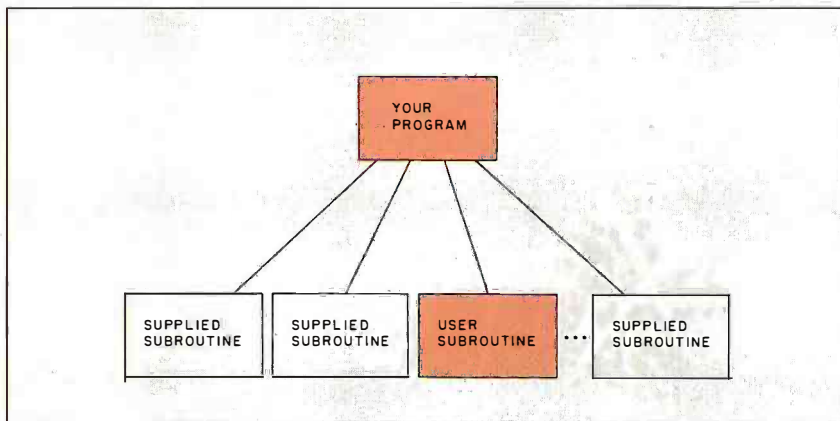


Figure 1: Creating an application program using a subroutine library. When you must make an application given a library of useful subroutines, you must write the driver program and whatever custom subroutines (shaded) are needed to create the application. If the application is embedded in a sophisticated user interface, you will spend a long time "reinventing the wheel" (writing the code to implement an already-specified user interface).

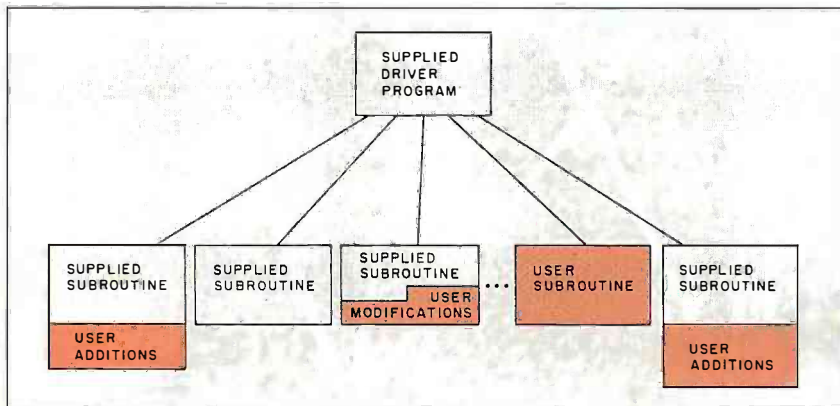


Figure 2: Creating an application program using a software framework. If you have been given a software framework that implements the user interface but nothing else, you need only write code that implements your application. In some cases, you will write entire subroutines; in others, you will modify ones already in the software framework.

*In the toolkit approach, the supplied program is in control and coordinates system-general behavior, such as moving windows.*

brought from behind several other windows (mouse button clicked when cursor is on some visible part of window); expand a selected icon to a window (cursor on icon, mouse button pressed twice quickly); and numerous other less visible tasks. Given all this, using a set of subroutines to develop such a program is like asking for a ride downtown and being shown to a warehouse of auto parts—you don't want to build the car yourself, you just want to get downtown.

### THE TOOLKIT APPROACH

Bruce Blumberg, J. Peter Young, and Larry Rosenstein of Apple's Apple 32

division have devised an alternative. Imagine a completely functional Lisa application that allows you to pull down menus, create, move, scroll, and rearrange windows, update the video display to correspond to mouse movement, and do all the other things associated with the Lisa user interface—only the windows and menus are blank. Then you (as programmer) need only add or modify code to show what's in a window and, in general, specify the behavior necessary to your application (as opposed to being generic to the Lisa user interface). Apple's Toolkit/32 gives you this capability.

The difference in philosophy is significant. In the traditional approach (figure 1), you are responsible for orchestrating correctly both system-general and application-specific behavior. In the toolkit approach (figure 2), you only have to modify and add subroutines to get your application to work. The supplied program is in control and coordinates system-general behavior (e.g., moving and scrolling windows); it calls your code when it needs to know what application-specific behavior you want (for example, what to show in a certain window).

There is nothing wrong with the toolbox (subroutine library) approach—it is certainly better than having to write everything from scratch. It's just that most software developers don't want the absolute freedom to combine library subroutines arbitrarily—they just want to adapt their program to run correctly within the standard desktop-metaphor environment and do it as quickly (and, therefore, as inexpensively) as possible.

### AN EXAMPLE

Let's see how a simple application can be written using an application framework like Toolkit/32. In a few hours, the people at Apple created a simple application called Lisa Boxer. In it, any window opened contains two shaded rectangles that can be moved around. The specific code needed to do this was five pages of Pascal-like code—not much at all, considering the amount of space and comments a structured program includes (see listing 1 for a segment of the code).

*(continued on page 394)*

*Listing 1: An example of Clascal code. This code, part of a five-page listing that creates the Lisa Boxer application, defines the methods that the class TBoxView responds to (i.e., the messages that objects of that type understand) and the code that executes when this class is created. Methods are capitalized, while fields are not. See the text for more details.*

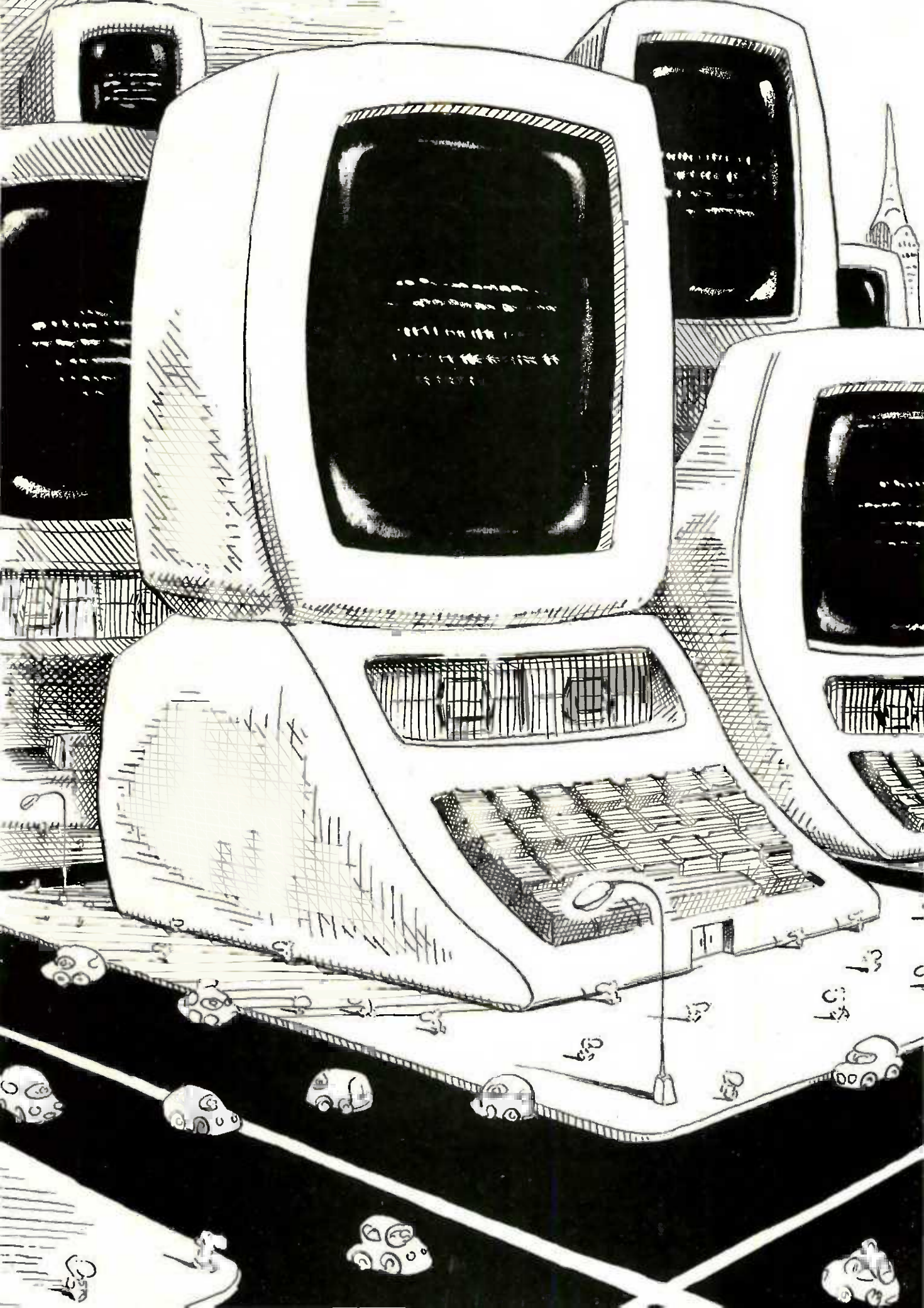
```
METHODS OF TBoxView;
 FUNCTION (TBoxView.)NEW((itsHeap: THeap; itsPanel; itsExtent: LRect;
 itsBoxList: TList; itsPrintable: BOOLEAN): TBoxView);
 BEGIN
 ($IFC fTrace)BP(11);($ENDC)
 SELF := SubObject(TView.NEW(itsHeap, itsPanel, itsExtent, itsPrintable),
 SIZEOF(SELF));
 SELF.boxList := itsBoxList;
 ($IFC fTrace)EP;($ENDC)
 END;

(This returns the box containing a certain point)
 FUNCTION (TBoxView.)BoxWith((LPt: LPoint): TBox);
 VAR box: TBox;
 s: TListScanner;
 BEGIN
 ($IFC fTrace)BP(11);($ENDC)
 boxWith := NIL;
 s := SELF.boxList.Scanner;
 WHILE s.Scan(box) DO
 IF LPtInLRect(LPt, box.shapeLRect) THEN
 boxWith := box;
 ($IFC fTrace)EP;($ENDC)
 END;

(This draws the list of boxes)
 PROCEDURE (TBoxView.)Draw;
 VAR box: TBox;
 s: TListScanner;
 BEGIN
 ($IFC fTrace)BP(10);($ENDC)
 s := SELF.boxList.Scanner;
 WHILE s.Scan(box) DO
 box.Draw;
 ($IFC fTrace)EP;($ENDC)
 END;

CREATION
BEGIN

 cBox := NewClass('Apple', 'TBoxView', SIZEOF(TBoxView), 1, 1);
END;
```



# Communications

---

|                                                                                             |     |
|---------------------------------------------------------------------------------------------|-----|
| <b>THE EVOLUTION OF A STANDARD ETHERNET</b><br><i>by Edwin E. Mier</i> . . . . .            | 131 |
| <b>LOCAL-AREA NETWORKS FOR THE IBM PC</b><br><i>by J. Scott Haugdahl</i> . . . . .          | 147 |
| <b>HIGH-SPEED DIAL-UP MODEMS</b><br><i>by Kim Maxwell</i> . . . . .                         | 179 |
| <b>WRITING COMMUNICATIONS IN BASIC</b><br><i>by Barry J. Arnow</i> . . . . .                | 187 |
| <b>LOOKING FOR THE PERFECT PROGRAM</b><br><i>by David Barr and George deW. Rogers</i> . . . | 199 |
| <b>THE ON-LINE SEARCH</b><br><i>by Suzana Lisanti</i> . . . . .                             | 215 |

---

DATA COMMUNICATIONS has generally been considered a distinct subset within computing. It's not an easy topic to become familiar with for a variety of reasons. A major one is expense—not so much for modems and communications software (although neither of these is cheap) as for line and connect charges. You can run up a phone bill of coronary proportions faster than you ever thought possible. As a result, progress in getting the actual benefit from data communications has been left up to corporations and insomniacs. Nevertheless, progress is being made, and several of the articles in this section will attempt to impart tricks of the trade.

Specifically, Suzana Lisanti's article about using on-line databases to their best advantage may give you some ideas for getting into and out of information repositories as quickly and efficiently as possible.

David Barr and George Rogers also present some suggestions on what to do to get the most out of communicating. Their particular concentration is on those criteria that make useful or useless communications software.

One of the best ways to reduce the amount of money you spend on communications is to reduce the amount of time you spend on line. One of the best ways of cutting your connect time is to speed up your transmission rate. Aha! Most of the time you're told, "You can't get there from here," when you try to pass data at rates higher than 1200 or 2400 bits per second. Kim Maxwell's article will tell you why you've been confronted with this particular brick wall and what movement toward a remedy may be in the wind.

Micro-to-mainframe communications may be the key to greater freedom for the individual data-communications application. It's an area that carries with it tremendous potential for working at home, keeping in touch with the office while traveling, and driving yourself crazy when the pieces don't fit together the way they're supposed to. Barry Arnow has written an informative piece that gives you the basics, points out the pitfalls, and guides you to some possible solutions to the problems of connecting your micro to a mainframe.

Finally, there is the field of local-area networking. For all the hoopla that the megabucks associated with LANs have recently generated, it's not all that difficult a discipline to master. As Ed Mier points out, the technology of local-area networking (Ethernet-style) is well established and not particularly mysterious or frightening once you get past the price tag. Scott Haugdahl creates a further sense of familiarity by pointing out the many personal computer local networks at your disposal. You can pick from a broad array of options and, rather than let the variety bewilder, look at it as the high-tech equivalent of a fruit stand during apple season. Once you know the best uses for the different varieties, it's easy to decide whether you want a pippin or a Granny Smith. You get to take your pick from among some known quantities.

All in all, the application of data communications to personal computing is a nontrivial "next step" that can extend your reach (without compromising your control) into new, or certainly broader, areas of information creation, management, and retrieval. Now if we could just do something about the price. . . .

—Glenn Hartwig, *Technical Editor*



## 10 Reasons Why We're #1 for Sanyo 555-2's

With each Sanyo 550-2 and 555-2 we include, at no additional charge, (1) Sketch-A basic color graphics drawing program (2) 15 Games for the Sanyo-A \$29.95 package (3) Doremaje - An appointment program with a perpetual calendar (4) Diagnostics-Tests your RAM, display, and keyboard (5) P.C. Filer- The program that made Freeware famous (6) J Extra Utilities that don't come on the systems disk (7) I.S. Manager - Allows you to change the structure of existing InfoStar records (like dBASE II).

Plus if you buy from Scottsdale Systems (8) you can choose between Micropro and IUS software on the two drive systems, and (9) we stock software reference manuals for our customers, and (10) we offer factory-trained service.

Yes we have the best prices around, but we have much more. Shop our competition, then shop Scottsdale Systems, you'll find our why we've sold more Sanyo computers than any other dealer in America.

## Introducing The Silver Fox™



Compare the Silver Fox with any other system from any other dealer. You get on MS-DOS machine with an 8088 CPU, a compatibility with over 200 applications programs, Dual drives with total storage of 1.6 megabytes, 256K RAM, video, keyboard, graphics, parallel port, and a 12" high-res green phosphor monitor are standard equipment.

Plus each Silver Fox comes with the best free software bundle in the business including MS-DOS, HAGEN-DOS, M-DISK, WordStar, Easy Writer, DataStar, RepairStar, I.S. Manager, FILEBASE, CalcStar, Color Graphics Basic, Mailmerge, SpellStar, plus 25 games, graphics and utilities. Plus we back it all with a one year warranty, and sell them at a price no other dealer can touch. Call for a free brochure.

**\$1398**

Sanyo "four digit" computers w/free LQ printers 1150's - \$1499 1250's - \$1849 4050 - \$1999



### ALTOS

From the lowest-priced dual-floppy multi-user systems to true 16 bit 10 Mhz, multi-user systems. Local service available via TRW. We will configure, test and install your systems for an additional charge (call for prices).

|        |        |
|--------|--------|
| 580-20 | \$3269 |
| 580-40 | \$3995 |
| 586-20 | \$5699 |
| 586-40 | \$7295 |



### We Discount Robots

Now for a limited time Scottsdale Systems is selling the popular Hero Jr. home robots at \$200 off the list price. Nationwide service via Health/Zenith - while they last only

**\$795**



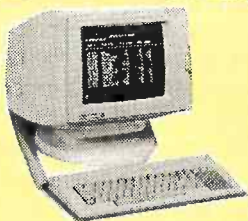
### COLUMBIA

What are you looking for in a compatible system? If maximum compatibility, minimum prices, \$3000 worth of software, reliability and nationwide service are on your checklist you should consider buying a Columbia computer from Scottsdale Systems. Each system includes a software pack with MS-DOS 2.1, Basic 2.0, Perfect Writer, Perfect Calc, Perfect Speller, Perfect Filer, Fast Graphs, Home Accountant Plus, Space Commanders, AT1 tutorials, and T.I.M. IV data base manager. Prices include video card and keyboard. Your choice 1600-1V (4210) or VP.

|                    |        |
|--------------------|--------|
| 1600-4V (10mb)     | \$3099 |
| Professionals from | \$3985 |

**\$1799**

### TERMINALS



|                |       |
|----------------|-------|
| ADD5 Viewpoint | \$439 |
| Wyse 50        | \$499 |

Also great prices on other Wyse and ADD5 terminals-plus Televideo, Qume, and Zenith.

### PLOTTERS

|           |        |
|-----------|--------|
| HI DMP-29 | \$1795 |
| HI DMP-40 | \$745  |
| HI DMP-41 | \$2340 |

### MODEMS

|          |       |
|----------|-------|
| Password | \$308 |
| Mark XII | \$249 |

### Compatible Drives Teac Slimline

|              |       |
|--------------|-------|
| FD54A (160K) | \$79  |
| FD55B (360K) | \$139 |
| FD55F (720K) | \$159 |

### IBM and Zenith Computers Call



## Scottsdale Systems Ltd.

617 N. Scottsdale Road, Suite B, Scottsdale, Arizona 85257

**(602) 941-5856**

Call 8-5 Mon.-Fri.



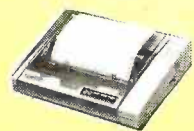


 We participate in arbitration for business and customers through the Better Business Bureau of Maricopa County.

### SINCE 1980

**TELEMARKETING ONLY:** If you plan to visit please call first for an appointment. Prices listed are for cash and include a 3% discount. We sell on a Net 30 basis to Fortune 1200 companies and universities. No C.O.D.'s or A.P.O.'s, P.O.'s add 2%. Visa, Mastercard add 3%. Az. residents add 6%. Prices subject to change, product subject to availability. Personal/company checks take 3 weeks to clear. All items listed are new with manufacturers warranty, 0-20% restocking fee for returned merchandise. Shipping extra-products are F.O.B. point of shipment. Software is not warranted for suitability. Registered trademarks: Televideo-Televideo Systems, Inc.; Silver Fox™, HAGEN-DOS-Scottsdale Systems, Ltd.; Compu-Visual Computer Incorporated.

### PRINTERS



|                            |           |
|----------------------------|-----------|
| Tally Spirit 80            | \$254     |
| Okidata 92 <del>2999</del> | \$125 off |
| Okidata 93 <del>2999</del> | \$210 Off |
| Okidata 84                 | Call      |
| Dataproducts 8050 "loaded" | \$1344    |
| Tally 160L                 | \$589     |
| EpsonFX-80                 | Call      |
| Panasonic 1091             | \$306     |
| Toshiba 1351               | \$1269    |

### LETTER QUALITY

|                  |        |
|------------------|--------|
| Juki 6100        | \$408  |
| Juki 6300        | \$767  |
| Silver Reed 400  | \$259  |
| Silver Reed 500  | \$319  |
| Silver Reed 550  | \$409  |
| Silver Reed 770  | \$799  |
| Diablo 630       | \$1649 |
| Daisywriter 2000 | \$824  |

### NEC LQ Sale

|                |        |
|----------------|--------|
| 2050 (for IBM) | \$689  |
| 3550 (for IBM) | \$1388 |
| 7710           | \$1669 |



### STAR MICRONICS SALE

|            |       |
|------------|-------|
| Gemini 10X | \$253 |
| Power Type | \$306 |
| Radix 15   | \$589 |





# THE EVOLUTION OF A STANDARD ETHERNET

BY EDWIN E. MIER

## *Alternatives in wide-band coaxial cable local networks*

TO MANY, the world of data communications revolves around the familiar RS-232C interface, relatively low-speed modems, and dial-up telephone lines that have changed little over the past 50 years. But, while these basic elements satisfy most rudimentary transmission needs, a host of newer communications schemes and products offer phenomenally greater capabilities—provided, of course, that you are willing to pay the price.

Today's networking products support data rates a hundred times faster than modem-based phone lines, allow simultaneous interconnection of hundreds of user devices, and offer much better transmission-error rates than dial-up phone lines. These networking schemes (sometimes called local-area networks or LANs), differ significantly from phone-line-based networks in four main areas: geographic scope, network topology, data rates supported, and transmission media.

As the name implies, local networks are constrained in the end-to-end distances they support. [Editor's note: the author forgoes the IEEE Project 802 com-

mittee-generated "local-area network" convention as a confusing redundancy.] Though the "local" in local network is generally in contrast with the "long-haul" nature of the telephone network, there is still considerable variety among products. Maximum distances between user devices may range from several hundred feet to 30 miles.

Local networks are oriented toward single buildings or campus-like environments, where the space between network stations is freely accessible to the network's operator. Unlike phone-line connections, which may span continents, local networks presume that rights-of-way are not an issue and that cable runs—through conduits, under floors, underground, etc.—to each station location present no legal problems.

### TOPOLOGY

One of the most significant differences between local networks and .....  
Edwin E. Mier is Western Bureau Manager for Data Communications magazine. He can be contacted at 425 Battery Street, San Francisco, CA 94111.

other communications arrangements is in their topology, or logical and physical configuration. Dial-up phone-line circuits connect only two parties, resulting in a point-to-point physical, as well as logical, connection. Local networks, by contrast, connect many stations logically and physically, usually over the same shared transmission medium (see figure 1). Each functioning device on the local network generally may access any other device, or any group of devices, at any time.

The topological uniqueness of local networks—where a common transmission channel is shared by many users at the same time—necessitates high transmission speeds. Compared to phone lines, which support no more than about 9.6K bits per second, local networks usually operate at data rates at or above 1 megabit per second. This is to be expected because many of the terminal nodes need a portion of the overall data-carrying capacity, or bandwidth. By contrast, only two users need to share the bandwidth of a phone-line circuit.

(continued)

Local networks employ a variety of transmission media in addition to the twisted-pair copper wire. The most common is a coaxial cable, usually 1/4-inch to 1/2-inch in diameter, consisting of a central conductor surrounded by a dielectric insulator, all contained within a wire-mesh or extruded-metallic sheathing. A newer medium used in local networks is lightwave, or fiber-optic, cable.

Coaxial-cable transmission uses one of two technologies: broadband, where multiple channels are frequency-divided over a wide radio-frequency (RF) bandwidth of about 400 MHz; or baseband, where a single modulated carrier signal carries the traffic of all the attached stations.

The cable television (CATV) industry

has used broadband transmission widely for years, and essentially the same technology, with the addition of RF data modems, has been carried over for use in data networks. Baseband coaxial transmission for local networks was first applied in the early 1970s. Originally an experiment within Xerox's Palo Alto Research Center, it resulted in the Ethernet local-network concept.

## ETHERNET

The term "Ethernet" has become almost synonymous with local networks. Ethernet was among the first commercial local-network offerings. It is one of the more prevalent designs in use today but it is by no means representative of all local networks.

Still a trademark of Xerox Corporation, Ethernet was first unveiled commercially in the late 1970s as a method for connecting Xerox office products. However, the concept of a single transmission cable, capable of interconnecting a variety of computer-based devices, quickly caught on within the industry.

In 1980, the first Ethernet technical specification, Release 1.0, was made public, coupled with a joint announcement by Xerox, Intel Corporation, and Digital Equipment Corporation (DEC), that all three would adopt the same compatible Ethernet local-network scheme for the attachment of their respective products and systems. This gesture was made, not surprisingly, at the same time that the Institute of Electrical and Electronics Engineers (IEEE) was beginning to define a standard for local-network structure and operation.

## LOCAL-NETWORK STANDARDS

Clearly, no major computer vendor wanted to jump on the Ethernet bandwagon until it became reasonably certain that the overpublicized local-network scheme would in fact be adopted as a standard.

As it turned out, the IEEE local-network standards group, the Project 802 committee, decided to develop several different local-network standards, the first of which was similar to the original Ethernet specification endorsed by Xerox, Intel, and DEC (see the text box "The Ethernet Specification" on page 134 for more information). The IEEE divided its work into three major subgroups, each dedicated to a different type of local-network access method.

The IEEE 802.3 subcommittee worked on the standard that essentially followed Ethernet: a 10-megabit-per-second baseband coaxial cable-based local network that used an access-control method called carrier-sense multiple-access with collision detection (CSMA/CD). This access-control method and several other aspects of Ethernet had some undesirable design limitations (some of

*(continued)*

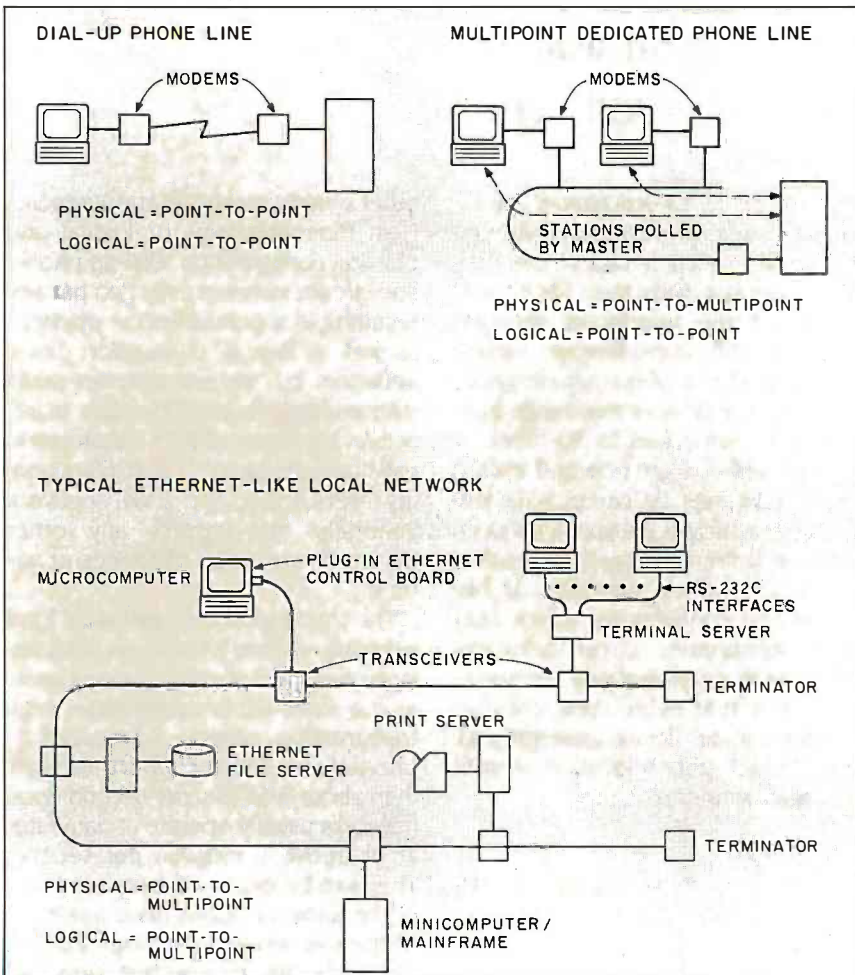


Figure 1: The topology of the local network shows that many stations can be connected—both logically and physically—over the same medium.

Available  
for IBM PC

# What C did for Programming

## Mark Williams has done for C Programming

### The C Programming System from Mark Williams

MWC86 gets your C programs running faster and uses less memory space than any other compiler on the market. Then *csd*, Mark Williams' revolutionary C Source Debugger, helps you debug faster. That's The C Programming System from Mark Williams Company.

#### MWC86

MWC86 is the most highly optimized C compiler available anywhere for the DOS and 8086 environment. The benchmarks prove it! They show MWC86 is unmatched in speed and code density.

MWC86 supports large and small models of compilation, the 8087 math coprocessor and DOS 2.0 pathnames. The compiler features common code elimination, peephole optimization and register variables. It includes the most complete libraries. Unlike its competition, MWC86 supports the full C language including recent extensions such as the Berkeley structure rules, voids, enumerated data types, UNIX\* I/O calls and structure assignments.

Quality is why Intel, DEC and Wang chose to distribute MWC86. These industry leaders looked and compared and found Mark Williams to be best.

#### User Friendly

MWC86 is the easiest to use of all compilers. One command runs all phases from pre-processor to assembler and linker. MWC86 eliminates the need to search for error messages in the back of a manual. All error messages appear on the screen in English.

A recent review of MWC86 in *PC World*, June, 1984, summed it up:

*"Of all the compilers reviewed, MWC86 would be my first choice for product development. It compiles quickly, produces superior error messages, and generates quick, compact object code. The library is small and fast and closely follows the industry standard for C libraries."*

#### *csd* C Source Debugger

Mark Williams was not content to write the best C compiler on the market. To advance the state of the art in software development, Mark Williams wrote *csd*.

*csd* C Source Debugger serves as a microscope on the program. Any C expression can be entered and evaluated. With *csd* a programmer can set tracepoints on variables and expressions with full history capability and can single step a program to find bugs. The debugger does not affect either code size or execution time. *csd* features online help instructions; the ability to walk through the stack; the debugging of graphics programs without disturb-

ing the program under test; and evaluation, source, program and history windows.

*csd* eases the most difficult part of development — debugging. Because *csd* debugs in C, not assembler, a programmer no longer has to rely on old-fashioned assembler tools, but can work as if using a C interpreter — in real time.

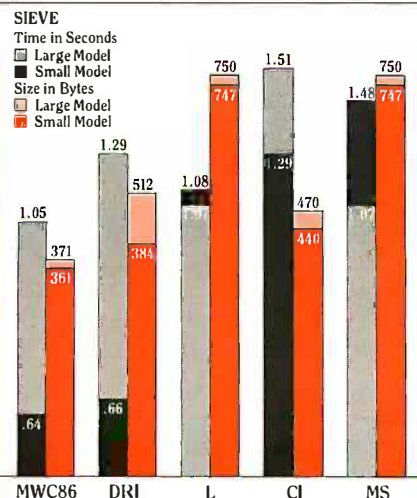
The C Programming System from Mark Williams now supports the following libraries:

| Library                 | Company            |
|-------------------------|--------------------|
| Windows for C           | Creative Solutions |
| Halo                    | Media Cybernetics  |
| PHACT                   | PHACT Associates   |
| The Greenleaf Functions | Greenleaf Software |
| Btrieve                 | SoftCraft          |

### The C Programming System from Mark Williams

The C Programming System from Mark Williams delivers not only the best C compiler for the 8086 but also the only C source level debugger. That's why it does for C programming what C did for programming. The Mark Williams C Programming System gives the programmer the MWC86 C compiler and the *csd* C Source Debugger for only \$495. Order today by calling 1-800-MWC-1700. Major credit cards accepted.

Technical support for The Mark Williams C Programming System is provided free of charge by the team that developed it.



Mark Williams Company  
1430 W. Wrightwood Ave.  
Chicago, IL 60614

\*Unix is a Trademark of Bell Laboratories.

which I'll discuss later), but the majority of the IEEE participants accepted the fact that Ethernet was the closest thing to a de facto industry standard at the time.

The IEEE also developed two other, considerably different, local-network "standards": one employing a bus topology (akin to Ethernet's, where all

devices listen to all transmissions all the time) and another that uses a ring topology. Both employ an access mechanism called token passing. IBM favors the token-ring approach, where each device in the ring retransmits every message it receives in turn. The token-bus subcommittee developed a specification now known as IEEE

802.4, while the token-ring scheme was designated IEEE 802.5. Both of these "Ethernet alternatives" have only recently been approved as standards.

Despite the fact that all three local-network alternatives (802.3, 802.4, and 802.5) were under development

(continued)

## THE ETHERNET SPECIFICATION

The Ethernet specification, which is now also an IEEE standard (IEEE 802.3), spells out every detail of Ethernet construction and operation (see figure 2). To be "Ethernet-compatible," a local network or board-level interface must conform to every detail relating to cabling, control, physical interfaces, and packet structure. The following is a capsulized summary of the specification.

Ethernet requires a 50- $\Omega$  (ohm) coaxial cable, with impedance varying no more than + or - 2 $\Omega$ . The maximum signal loss from one end of a cable "segment" to the other is 8.5 dB (decibels)

at 10 MHz. Cable shielding may allow for an ambient field of no more than 2 V (volts) per meter (for operation up to 30 MHz), and a transfer impedance of no more than 1 m $\Omega$  (milliohm) per meter for operation from 0.1 to 20 MHz. The cable itself consists of a 0.0855-inch center conductor of solid tinned copper, a foam polyethylene or foam Teflon core insulator, and a PVC (polyvinyl chloride) or Teflon fluorinated ethylene propylene (FEP) jacket. The outside cable diameter must be 0.405 inch.

Up to 100 transceivers, or taps, may be placed on a cable segment, but they must not be closer together than 2.5

meters. Single cable segments may be 1500 feet in length; extensions are possible if you use "repeaters," which regenerate the signal from one cable segment to another.

Ethernet cable attachment is "passive"; that is, the cable is not broken or cut, and the tap (a "vampire" type with two piercing "fangs") can normally be inserted or extracted without affecting other communications over the cable. The transmit power level is -1.025 V DC (direct current) (at 41 mA (milliamperes); variations are from -0.9 to -1.2 V (36 to 48 mA). Voltage must never be positive on the coaxial cable.

The transceiver encodes data on the cable using Manchester encoding to ensure a signal transition in the middle of each bit "cell," or data transition. Each bit cell is 100 ns (nanoseconds) long (+ or - 0.01 percent). The data rate is 10 megabits per second. The transceiver cable, up to 50 meters in length, consists of four pairs of #20 or #22 gauge wire inside an insulating shield jacket. Impedance is 78  $\Omega$  and maximum signal loss is 3 dB at 10 MHz. One male and one female 15-pin D-series connector terminates either end of the transceiver cable. Naturally, pin assignments are all specified in the standard.

The minimum size of a packet is 72 bytes; the maximum packet size is 1526 bytes (see figure 2). No device may transmit if a carrier is detected on the cable, and a minimum waiting period of 9.6  $\mu$ s (microseconds) must be observed after one transmission before another can begin. In the event of a collision, devices must back off for a random period of time before retransmitting. The period is determined by a "back-off" algorithm designed to accommodate up to 1024 stations on the cable.

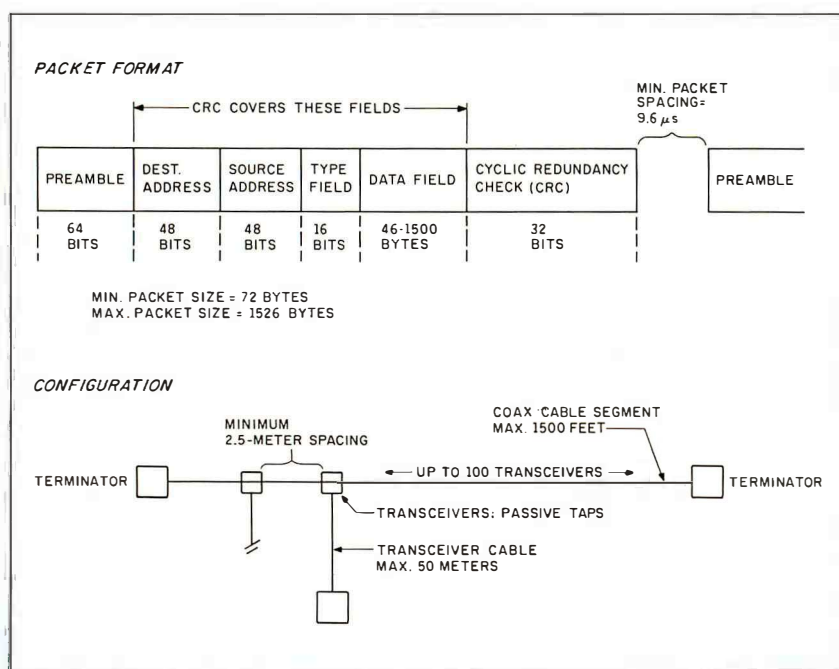


Figure 2: The Ethernet specification, as defined by Xerox and later the Project 802 committee of the IEEE, covers physical and logical dimensions.

# Champagne Taste Beer Budget



**\$795 10 MEGA-BYTE HARD DISK SYSTEM**  
**\$1095 20 MEGA-BYTE HARD DISK SYSTEM**  
 NOW INCLUDES ASSIST/PAK™ SOFTWARE\*

• • **THE INSIDER SERIES** • •

- |                                            |                                                 |
|--------------------------------------------|-------------------------------------------------|
| IS00 • 10 MEGA-BYTE WINCHESTER . . . \$795 | IS16 • MICRO-TAPE BACKUP SYSTEM . . . \$995     |
| W/Hard disk controller                     | with power supply                               |
| IS20 • 20 MEGA-BYTE WINCHESTER . . \$1095  | XT01 • MICRO-TAPE W/1/2 High Floppy . . . \$995 |
| W/Hard disk controller                     |                                                 |
| IS40 • 40 MEGA-BYTE WINCHESTER . . \$2295  | ISPS • POWER SUPPLY . . . . . \$295             |
| W/Hard disk controller and pwr. supply     |                                                 |

ALSO AVAILABLE: SINGLE-CARD FLOPPY/HARD DISK CONTROLLER ADD \$185.00 TO ABOVE PRICES  
**ONE YEAR WARRANTY - 30 DAY MONEY BACK GAURANTEE.**

Command/Assist™ • Dos manual on-Disk - There when you need it!  
 Cache/Assist™ - A new HARD disk caching program gives more speed - faster disk access time and increased throughput

Micro Design International Inc.; 6566 University Blvd.; Winter Park, FL 32792

Micro Design International Inc (MDI) is an 8 year old Company Specializing in internal upgrades for IBM PC, XT and PC Compatables. MDI has extensive experience in magnetic media-management systems.

**FOR ORDERS CALL COLLECT: (305) 677-8333**

IBM is a registered trademark of International Business Machine Corporation.  
 Hard disk drives by Microscience International Inc. We accept VISA/MC

at the same time, Ethernet implementations began to mushroom when the IEEE's CSMA/CD specification (802.3) finally began to solidify. In fact, the DEC-Intel-Xerox triumvirate, which pioneered the initial Ethernet "standard," made several subtle changes to their specification to bring it in closer alignment with the IEEE 802.3 document.

As a result, IEEE's 802.3 and Ethernet are today virtually identical. Technical gurus familiar with both specifications maintain that a later-release Ethernet implementation will handle all the functions required by the IEEE 802.3, and that the remaining differences will be inconsequential.

**ETHERNET PROS AND CONS**

The Ethernet specification, and the IEEE 802.3 document that embodies it, allows devices with compatible interfaces to be interconnected over a shared coaxial cable. However, without higher-level software, devices from different manufacturers are still not able to communicate. This is because the true differences between computers are not addressed by the

Ethernet standard, only their ability to exchange bits on a physical level.

It is at these higher levels that many who buy Ethernets or Ethernet-compatible products are sorely disappointed. Table I shows a comparison of the characteristics of the leading Ethernet-compatible board manufacturers. It should be noted that, even though the microprocessor chip sets employed are different, all will interact reasonably well together over the common Ethernet cable. However, note that there are two different higher-level protocol sets employed by the different manufacturers: XNS and TCP/IP.

The Xerox Network System (XNS) is perhaps the most prevalent of the high-level protocols employed in Ethernet interfaces today. It is a derivative of the software developed by Xerox for handling network messaging and logical session management between devices over the Xerox Ethernet.

The Transmission Control Procedure/Internet Protocol (TCP/IP) is a set of network software utilities that perform the same functions as XNS.

TCP/IP is borrowed from the software developed by the Department of Defense for use in handling network connections over the early Advanced Research Projects Agency Network (ARPANET), a long-haul packet-switching network constructed in the 1960s.

In their zeal to market early Ethernet-compatible products, manufacturers chose one or the other of these high-level protocol sets. As a result, an interface from a vendor using one of these protocol sets generally will not work with an interface board that employs the other. Ironically, this subtle difference in software, quite often fixed in the Ethernet interface's ROM (read-only memory) firmware, negates the universal interconnectivity that was the whole point of the Ethernet local network.

**COST SHARING**

Early Ethernet interfaces cost between about \$2000 and \$3000. Each consisted of two, and sometimes three, plug-in boards. Users with several microcomputers to network generally scoffed at the idea of using Ethernet because of the cost. The few early Ethernet installations typically connected high-performance mini-computers from the same vendor, such as DEC VAXes, where high-speed communications within a processor "cluster" were needed and board space and cost were not as critical.

The first big break for Ethernet came when vendors realized that a single interface could be shared by many devices, thereby significantly lowering the Ethernet cost-per-device-attachment. These multiport stand-alone interface units generally offer RS-232C ports for attaching terminals and microcomputers in the dumb, asynchronous-terminal mode. A few examples of these terminal servers currently include:

- Interlan's NTS-10 Network Terminal Server, either in 4- or 8-port versions, incorporates Intel 80186 and 82586 (Ethernet) microprocessors with 128K bytes of RAM (random-access read/

*(continued)*

*Table I: A significant point is that vendors supporting the XNS protocol and those supporting the TCP/IP protocol produce noncompatible gear.*

| Ethernet Plug-In Board Vendor                                    | On-Board Micros                                             | High-Level Protocol Set | Host Environment                   | Cost          |
|------------------------------------------------------------------|-------------------------------------------------------------|-------------------------|------------------------------------|---------------|
| Bridge Communications<br>Cupertino, CA<br>Ethernet Controller/2  | M68000,<br>AMD Lance                                        | XNS                     | UNIX<br>(OEM to Honeywell)         | \$1500-\$3000 |
| Communication Machinery Corp.<br>Santa Barbara, CA<br>ENP Series | M68000,<br>AMD Lance                                        | XNS,<br>or TCP/IP       | UNIX, RSX,<br>VMS                  | \$2000-\$3000 |
| Excelan<br>San Jose, CA<br>EXOS 200 Series                       | Intel 80186,<br>82586                                       | TCP/IP                  | UNIX (OEM to NCR)                  | \$2000-\$4000 |
| Interlan<br>Westford, MA<br>NET/PLUS Series                      | Current AMD 2901 Bit-Slice<br>Intel 80186,<br>82586 planned | XNS                     | UNIX, RSX,<br>VMS, DG<br>AOS, RDOS | \$1400-\$3200 |
| 3Com<br>Mountain View, CA<br>EtherSeries                         | None,<br>uses host processor                                | XNS                     | IBM PC, TI Professional,<br>HP 150 | \$800         |

TOLL FREE ORDERS ONLY! **800-631-0962**  
 (INSIDE CALIFORNIA) **800-521-6162**

Customer Service **HOTLINE**  
 (408) 371-9078

# GUARANTEED the LOWEST!

OUR PRICE GUARANTEE - It's Simple! We'll beat any ad in this magazine - same terms - call TOLL FREE for details!

**DCC DISCOUNT COMPUTER CENTERS**  
 OUR CUSTOMER SATISFACTION GUARANTEE: If for any reason your DCC purchase fails to meet manufacturers specifications within 30 days of purchase, please return it to us for a full refund or exchange of your choice! Sorry, software excluded due to copyright laws.

**EPSON** all models!  
 RX/FX and LQ1500  
 also NEW JX80  
 (7 colors)

**PRINTER SALE!!!**

models 82/83/84 and 92/93!  
 also 2410 (350 cps)!

**OKIDATA**

**IBM PC** \$1695 2 drvs 256K  
 or 2 drives/256K,  
 10 mg hard disk

**IBM XT** \$3495  
 10 mg. hard disk  
 256K, 1-360Kb drive only

**FRAMEWORK \$355**  
 ASHTON-TATE  
 \*\*\*\*\*SPECIAL\*\*\*\*\*  
**\$355 dBASE III**

**COMPUTERS**

IBM PC & XT ..... See special above!!!

PC with 1 drive/64K ..... 1395  
 PC with 1 drive/256K ..... 1575  
 PC with 2 drives/256K ..... 1695  
 PC with 10mg HD/2 drvs/256K ..... 2495  
 XT with 1 drive/128K ..... 3449  
 XT with 2 drives/256K ..... 3695

**PRINTERS**

\*\*\*\*DOT MATRIX\*\*\*\*

EPSON RX 80 100 cps ..... 239  
 RX 80 F/T 100 cps ..... 294  
 RX 100 100 cps, 132 col. .... 399  
 FX 80 or JX 80 ..... best price  
 FX 100 160 cps, 132 col. .... in  
 LQ 1500 200 cps NEW! ..... magazine  
 OKIDATA 82A/83/84 ..... Save  
 93P ..... All  
 2410 ..... Models  
 Drastically Reduced!!!

GEMINI 10-X ..... 239  
 15-X ..... 349  
 DELTA 10 or 15 ..... Special  
 REXIA 10 or 15 ..... \$Call

**IBM SOFTWARE**

\*\*\*\*SPREADSHEET\*\*\*\*

FRAMEWORK Monthly Special ..... 355  
 FRIDAY ..... 195  
 SUPERCALC 3 ..... 228  
 MULTIPLAN ..... 136  
 \*\*\*\*IBM WORDPROCESSORS\*\*\*\*

WORDSTAR PRO PACK ..... 249  
 PFS WRITE ..... 84  
 MULTIMATE ..... 249  
 WORD W/MOUSE ..... 269  
 VOLKSWRITER DELUXE ..... 159  
 PFS PROOF ..... 84

**IBM - BOARDS**

HERCULES GRAPHICS ..... 315  
 HERCULES COLOR New! ..... 175  
 AST SIX PAK W/64K ..... 249  
 MEGAPLUS ..... 259  
 STB GRAPHX PLUS ..... 322  
 EVEREX GRAPHIC EDGE ..... 379  
 H.D. CONTROLLER ..... 299  
 MAGIC CARD ..... 199  
 QUADRAM QUADBOARD W/64K ..... 269  
 QUADLINK ..... 449  
 IBM MONOCHROME ..... 249  
 COLOR GRAPHICS ..... 219  
 PLANTRONICS COLOR PLUS ..... 358  
 MA SYSTEMS PC PEACOCK ..... 84  
 COLOR GRAPHICS ..... 235  
 TECHMAR GRAPHICS MASTER ..... 475

**APPLE - BOARDS**

ORANGE MICRO GRAPPLER + ..... 113  
 BUFFERED w 64K ..... 168  
 MICROMAX GRAPHMAX ..... 99  
 VIEWMAX 80 ..... 139  
 VIEWMAX 80E W/64K ..... 189  
 MAC DISKETTES ..... 26  
 IIC PRINTER INTERFACE ..... 59  
 SUPER COOLING FAN ..... 49

**MONITORS**

IBM MONOCHROME ..... 259  
 COLOR ..... 589  
 AMDEK 300G ..... 129  
 300A ..... 145  
 310A ..... 165  
 COLOR 600 ..... 419  
 COLOR 700 ..... 469  
 TAXAN 12" Green ..... 114  
 12" Amber ..... 117  
 420 RGB ..... 439  
 PRINCETON HX-12 ..... 467  
 SR-12 ..... 649  
 MAX-12 ..... 184  
 ZENITH 122 - 12" G ..... 93  
 12" A ..... 93  
 124 MONO - IBM ..... 169  
 133 RGB ..... 446  
 135 RGB/COMP ..... 475

\*\*\*\*DAISY WHEEL\*\*\*\*

PRIMAGE I 55 cps, SER/PARR ..... 1395  
 w/Cut Sheet Feeder ..... 1695

BROTHER DAISY WHEEL

HR-15 ..... 339  
 HR-25 ..... 569  
 HR-35 (96 cps) ..... 769  
 JUKI 6100 ..... 409  
 JUKI 6300 ..... 749  
 DIABLO 620 ..... 829  
 36 ..... 1276  
 630 ..... 1689  
 DYNAX DX-15 ..... 339  
 NEC all models ..... \$Call  
 QUME all models ..... \$Call

**IBM DATA BASE\*\***

dBASE II ..... 284  
 dBASE III ..... 355  
 PFS FILE ..... 84  
 CONDOR III ..... 84  
 R-BASE 4000 ..... 279  
 R-BASE CLOUT ..... 129

\*\*\*\*IBM MISC\*\*\*\*

SIDKICK ..... 45  
 COPY II PC ..... 29  
 THINKTANK ..... 129  
 PROKEY 3.0 ..... 749  
 HARVARD PROJECT MGR ..... 295  
 SIDWAYS ..... 45  
 NORTON UTILITIES ..... 55  
 PFS REPORT ..... 219  
 DOW JONES ANALYST ..... 79  
 SET FX + ..... 47

**IBM ACCESSORIES**

64K RAM CHIPS 200ns ..... 39  
 150ns ..... 39  
 IBM KEYBOARDS ..... 179  
 KEYTRONICS 5151 NEW! ..... 199  
 5150 ..... 189  
 MICRO-SOFT MOUSE ..... 144  
 MOUSE SYSTEM-MOUSE ..... 139  
 KOALA PAD ..... 85  
 JOYSTICKS - KRAFT/HAYES ..... 45

**ACCESSORIES**

PRINTER RIBBONS all makes ..... Low!!!  
 64K RAM chips SALE ..... 39  
 VERBATIM SS/DD diskettes ..... 21  
 DS/DD diskettes ..... 27  
 DYSPAN SS/DD diskettes ..... 26  
 DS/DD diskettes ..... 34  
 DISK MINDER-PLEXI (75) ..... 19  
 DISK MINDER W/KEY (100) ..... 24  
 SURGE PROTECTOR Compugard ..... 59  
 PTI POWER BACK-UP 200 w ..... 299  
 300 w ..... 399  
 FINGERPRINTS - EPSON all models ..... 48  
 PRINTER DUST COVER all models ..... 10  
 MONI-BASE Monitor Stands ..... 19  
 COMPUTER PAPER all makes ..... Low!!!  
 PRINTER STANDS Plexiglass ..... 29/39  
 SURGE PROTECTORS ..... \$Call

**MODEMS**

HAYES 300 ..... 199  
 1200 ..... 468  
 1200B IBM INTERNAL ..... 389  
 MICROMODEM II E ..... 209  
 ANCHOR MARK XII ..... 259

**DRIVES**

IBM 360 KB ..... 219  
 TANDON 100-2 360KB ..... 185  
 APPLE DRIVES Sale ..... 149

**WORDSTAR PRO PACK**

• Wordstar • Star Index  
 • Correct Star • Mail Merge

only **\$295**

**COGITO**

10 MG HARD DISK

• 1/2 Hi Internal \$  
 • Controllers \$  
 Card and Cables!

**699**

**SHUGART**

1/2 Hi-Drives \$119  
**IBM™ \$219**  
 360Kb drvs.

**QUADRAM 384K QUADBOARD**

w/64K RAM **\$249**

**AST \$229 SIX PAK PLUS**

w/64K RAM **\$249**

**DCC DISCOUNT COMPUTER CENTERS**  
 an established mail order/retail distribution network

BUYER FRIENDLY TERMS! • DELIVERY We ship immediately! Most orders delivered within 5 days! Add 3% (15% min) for UPS shipping, handling, insurance, Calif. residents add 6.5% sales tax. 2<sup>nd</sup> day UPS available at extra charge. • PAYMENT Visa, M/C, cashiers checks, money orders, personal checks accepted. (Allow 10 business days for personal/company checks to clear). WE NEVER CHARGE EXTRA FOR CREDIT CARDS! C.O.D.'s welcome (20% p/p deposit) with cash, certified check or money order. • WARRANTY All items shipped are new, include FACTORY WARRANTY and are GUARANTEED TO WORK. DCC is an AUTHORIZED DEALER and SERVICE CENTER for most major brands. • RETURNS Must be accompanied by RMA number (supplied by DEALER) and may be subject to a 20% restocking fee. Prices and availability subject to change without notice. All items limited to stock on hand. • MAIL ORDER PRICES NOT VALID AT RETAIL OUTLETS DUE TO REGIONAL PRICING RESTRICTIONS. Minimum order 150\*

1707 S. BASCOM AVE • SAN JOSE, CA 95008 • (408) 559-6555  
 1243 W. EL CAMINO • SUNNYVALE, CA 94087 • (415) 965-4494  
 1341 FULTON AVE • SACRAMENTO, CA 95825 • (916) 971-3503

**FREE - VISA/MC!**

**VISA**

**VISIT OUR DISCOUNT SHOWROOMS!**

write memory). Cost for an 8-port server is \$3200, or \$400 per attached device.

- Bridge Communications' CS/I Communications Server is available in 8-, 16-, 24-, or 32-port versions. The CS/I reportedly will support asynchronous and bisynchronous terminal devices via RS-232C, RS-449, and CCITT (Consultative Committee for International Telephony and Telegraphy). Price for a 32-port version starts at \$9900, or roughly \$315 per attached device. The CS/I is said to be driven by a Motorola 68000 processor with up to 512K bytes of RAM.

- Ungermaun-Bass's NIO-150 Network Interface Unit supports up to six RS-232C-equipped ports. A six-port unit costs \$2800, or roughly \$450 per device.

There are other manufacturers of shared Ethernet interfaces, and prices

are expected to drop even lower as specialized Ethernet chip sets become widely available and implemented. Via these multiport adapters, you can reasonably expect attachment prices per device to eventually nestle into the \$250 to \$300 range. Ethernet terminal connections then would be reasonably competitive with other local-area transmission means, such as short-haul or limited-distance modems and twisted-pair phone lines.

#### CHIP SETS

The greatest boon to Ethernet and Ethernet-like local networks is the reduction of the complex control circuitry to several semiconductor chips. A number of chip suppliers have decided to vigorously pursue this market, the two most notable being Advanced Micro Devices, or AMD, and Intel.

The AMD Ethernet microprocessor,

called Lance, will reportedly handle most Ethernet packet-forming and network-control functions and will interface with a number of 16-bit microprocessors, including the 8086, Z8000, Motorola 68000, and DEC LSI-11. The Lance is generally employed in the same board with one of these processors, along with another chip called the serial interface adapter (SIA).

The SIA, increasingly based on bipolar technology and available from chip makers such as Seeq and Fujitsu, performs many of the Ethernet synchronization and Manchester encoding (a straightforward modulation technique in which an electrical pulse represents either the clock signal or logical 1 and the absence of a pulse equals logical 0) functions associated with the cable transceiver. Ethernet board suppliers adopting or planning to adopt the Lance microcomputer reportedly include Communications Machinery Corporation (CMC), Bridge Communications, and DEC.

Intel's Ethernet chip offering is the 82586, which is said to be a more generic microprocessor than the AMD Lance, although still oriented toward Ethernet network processing. When large quantities of this chip are available, deployment with one of Intel's generic microcomputers, probably the 80186 or 80286, will comprise the Intel-based single-board Ethernet interface. The 82586 reportedly costs more than AMD's microprocessor, although the current \$80 price tag for quantity purchases is expected to drop. Ethernet interface suppliers said to be awaiting delivery of the Intel chips include Hewlett-Packard, Excelan, and Interlan.

#### ETHERNET SUPPORT

End users typically have two choices for implementing an Ethernet: they can either buy plug-in boards for their processors, which requires some host-software modification, or they can buy Ethernet interfaces from the computer manufacturer, which generally come complete with software for

(continued)



**TOTAL CONTROL WITH LMI FORTH**

Try the *professional language* offering the *utmost performance* in the *shortest development time*. Transport your applications between any of our enhanced 83-Standard compilers or expanded 32-bit versions. Choose from our wide selection of programming tools including native code compilers, cross-compilers, math coprocessor support, and B-Tree file managers. All fully supported with hot line, updates, and newsletters.

**PC FORTH™**  
 IBM PC & XT,  
 HP-150,  
 Macintosh,  
 Apple II,  
 CompuPro,  
 Sage & CP/M-68K,  
 Wang PC,  
 All CP/M and  
 MSDOS computers.

**Laboratory Microsystems Incorporated**  
 Post Office Box 10430, Marina del Rey, CA 90295  
 Phone credit card orders to (213) 306-7412





# COMPUTER WAREHOUSE

CALL TOLL FREE **1-800-528-1054**

## PRINTERS

|                                        |        |
|----------------------------------------|--------|
| <b>Anadex</b>                          |        |
| 9825 B.....                            | \$1129 |
| WP6000.....                            | \$2039 |
| DP6500.....                            | \$2259 |
| <b>Brother</b>                         |        |
| DX-15.....                             | \$369  |
| HR-25.....                             | \$649  |
| HR-35.....                             | \$875  |
| <b>C-Itch</b>                          |        |
| A10-20.....                            | \$459  |
| F-10 Parallel or Serial.....           | \$909  |
| 55 CPS Serial or Parallel.....         | \$1189 |
| 8510 Parallel (Prowriter).....         | \$315  |
| 8510 SP.....                           | \$435  |
| 8510SCP.....                           | \$509  |
| 8510 BPI.....                          | \$335  |
| <b>Comrex</b>                          |        |
| CR-2 Paralle.....                      | \$339  |
| CR-2 Serial.....                       | \$499  |
| CR-2 Keyboard.....                     | \$129  |
| CR-3.....                              | Call   |
| <b>Datasouth</b>                       |        |
| DS180.....                             | \$1149 |
| DS220.....                             | \$1469 |
| <b>Diablo</b>                          |        |
| 820.....                               | \$694  |
| 830API.....                            | \$1499 |
| 830ECS.....                            | \$1669 |
| 830 ECS/IBM.....                       | \$1669 |
| Series 36.....                         | \$1139 |
| 801F.....                              | \$2649 |
| P12CQI.....                            | \$ 529 |
| P32CQI.....                            | \$ 759 |
| S32CQI.....                            | \$ 839 |
| P38.....                               | \$1639 |
| S38.....                               | \$1719 |
| C150.....                              | \$ 999 |
| <b>Epson All Printer Models.....</b>   |        |
| <b>Call</b>                            |        |
| <b>Inforunner</b>                      |        |
| Riteman.....                           | \$249  |
| <b>Juki</b>                            |        |
| 5500.....                              | Call   |
| 6100.....                              | Call   |
| 6300.....                              | Call   |
| <b>NEC</b>                             |        |
| 2010, 2015, 2030.....                  | \$639  |
| 2050.....                              | \$669  |
| 3510, 3515, 3530.....                  | \$1215 |
| 3550.....                              | \$1359 |
| 7710, 7715, 7730.....                  | \$1649 |
| P2, P3.....                            | Call   |
| <b>Okidata All Printer Models.....</b> |        |
| <b>Call</b>                            |        |
| <b>Panasonic</b>                       |        |
| 1091.....                              | \$299  |
| 1092.....                              | \$445  |
| <b>Qume</b>                            |        |
| Letter Pro 20 Parallel or Serial.....  | \$619  |
| 11/40 W/Interface.....                 | \$1369 |
| 11/55 W/Interface.....                 | \$1569 |
| <b>Silver Reed</b>                     |        |
| EXP400.....                            | \$245  |
| EXP500 Parallel.....                   | \$339  |
| EXP500 Serial.....                     | \$339  |
| EXP550 Parallel.....                   | \$399  |
| EXP550 Serial.....                     | \$399  |
| 770 Parallel.....                      | \$789  |
| 770 Serial.....                        | \$789  |
| <b>Star Micronics</b>                  |        |
| All Printer Models.....                | Call   |
| <b>Tally</b>                           |        |
| MT 160L.....                           | \$555  |
| MT 180L.....                           | \$769  |
| Spirit 80.....                         | \$245  |
| <b>Toshiba</b>                         |        |
| P1340 Parallel or Serial.....          | \$709  |
| P1351 Parallel or Serial.....          | \$1249 |

## \*SPECIALS OF THE MONTH\*

### COLUMBIA COMPUTERS

All systems include fifteen software packages with a \$3,200 value.

MPC4210 MPC4220  
MPC4610 MPC4620  
Columbia VP

**PRICED TOO LOW  
TO ADVERTISE**  
Call for Prices.

### TECMAR HARD DISK SUB-SYSTEMS

#### Macintosh



|                                             |        |                                           |        |
|---------------------------------------------|--------|-------------------------------------------|--------|
| 5 Megabyte Removable.....                   | \$1480 | 10 Megabyte in Mini Cabinet.....          | \$1775 |
| 10 Megabyte Fixed.....                      | \$1480 | 15 Megabyte in Mini Cabinet.....          | \$2050 |
| 10 Megabyte Fixed/5 Megabyte Removable..... | \$2450 | 5 Megabyte Removable in Mini Cabinet..... | \$1495 |
| Dual 5 Megabyte/both removable.....         | \$2450 |                                           |        |

### VIDEO TERMINALS

|                          |       |
|--------------------------|-------|
| <b>ADDS</b>              |       |
| A-2 Green.....           | \$469 |
| A-3.....                 | \$469 |
| Viewpoint 60.....        | \$485 |
| Viewpoint 90.....        | \$849 |
| <b>Altos</b>             |       |
| Smart II.....            | \$699 |
| <b>Qume</b>              |       |
| QVT 102 Green.....       | \$399 |
| QVT 102 Amber.....       | \$419 |
| QVT 103 Green.....       | \$816 |
| QVT 103 Amber.....       | \$850 |
| QVT 108 Green.....       | \$449 |
| QVT 108 Amber.....       | \$519 |
| <b>Televideo</b>         |       |
| 910.....                 | \$439 |
| 910+.....                | \$559 |
| 914.....                 | \$515 |
| 924.....                 | \$635 |
| 925.....                 | \$700 |
| 950.....                 | \$905 |
| 970.....                 | \$985 |
| 800A (User Station)..... | \$979 |
| Personal Terminal.....   | \$385 |
| <b>Wyse</b>              |       |
| 50.....                  | \$489 |
| 75.....                  | \$565 |
| Zenith Z-29.....         | \$599 |

### DISKETTES

|                            |       |
|----------------------------|-------|
| <b>Maxell</b>              |       |
| MD-1 (Qty 100).....        | \$175 |
| MD-2 (Qty 100).....        | \$225 |
| <b>Scotch</b>              |       |
| 5 1/4 SS/DD (Qty 100)..... | \$175 |
| 5 1/4 DS/DD (Qty 100)..... | \$245 |
| <b>Elephant</b>            |       |
| 5 1/4 SS/SD (Qty 100)..... | \$135 |

### COMPUTERS

|                                       |          |
|---------------------------------------|----------|
| Altos All Computer Models.....        | Call     |
| Columbia.....                         | Call     |
| Leading Edge Personal Computer.....   | Call     |
| <b>NEC</b>                            |          |
| PC-8201 Computer.....                 | \$459    |
| PC-8201A-90 Battery Pack.....         | \$17     |
| PC-8206A 32K Ram.....                 | \$305    |
| PC-8271A-01 AC Adapter.....           | \$17     |
| PC-8271A-02 AC Adapter.....           | \$17     |
| PC-8281A Recorder.....                | \$89     |
| <b>Northstar</b>                      |          |
| All Computer Models.....              | Call     |
| <b>Sanyo MBC-77 Portable</b>          |          |
| MBC-550 System.....                   | Call     |
| MBC-555 System.....                   | Call     |
| MBC-550-2 System.....                 | Call     |
| MBC-555-2 System.....                 | Call     |
| <b>Televideo</b>                      |          |
| 802H.....                             | \$4285   |
| 803.....                              | \$1765   |
| 803H.....                             | \$2850   |
| 806/20.....                           | \$4640   |
| TPC-1.....                            | \$869    |
| TPC-2 Dual Drive.....                 | \$1749   |
| TPC-2 Single Drive.....               | \$1509   |
| 1605.....                             | \$1729   |
| <b>Zenith</b>                         |          |
| Z-150 Single Drive.....               | Save 25% |
| Z-150 Dual Drive.....                 | Save 25% |
| Z-150 W/10 Megabyte.....              | Save 25% |
| Z-160 Single Drive.....               | Save 25% |
| Z-160 Dual Drive.....                 | Save 25% |
| <b>MODEMS</b>                         |          |
| <b>Anchor Automation</b>              |          |
| Mark XII.....                         | \$239    |
| <b>Hayes</b>                          |          |
| Smartmodem 300 Baud.....              | \$189    |
| Smartmodem 1200 Baud.....             | \$459    |
| Smartmodem 1200B Baud (IBM).....      | \$389    |
| Micromodem IIE (Apple).....           | \$214    |
| <b>Racal-Vadic All Models.....</b>    |          |
| <b>Call</b>                           |          |
| <b>US Robotics Password 1200.....</b> |          |
| <b>\$319</b>                          |          |

### MONITORS

|                                |             |
|--------------------------------|-------------|
| Amdek All Monitors.....        | Call        |
| <b>Princeton Graphic</b>       |             |
| HX-12.....                     | \$479       |
| <b>Sanyo</b>                   |             |
| CRT-30.....                    | \$99        |
| CRT-36.....                    | \$149       |
| CRT-50.....                    | Call        |
| CRT-70.....                    | \$549       |
| <b>Sony</b>                    |             |
| 19" RGB (KX1901A).....         | \$709       |
| 25" RGB (KX2501A).....         | \$1089      |
| Taxan 12" Amber.....           | \$125       |
| <b>Visual</b>                  |             |
| Computer.....                  | From \$1469 |
| <b>Zenith</b>                  |             |
| ZVM-122 Amber.....             | \$95        |
| ZVM-123 Green.....             | \$95        |
| ZVM-124.....                   | \$129       |
| ZVM-133 Color/RGB.....         | \$410       |
| ZVM-135 Color/RGB W/Audio..... | \$459       |

### DISK DRIVES

|                                |        |
|--------------------------------|--------|
| <b>lomega</b>                  |        |
| Bernoulli Box for IBM.....     |        |
| 10 Megabyte.....               | \$1950 |
| 20 Megabyte.....               | \$2660 |
| <b>Rana</b>                    |        |
| Elite I.....                   | \$199  |
| Elite II.....                  | \$269  |
| Elite III.....                 | \$399  |
| Controller (W/Drive Only)..... | \$69   |
| 1000 W/DOS for Atari.....      | \$305  |

### TECMAR

|                          |       |
|--------------------------|-------|
| Graphics Master.....     | \$449 |
| 128K Dynamic Memory..... | \$225 |
| 256K Dynamic Memory..... | \$299 |
| Captain 128K.....        | \$299 |
| Captain 256K.....        | \$399 |

Order Line: 1-800-528-1054

Order Processing &

Other Information: 602-954-6109

2222 E. Indian School Rd.

Phoenix, Arizona 85016

**GEMINI**  
**10X or 10XPC**  
with  
**Cable & Paper**  
**Super Price**  
**CALL**

**COMPUTER  
WAREHOUSE**



Store Hours: Mon-Fri 10-5:30 Saturday 9-1  
Order Line Hours: Mon-Fri 8:30-5:30 Saturday 9-1



Prices reflect 3% to 5% cash discount. Product shipped in factory cartons with manufacturer's warranty. Please add \$8.00 per order for UPS shipping. Prices & availability subject to change without notice. Send cashier's check or money order...all other checks will delay shipping two weeks.

specific processors and network applications.

For the most part, computer manufacturers are licensing Ethernet interfaces from one of the plug-in board suppliers. Honeywell, for example, added its own software interfaces to Ethernet hardware acquired from Bridge Communications. Honeywell now offers Ethernet adapters for its DPS 8 and 88 mainframes, DPS 6 minicomputer, and 6/10 and 6/20 microcomputers.

Other computer vendors that have jumped on the Ethernet bandwagon include DEC, Hewlett-Packard, Data General, AT&T (for its 3B UNIX-based systems), Texas Instruments (for its complete line of System 300, 600, 800, and 900 series processors) and NCR (for its Tower multiuser system). NCR now offers a personal computer local network believed to be licensed from Corvus, which sells a popular low-cost Ethernet-like local network for a variety of vendors' microcomputers.

Corvus claims that almost 60 percent of all personal computers now connected to local networks use the Corvus Omnet. Omnet operates at 1 megabit per second, employs the same standard twisted-pair wiring used for telephone communications,

and features software support for many of the most popular microcomputers, including IBM's PC and PC XT, DEC's personal computers, TI's Professional, Apple IIs, and Zenith's. In addition, Corvus sells one or more of its print and file servers with each of its Omninet.

Logically speaking, Corvus's Omnet is similar to Ethernet in design, but it is not compatible with Ethernet because it uses twisted-pair wire for data transfer instead of a coaxial cable. The Omnet's 1-megabit-per-second data-transfer rate saves considerably on the cost of transceiver circuitry. Omnet employs a bus-type structure like Ethernet, and a CSMA access method. However, rather than the collision detection employed in Ethernet, Corvus employs a simplified scheme called collision avoidance, which reduces costs by shrinking the amount of logic and processing required to handle this function.

Corvus is a local-network vendor that has deviated from the Ethernet standard and improved on many of the Ethernet design limitations that have kept costs high. The company has had unquestionable success. Corvus boasts of a per-microcomputer connection cost of under \$500. In comparison, Ethernet-compatible in-

terfaces, including the necessary computer-specific software, typically still cost at least \$1000.

Corvus is believed to have designed its own semiconductor chip set, which is reportedly being produced by an unnamed Japanese manufacturer. This chip set is expected to further reduce the cost of the company's local-network interfaces. Corvus is also expected to use the new chips in a higher-speed Omnet version, operating at 4 megabits per second, with first deliveries expected sometime in 1985.

**ETHERNET COMPETITION**

Ethernet has unquestionably made great strides, given its adoption as an IEEE standard and the appearance of affordable Ethernet-compatible controller chip sets, but the long-term viability of the local-network scheme is still the subject of controversy. Two things could determine whether Ethernet has a prosperous future or is relegated to obsolescence. One is the impact of IBM's local network; the other is the possibility that significant changes to the existing Ethernet standard, now under consideration by the IEEE, may be adopted.

In August IBM announced its PC *(continued)*



## HIGH PERFORMANCE LEADER

### EPROM PROGRAMMERS & UV ERASERS

**GANG MULTIPROGRAMMER™**

**S15-G \$995**

- Stand Alone or RS232
- Detachable keyboard (opt.)
- Programs over 400 devices
- Bipolar • Microchips (opt.)
- 3 Voltage EPROMS (opt.)

**ORDER NOW & RECEIVE KEYBOARD MODULE FREE!**

**1-800-53-BYTEK**

BYTEK® Computer Systems Corp.  
4089 S Rogers Circle  
Boca Raton FL 33431



**UV MULTIERASER™**

- Built-in safety switch
- Removable anti-static UNITRAY™ (opt.)
- 1 Hour Timer (opt.)

**\$67**  
BUV-3 C



**(305) 994-3520**

Telex: 4310073 MEVBTC

Distributor Inquiries Welcome

# LOOK WHO BUYS SOFTWARE FROM US!

IBM • XEROX • NCR  
 CHEVRON • GTE • SPERRY  
 JFK SPACE CENTER • ARAMCO  
 AT&T • BENDIX • PRICE WATERHOUSE  
 HEWLETT PACKARD • GENERAL ELECTRIC  
 GENERAL DYNAMICS • TRW • KAISER CEMENT

If you order software from us, you're in good company. You see, some of our best customers are America's biggest corporations.

Maybe they're attracted by our low, low prices (big companies are price-conscious too!).

Or maybe when you're an "IBM", you're looking for something extra. Like the personal service, giant inventory, and in-depth technical support you'll find at 800-SOFTWARE.

You see, when you call us, we'll take care of you like our business depends on it. Because it does. Which means when you place an order, you can be sure we'll fill it promptly. And that our unique Order Tracking System™ is keeping tabs on your order every step of the way.

Most important, we'll be there if you need us after your software arrives. We'll make sure that you'll receive the finest technical support and customer

service in the industry. And that's a promise. If you purchase in large quantities, you'll be delighted by the service our National Accounts Program provides.


Next time you're looking for low price and great service, do what IBM, General Electric, and a lot of other big companies do. Pick up the phone and give us a call.

We'll show you why some hard-headed companies buy their software from us.

## CHECK OUT ALL OUR INCREDIBLE BUSINESS SOFTWARE PRICES:

| Lotus 1-2-3<br>\$319                                                                                                                                                                                                                                                                                                                                                                                                                                      | dBase II/III<br>\$309/\$399                                                                                                                                                                                                                                                                                                                                                                                                  | Framework<br>\$399                                                                                                                                                                                                                                                                                                                                                                                                                                | WordStar Pro Pack<br>\$299             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| Lotus Symphony<br>\$449                                                                                                                                                                                                                                                                                                                                                                                                                                   | Crosstalk<br>\$105                                                                                                                                                                                                                                                                                                                                                                                                           | SuperCalc 3<br>\$219                                                                                                                                                                                                                                                                                                                                                                                                                              | Hayes Modems 1200/1200B<br>\$499/\$425 |
| <b>AMDEK™</b><br>Monitors CALL<br><b>ASHTON-TATE™</b><br>dBase II/III \$309/\$399<br>Framework \$399<br>Friday! \$219<br><b>AST™ PRODUCTS</b> CALL<br><b>ATI™ &amp; COEX™ TRAINING</b> CALL<br><b>DIGITAL RESEARCH™</b> CALL<br><b>FOX &amp; GELLER</b> CALL<br><b>HAYES™</b><br>Smartmodems 1200/1200B \$499/\$425<br>All Other Products CALL<br><b>HERCULES™</b><br>Graphic Card \$375<br><b>IMSI™</b><br>4-Point Graphics \$129<br>PC Paintbrush \$149 | <b>LIFETREE™</b><br>Volkswriter Deluxe \$179<br><b>LOTUS™</b><br>1-2-3 \$319<br>Symphony \$449<br><b>MAXELL™ DISKETTES</b> CALL<br><b>MEMOREX™ DISKETTES</b> CALL<br><b>MICROPRO®</b><br>WordStar \$209<br>WordStar Prof Package \$299<br>InfoStar CALL<br>ChartStar \$239<br>TelMerge \$99<br>All Other Products CALL<br><b>MICRORIM™</b><br>RBase 4000 \$309<br><b>MICROSOFT®</b><br>Multiplan \$149<br>Word w/Mouse \$359 | Fortran \$269<br>All Other Products CALL<br><b>MICROSTUF™</b><br>Crosstalk \$105<br><b>MULTIMATE™</b> \$299<br><b>NORTON UTILITIES™</b> \$59<br><b>QUADRAM™</b> CALL<br><b>ROSESOFT™</b><br>Pro Key \$99<br><b>SOFTWARE PUBLISHERS™ (PFS)</b> CALL<br><b>SDRCIM/IUS™</b><br>SuperCalc 2/3 \$159/\$219<br>EasyWriter II System \$195<br>IUS Easy Business Accounting \$299/mod.<br>All Other Products CALL<br><b>WESTERN UNION EASY LINK®</b> FREE |                                        |

## WE ALSO CARRY HUNDREDS OF OTHER PRODUCTS!

 **WRITE:**  
 800-SOFTWARE, INC.  
 940 Dwight Way, Suite 14  
 Berkeley, CA 94710



Copyright 1984 Software 1984  
 Microsoft is a registered trademark.

 **800-SOFTWARE**

**TO ORDER CALL TOLL FREE:**  
 800-227-4587 or 415-644-3611

- Dealer inquiries welcome.
- Quantity discounts available through our National Accounts Program.
- Purchase orders accepted. Please call in advance.
- Call for shipping charges. Overnight delivery available.
- We do not add surcharge for credit card purchases.
- Prices may change. Above prices are for IBM PC and compatibles.
- International orders welcome.
- TELEEX #75174-3800-SOFTWARE, UD
- Compuserve Key Word "GO-EH."
- Member of Direct Marketing Association and Better Business Bureau.

Network, a broadband-based local network that is not affiliated with the cabling system it had unveiled a few months earlier (see "The IBM PC AT," October BYTE, page 108, for more information). IBM's still-unannounced local network for its cabling system will employ the same token-passing specification that the company

helped define within IEEE 802.5.

The IBM token ring and Ethernet are widely divergent schemes, though both employ a compatible link-level control (LLC) protocol that the IEEE has insisted be common to all of its local-network specifications. This means that a "gateway" type of processor can reasonably be expected

now that IBM has entered the local-network market.

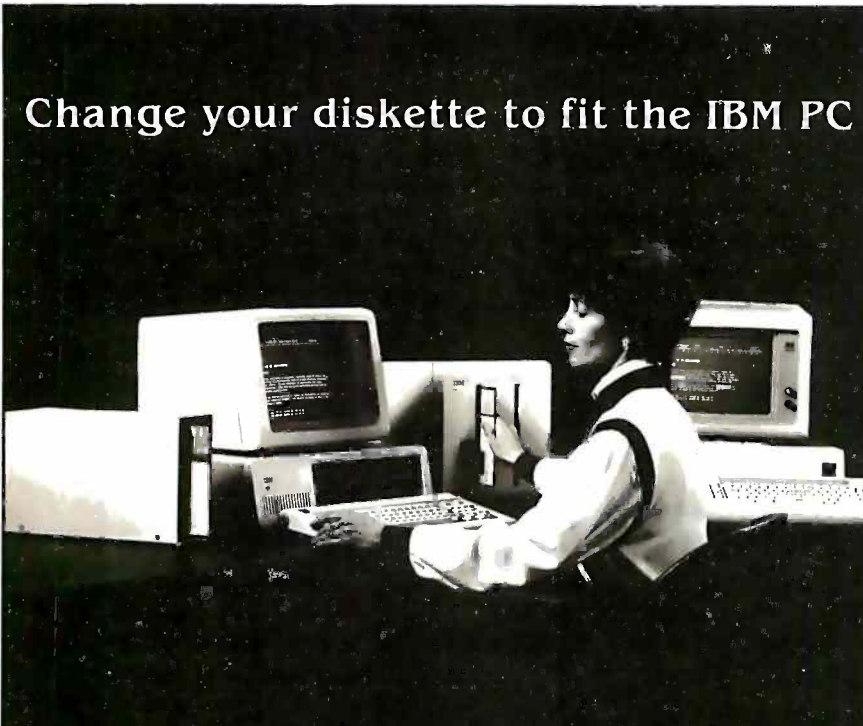
Gateways, however, tend to be bottlenecks, especially when they connect two or more high-speed local networks. So, while rudimentary interconnection between IBM token rings and Ethernets can be expected to accommodate already-installed Ethernets, IBM's dominance in mainframes and microcomputers could signal a slow death for Ethernet and Ethernet-compatible products.

There is also a possibility, some say a probability, that the IEEE may significantly alter, or add to, the existing Ethernet standard, which could make current products obsolete. Ethernet vendors are expected to resist any drastic changes by the Project 802 committee, but changes that address some of Ethernet's limitations are nevertheless expected. These are embodied in two proposals now circulating within the IEEE: one is called Star-LAN and the other is a modification to the Ethernet cabling called Cheapernet.

Star-LAN calls for a twisted-pair adjunct to Ethernet through which user devices would be connected in a "star" topology from a small centralized bus-based local network with a gateway to a conventional Ethernet. Devices would transmit and receive at 1 megabit per second over the simple twisted-pair extension to a still-unspecified Ethernet interface. The current Ethernet standard allows a device to be no more than 50 meters from the main cable, attached via an expensive transceiver-to-device cable.

The Cheapernet proposal calls for a thinner, cheaper coaxial cable than is now used in Ethernets. Because this type of cable wouldn't offer the same electrical characteristics as the cabling in the Ethernet specification, it could only be used over shorter distances and with fewer devices. Still, many IEEE members are said to favor the proposal which, if approved, could result in lower-cost components. These components, in turn, would probably not support the specifications delineated in the original Ethernet. ■

## Change your diskette to fit the IBM PC



## THE FILE CONNECTION 8" DISKETTE SYSTEM FOR THE IBM PC

Our "FILE CONNECTION" programs provide 8" diskette file exchange between the IBM PC and most Micro-Mini-Main Frame computer systems.

Our "WORD CONNECTION" programs provide 8" diskette text document exchange between the IBM PC and many word processing systems.


Our "DISPLAYWRITER CONNECTION" programs transform documents from Textpack, Wordstar, Multimate, etc. to the new DisplayWrite 2 format.

In addition to our hardware and program products, we also provide a conversion service for customer supplied diskettes. Please contact us for information about the hundreds of 5 1/4" and 8" diskette formats and systems which we currently support.

FLAGSTAFF ENGINEERING / P.O. Box 1970 / Flagstaff, AZ 86002  
Telephone 602-774-5188 / Telex 705609 FLAG-ENG-UD

# Now, You Can Buy an IBM-PC™ and OPTOMUX from Opto 22.

(Industrial Control has never been Easier!)



**Opto 22, an IBM-PC Value Added Dealer,** combines OPTOMUX and the IBM-PC to provide a powerful general purpose industrial control or data acquisition system. Optically isolated analog and digital I/O modules plug into a variety of mounting racks which communicate to the IBM-PC over a simple pair of twisted wires.

Opto 22 provides the software to program the PC in a high level language, commanding OPTOMUX to perform:

- Process Control
- Energy Management
- Machine Control
- Data Acquisition or any combination of analog or digital control.

Our application engineers are ready to answer any questions you may have regarding the use of the IBM-PC and OPTOMUX. Call us at 1-800-854-8851.\*

**opto 22**

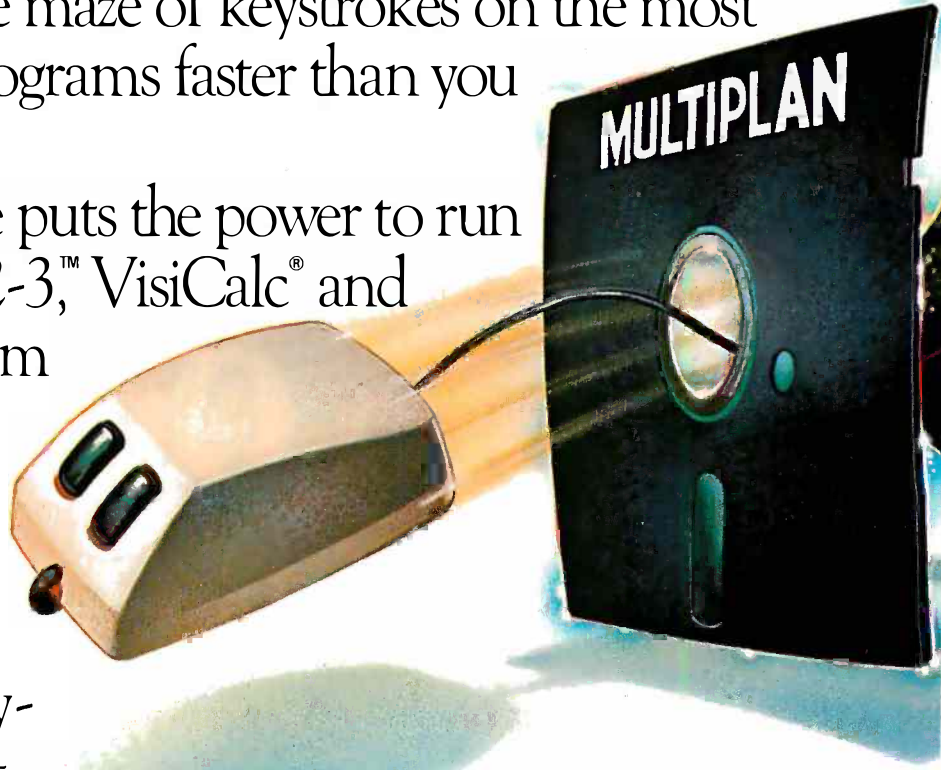
15461 Springdale Street ▪ Huntington Beach ▪ California ▪ (714) 891-5861

\*In California use our direct line.

# Get yourself a

This little critter comes with specially-designed software that flies through the maze of keystrokes on the most popular business programs faster than you can say "cheese."

Microsoft® Mouse puts the power to run Multiplan®, Lotus 1-2-3™, VisiCalc® and WordStar® in the palm of your hand. Click the left button on the mouse, a custom menu appears. In English, not hieroglyphics. Click the right button and execute your command: move text or data, edit, format, print. All at blinding speed without touching the keyboard.

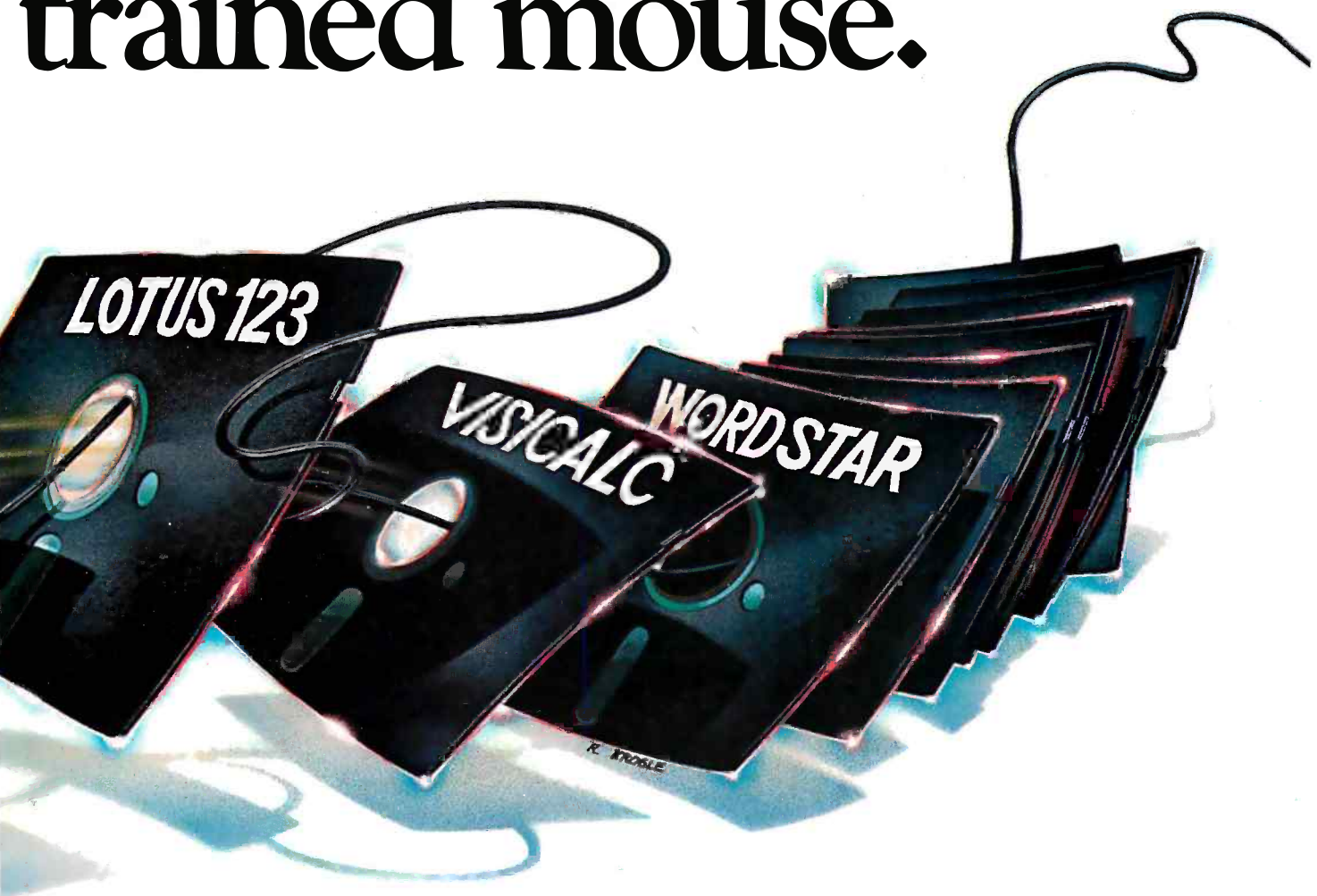


It also lets you create your own menus for editing and formatting existing application programs. So people can learn programs quicker and do more productive work as they learn.

## **The mightiest mouse.**

Microsoft Mouse runs circles around other mice. It is the high performance mouse for the IBM® PC and PC XT. From the company known for high

# trained mouse.



performance software. Microsoft BASIC is the language spoken by nine out of ten microcomputers worldwide.

**MICROSOFT**® Our MS™-DOS operating system tells  
The High Performance Software your IBM PC how to think.

So don't monkey around with any other mouse. Call 800-426-9400 (in Washington State call 206-828-8088) for the name of your nearest Microsoft dealer. Then go with Microsoft Mouse. The mouse that soars.

**MICRO  
SOFT**

Microsoft and Multiplan are registered trademarks and MS is a trademark of Microsoft Corporation.  
Lotus 1-2-3 is a trademark of Lotus Development Corporation. VisiCalc  
is a registered trademark of VisiCorp. WordStar is a registered trademark of MicroPro.  
IBM is a registered trademark of International Business Machines Corporation.

# Introducing the Most Powerful Business Software Ever!

TRS-80™ (Model I, II, III, or 16) • APPLE™ • IBM™ • OSBORNE™ • CP/M™ • XEROX™



## The VERSABUSINESS™ Series

Each VERSABUSINESS module can be purchased and used independently, or can be linked in any combination to form a complete, coordinated business system.

### VERSARECEIVABLES™

**\$99.95**

VERSARECEIVABLES™ is a complete menu-driven accounts receivable, invoicing, and monthly statement-generating system. It keeps track of all information related to who owes you or your company money, and can provide automatic billing for past due accounts. VERSARECEIVABLES™ prints all necessary statements, invoices, and summary reports and can be linked with VERSALEDGER II™ and VERSAINVENTORY™.

### VERSAPAYABLES™

**\$99.95**

VERSAPAYABLES™ is designed to keep track of current and aged payables, keeping you in touch with all information regarding how much money your company owes, and to whom. VERSAPAYABLES™ maintains a complete record on each vendor, prints checks, check registers, vouchers, transaction reports, aged payables reports, vendor reports, and more. With VERSAPAYABLES™, you can even let your computer automatically select which vouchers are to be paid.

### VERSAPAYROLL™

**\$99.95**

VERSAPAYROLL™ is a powerful and sophisticated, but easy to use payroll system that keeps track of all government-required payroll information. Complete employee records are maintained, and all necessary payroll calculations are performed automatically, with totals displayed on screen for operator approval. A payroll can be run totally, automatically, or the operator can intervene to prevent a check from being printed, or to alter information on it. If desired, totals may be posted to the VERSALEDGER II™ system.

### VERSAINVENTORY™

**\$99.95**

VERSAINVENTORY™ is a complete inventory control system that gives you instant access to data on any item. VERSAINVENTORY™ keeps track of all information related to what items are in stock, out of stock, on backorder, etc., stores sales and pricing data, alerts you when an item falls below a preset reorder point, and allows you to enter and print invoices directly or to link with the VERSARECEIVABLES™ system. VERSAINVENTORY™ prints all needed inventory listings, reports of items below reorder point, inventory value reports, period and year-to-date sales reports, price lists, inventory checklists, etc.

### VERSALEDGER II™

**\$149.95**

VERSALEDGER II™ is a complete accounting system that grows as your business grows. VERSALEDGER II™ can be used as a simple personal checkbook register, expanded to a small business bookkeeping system or developed into a large corporate general ledger system **without any additional software.**

- VERSALEDGER II™ gives you almost unlimited storage capacity (300 to 10,000 entries per month, depending on the system),
- stores all check and general ledger information forever,
- prints tractor-feed checks,
- handles multiple checkbooks and general ledgers,
- prints 17 customized accounting reports including check registers, balance sheets, income statements, transaction reports, account listings, etc.

VERSALEDGER II™ comes with a professionally-written 160 page manual designed for first-time users. The VERSALEDGER II™ manual will help you become quickly familiar with VERSALEDGER II™, using complete sample data files supplied on diskette and more than 50 pages of sample printouts.

### SATISFACTION GUARANTEED!

Every VERSABUSINESS™ module is guaranteed to outperform all other competitive systems, and at a fraction of their cost. If you are not satisfied with any VERSABUSINESS™ module, you may return it within 30 days for a refund. Manuals for any VERSABUSINESS™ module may be purchased for \$25 each, credited toward a later purchase of that module.

#### To Order:

**Write or call Toll-free (800) 431-2818**  
(N.Y.S. residents call 914-425-1535)

- \* add \$3 for shipping in UPS areas
- \* add \$4 for C.O.D. or non-UPS areas
- Circle 399 on inquiry card.



DEALER INQUIRIES WELCOME

All prices and specifications subject to change / Delivery subject to availability.

# COMPUTRONICS

50 N. PASCACK ROAD, SPRING VALLEY, N.Y. 10977

\* TRS-80 is a trademark of the Radio Shack Division of Tandy Corp. \* APPLE is a trademark of Apple Corp. \* IBM is a trademark of IBM Corp. \* OSBORNE is a trademark of Osborne Corp. \* CP/M is a trademark of Digital Research. \* XEROX is a trademark of Xerox Corp.



# LOCAL-AREA NETWORKS FOR THE IBM PC

BY J. SCOTT HAUGDAHL

*Be sure of your networking goals and needs before you invest in expensive technology*

THERE ARE 40 OEMs (original equipment manufacturers) of personal computer local networks in the industry; 18 (not including third-party OEMs) of these are basically only for the IBM PC. *None* of these systems is fully compatible with any of the others. Most were introduced in 1983, and many are from "me-too" vendors that have jumped on the IBM PC local-area-network (LAN) bandwagon. Table 1 indicates the wide variety of local networks available for the IBM PC.

Every vendor usually claims that it has the best technology, the best idea, the best implementation; clearly, this cannot be true for all of them. Manufacturers would like you to believe in the idea of the turnkey system, the kind of information source or utility that you simply plug your computer into and it works beautifully. No system is really as turnkey as we'd like it to be, mainly because the technology is so new. The oldest personal computer LAN vendors are three to four years old.

As everyone should be aware of by now, a revolution has taken place over the past 10 years in silicon and inte-

grated circuit technology. The result is that the cost of a central processing unit is really a small fraction of the cost of a whole system. The real cost is in the electromechanical peripheral devices connected to a system—disk drives, printers, etc., and the necessary support circuitry it takes to drive them. Thus, with LANs you want to preserve the benefits of stand-alone microcomputers, namely, use of your favorite software and peripherals and having a machine all to yourself, as well as adding new benefits from networking. Besides sharing expensive peripherals, you can add electronic mail, multiuser databases, high-speed communications between personal computers, minicomputers, and mainframes, and a slew of multiuser applications such as accounting and inventory control.

.....  
J. Scott Haugdahl is a systems specialist at Architecture Technology Corp. (POB 24344, Minneapolis, MN 55424), a consulting firm that specializes in computer architecture, including local-area networking systems. He is coauthor of the company's "Personal Computer Local Network" seminar series.

An interesting technological issue often ignored by manufacturers is the concept of open versus closed systems. Open systems are basically systems that are built to a published specification—either standardized or designed in a nonproprietary way. With open systems, all the design details of the implementation are published; closed systems are completely proprietary. Most systems that follow de facto standards, such as Ethernet or Arcnet, and those that follow "committee" standards, such as IEEE-802 or those of the National Bureau of Standards, tend to be open systems. Open systems that follow standards also typically allow the user to buy equipment that will work on a specific network from more than one vendor. Most of the microcomputer local networks, however, tend to be highly proprietary, leaving the end user at the mercy of the vendor.

Unfortunately, there are still some technical drawbacks to microcomputer LANs. The worst problem is the need LANs create for very complex and specialized software to handle

*(continued)*

## IBM PC LANs

the communication that will take place over the network. Also, when you are working with a complete system that is going to be spread out over thousands of feet, something may fail and it may be difficult to find out exactly what has failed and where. In the past, with the stand-alone personal computer, if you couldn't read a disk drive you had a pretty good idea that something was wrong with either the disk drive or the disk.

Unique expertise is usually needed in day-to-day operations to maintain

and administer these systems. Also, the manufacturer should provide diagnostic tools to help you maintain the network. These are typically software programs that do a variety of tests, such as testing the network or the network interface in a particular computer. You should also be able to diagnose and repair problems concurrent with the normal operation of the network. For instance, if you have a computer that fails, you should be able to take the computer off the network and fix it and then put it back

on without having to interrupt the normal use of the network.

The cost of the transmitting cable is probably one of the most deceiving things about LANs. Many vendors tout "low cost" when describing this item, whether it be coaxial cable or twisted-pair wire. The real cost is not the cable itself but how much it costs per foot to install it in a system. A number of companies have actually paid as much as \$1000 per foot for installation.

*(continued)*

Table 1: A survey of local-area networks that support the IBM PC and their features.

| VENDOR                       | NETWORK              | MEDIUM | DATA RATE | ADDRESSABLE NODES * | LINK PROTOCOL | DISTANCE ** | SERVER TYPES SUPPORTED | OS SUPPORT | OTHER PCs *** |
|------------------------------|----------------------|--------|-----------|---------------------|---------------|-------------|------------------------|------------|---------------|
| AST Research                 | PCnet II             | T      | 800K      | 64K                 | CS            | 10          | D,P                    | M          |               |
| Christain Rovsing            | X-Net                | T      | 1.8M      | 64K +               | P             | 22          | 32                     | M          |               |
| Corvus                       | Omninet              | T      | 1M        | 64                  | CS            | 10          | D                      | M,P,C      | Y             |
| Davong                       | Multilink            | C      | 2.5M      | 255                 | A             | 22          | DP                     | M,P,C      |               |
| Fox Research                 | 10-Net               | T      | 1M        | 255                 | CS            |             | F,P,32                 | M          |               |
| Great Lakes Computer Gateway | Great Net            | C      | 5M        | 64                  | P             |             |                        | M          |               |
| Communications               | G-Net                | C      | 1.43M     | 256                 | CS            | 10          | F,P,32,G               | M          |               |
| IBM                          | Cluster              | C      | 375K      | 64                  | CS            | 10          | D                      | M          |               |
| IBM                          | PC Network           | C      | 2M        | 64                  | CS            | 2           | F,P,32,G               | M          |               |
| 3M                           | LAN/I                | C      | 2.5M      | 255                 | A             | 22+         | G                      | M          |               |
| Nestar                       | PLAN 4000            | C      | 2.5M      | 64K +               | A             | 22          | D,P,32,G               | M,P        | Y             |
| NCR                          | DecisionNet          | T      | 1M        | 64                  | CS            | 10          | F                      | M,C        | Y             |
| Novell                       | NetWare/X            | C      | 1.43M     | 256                 | CS            | 10          | F,P                    | M          |               |
| Novell                       | NetWare/S            | T      | 500K      | 24                  | P             | 2           | F,P                    | M,C        | Y             |
| Orchid                       | PCnet                | C      | 880K      | 64K                 | CS            | 10          | D,P                    | M          |               |
| Percom Data                  | PerComNet            | C      | 1M        | 256                 | TP            | 10          | D                      | M,C        |               |
| Proteon                      | proNET               | T,C,F  | 10M       | 256                 | TP            | 10          | F,P                    | M          |               |
| Standard Data                | STANDARDNET          | C      | 3M        | 256                 | CS            | 2           | D,F,P                  | M          |               |
| Tecmar                       | Elan                 | C      | 10M       | 64K +               | E             | 10          | D                      | M          |               |
| 3Com Corporation             | Ethernet             | C,F    | 10M       | 64K +               | E             | 10          | D,P                    | M          |               |
| Ungermann-Bass               | Net/One PC Baseband  | C,F    | 10M       | 64K +               | E             | 10          | D,P,32,G               | M          |               |
| Ungermann-Bass               | Net/One PC Broadband | T      | 5M        | 64K +               | CS            | 22+         | D,P,32,G               | M          |               |
| VLSI Networks Inc.           | 1553-Net             | C      | 3M        | 256                 | CS            | 2           | D                      | M          | Y             |
| XCOMP                        | XNET                 | T      | 2.5M      | 256                 | CS            | 10          | F,P                    | M          |               |

\* Theoretical maximum number (see text of article)

\*\* Repeaters may be necessary to achieve the distance indicated

\*\*\* Other than the IBM PC

### LEGEND

#### MEDIUM

T = twisted-pair  
C = coax  
F = fiber

#### DATA RATE

K = kilobits per second  
M = megabits per second

#### LINK PROTOCOL

A = Arcnet  
E = Ethernet  
CS = CSMA  
TP = token passing  
P = proprietary

#### DISTANCE

2 = less than 2000 feet  
10 = less than 10,000 feet  
22 = less than 22,000 feet  
22+ = 22,000 feet or more

#### SERVERS

D = disk  
F = file  
P = print  
32 = 3270  
G = gateway

#### OPERATING SYSTEM SUPPORT

M = MS-DOS  
C = CP/M-86  
P = p-System

# THE PANASONIC<sup>®</sup> SR. PARTNER<sup>™</sup> NO PERIPHERALS NEEDED

Because they're already built-in. The 80/132-column printer. The 9-inch, high-resolution display. There's even a built-in 360K disk drive. Which all make the Sr. Partner a complete computer as is.

The Sr. Partner is IBM hardware and software compatible so you can run popular business programs immediately. The software bundle currently offered with the Sr. Partner is WordStar, VisiCalc, pfs:Graph, File, Report, MS-DOS 2.11 and GW BASIC.\*

And with its 256K internal memory expandable to 512K, the Sr. Partner can run the new integrated software.

Built-ins also include expansion slots and parallel and serial I/O ports. There's even a built-in RGB monitor port so you can take advantage of the Sr. Partner's color and graphics capability.

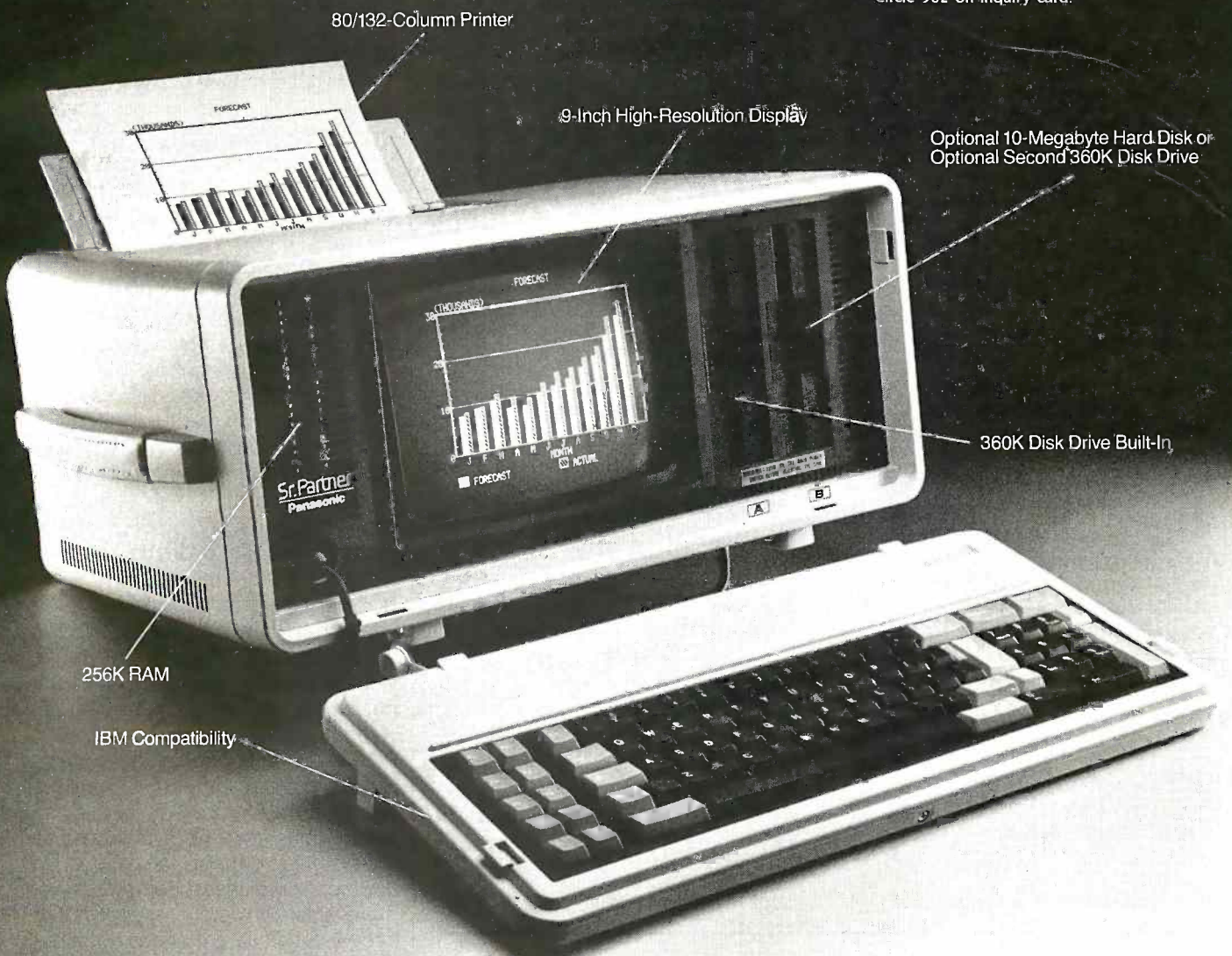
If you want 10 megabytes of storage, choose the new hard disk Sr. Partner.

Both the Sr. Partner and the hard disk Sr. Partner come with an exceptional Panasonic warranty.\*\*

For the dealers nearest you, call: 201-392-4261. The Panasonic Sr. Partner. No peripherals needed. It makes the competition look like Jr. Executives.

## Panasonic Industrial Company

Circle 302 on inquiry card.



\*Software bundle offer subject to change or withdrawal at any time without notice. \*\*One-year limited warranty, 6 months on thermal printer head. Carry-in or mail-in service. Sr. Partner is a trademark of Matsushita Electric Industrial Company Ltd; WordStar is the trademark of MicroPro International Corporation; VisiCalc is the registered trademark of VisiCorp (Software Arts, Inc.); pfs:Graph, File, Report are the registered trademarks of Software Publishing Corporation; GW BASIC, MS-DOS are the trademarks of Microsoft Corporation.

# Perfect Compatibility

IBM™ & ACP

Circle 30 on inquiry card.

## HARDWARE

### COMPUTER SYSTEMS

#### IBM

PC w/256K 2 DS/DD Disk Drives ..... \$ Call  
 PC w/256K 1-360K Drive  
 1-10MB Hard Disk ..... \$ Call

#### COMPAQ

w/256K 2 DS/DD Disk Drives ..... \$ Call

### COMMUNICATION PRODUCTS

#### HAYES

Smartmodem 300 ..... \$ 209  
 Smartmodem 1200 ..... \$ 489  
 Smartmodem 1200B w/Smartcom II ..... \$ 419  
 Smartmodem-to-IBM 6 ft. Cable ..... \$ 25  
 Smartcom II ..... \$ 99

#### TAC

Irma (Emulates 3278 Terminal) ..... \$ Call  
 Irma Line (For Remote Emulation) ..... \$ Call

### FLOPPY & HARD DISK DRIVES

#### CONTROL DATA

Full Size 320K DS/DD ..... \$ 199  
 Half-Height 320K DS/DD w/Bracket ..... \$ 169

#### DAVONG

10 MB to 41 MB Hard Disk Int./Ext. .... \$ Call

#### IOMEGA

Bernoulli Box (10 or 20MB) ..... \$ Call

#### TALLGRASS

12—70 MB Hard Disk w/Tape Backup .. \$ Call

#### TEAC

Half-Height 320K DS/DD w/Bracket ... \$ 159  
 Half-Height 640K DS/DD w/Bracket ... \$ 215

#### MAYNARD ELECTRONICS

10MB Hard Disk WS-1 (XT Lookalike) .. \$ 899  
 10MB Hard Disk WS-2 (XT Lookalike) .. \$ 1049

### EXPANSION BOARDS

#### MAYNARD ELECTRONICS

Modular Memory Brd. w/64K to 576K .. \$ 219  
 Modular Multifunction Board ..... \$ 95

#### AST RESEARCH

(All AST boards include SuperDrive, SuperSpool and 1 year warranty)  
 SixPack Plus w/64K to 384K ..... \$ 269  
 MegaPlus II w/64K to 512K ..... \$ 269  
 Memory Board II w/64K to 384K ..... \$ 239  
 I/O Plus II ..... \$ 139  
 MegaPack w/128K or w/256K ..... \$ Call  
 Parallel, Serial, Game Options ..... \$ 35

#### ORCHID TECHNOLOGY

Blossom w/64K to 384K ..... \$ 249

#### TECMAR

Captain w/64K to 384K w/Software ... \$ 269

#### EXPANSION BOARDS CONT.

#### QUADRAM

Quadboard w/64K to 384K ..... \$ 279

### PRINTERS & PLOTTERS

#### C. ITOH

Starwriter Letter Quality 40 cps ..... \$ 999  
 Printmaster Letter Quality 55 cps ... \$ Call  
 Cut Sheet Feeder (Feeds 200 sheets) .. \$ 395

#### EPSON

(All Printers include GRAPHTRAX-Plus)  
 RX-80 (120 cps, 80 cols) ..... \$ Call  
 RX-80 F/T (120 cps, 80 cols) ..... \$ Call  
 RX-100 F/T (100 cps, 132 cols) ..... \$ Call  
 FX-80 F/T (160 cps, 80 cols) ..... \$ Call  
 FX-100 F/T (160 cps, 132 cols) ..... \$ Call  
 Epson-IBM Cable ..... \$ 30

#### HEWLETT PACKARD

HP—7470A Two Pen Plotter ..... \$ Call  
 HP—7475 Six Pen Plotter ..... \$ Call  
 HP-IBM Cable (works w/Lotus 1-2-3) .. \$ 50

#### NEC

NEC 3550 Letter Quality 35 cps ..... \$ 1599  
 NEC 2050 Letter Quality 18 cps ..... \$ 799  
 Bi-Directional Tractor ..... \$ 235  
 Cut Sheet Feeder (Feeds 200 Sheets) .. \$ 299  
 NEC-IBM Cable ..... \$ 30

#### OKIDATA

Microline 83A (120 cps, 132 cols) . Best Price  
 Microline 92 (160 cps, 80 cols) ... Best Price  
 Microline 93 (160 cps, 132 cols) .. Best Price  
 Microline 84 (200 cps, 132 cols) .. Best Price  
 Plug n' Play ..... Best Price  
 Okidata-IBM Cable ..... \$ 30

#### SILVER-REED

EXP 550 (20 cps, 132 cols) ..... \$ 595

### VIDEO—MONITOR BOARDS

#### HERCULES

Graphics Card ..... \$ 359  
 Color Card ..... \$ 179

#### PC COMPONENTS

Bi-Graphix I ..... \$ Call

#### PARADISE SYSTEMS

Multidisplay ..... \$ 339

#### PC+ PRODUCTS

Colorplus ..... \$ 419

#### STB

Graphix Plus ..... \$ 359

#### QUADRAM

Quadcolor I ..... \$ 199

#### TECMAR

Graphics Master \$ 499

### MONITORS

#### AMDEK

Video 300 Green Screen ..... \$ 140  
 Video 300A Amber Screen ..... \$ Call  
 Video 310A IBM Monochrome in  
 Amber ..... \$ 170

#### PRINCETON GRAPHICS

HX-12 RGB Hi Resolution Color ..... \$ 499\*  
 Max-12 IBM Monochrome in Amber .. \$ Call  
 SR-12 Hi Resolution Color ..... \$ Call

## IBM PC LANs

You probably won't see the transmitting cable cost in an IBM PC LAN cost estimate because these systems tend to be broadband types installed in metropolitan high rises with previously installed cable. On the other hand, cable cost can still be a cost factor in these IBM PC networks, especially if there are a lot of nodes on the system. They call for a lot of wire, and the environment may require union people or an electrical staff to install the system. All of these cost factors are important.

The way a vendor has designed the network interface board that connects the IBM PC to the network varies dramatically from vendor to vendor. Unfortunately, most end users don't really take a look at the hardware; they care more about the functionality at the application level.

This is unfortunate because the performance of these systems has to do with how intelligent the network interface board is. Does it use very-large-scale integration (VLSI) data-link controllers and/or dedicated central processors? Or does it use a lot of basic building blocks, such as small-scale integration (SSI)? Does it support direct memory access (DMA)? How about interrupts? Does it require a lot of processor time, for example, from the IBM PC's 8088 processor to service the card? Or can the IBM PC go off and do its own thing and be interrupted, for example, if a packet has been received? In some systems you can send a packet of data to the network-controller board and go away to perform another task. The controller will form the packet (add headers, addressing, checksums, etc.), sense when the network is free (or wait for a free token), and send the packet to the receiving node, all without any intervention from the IBM PC. On the other hand, some systems require constant attention from the host central processor, adding a tremendous amount of overhead to the system to support the network. In addition, intelligent controllers require less software to support the network—software that has to be designed, debugged, maintained, etc.—

**WE'LL GIVE YOU \$10.00**

Simply refer to this reference number—BY3 with your order and receive \$10.00 credit toward your next purchase.\*

\*Minimum order \$100.00. Limit one credit per customer.

- No Credit Card Surcharge
- Special Corporate Accounts Division
- Company P.O. Accepted
- Training
- Equipment Maintenance
- Next Day Shipping

which leaves more memory in the IBM PC for the individual user.

Most LAN data-link protocols in use today were derived from one of two general schemes known as carrier-sense multiple-access (CSMA) and token passing. The Xerox-developed Ethernet uses the best-known implementation of a carrier-sense multiple-access protocol; Ethernet assumes that its nodes will be connected in a bus-type layout and adds collision detection (so the protocol is called CSMA/CD). On the other hand, Data-point Corporation used token passing over a bus layout in designing its popular Arcnet protocol. Several semiconductor houses are offering or will soon offer special chips for handling these and other protocols, but some local networks, such as Omninet from Corvus and Netware/X from Novell, rely on a dedicated microprocessor.

**SERVERS**

Let's take a look at servers, since they are key to supporting LANs. A server could be an IBM PC or a specialized "black box" that performs some function at the request of a client.

In general, how can you compare two or more servers? There are a few questions you might ask. What is the capacity of the server? In the case of a file server, how many megabytes of storage can it support? In the case of a print server, how many printers can it support? Can it print concurrently on more than one printer? Does it use virtual printing, spooled printing, or a combination of both? Can you have more than one of a certain type of server on the network?

Because all these servers support multiple users, you're going to need some sort of password protection scheme, as well as some means of protecting the data of one user from another. Also, because large amounts of disk storage are typically handled by a file server, it should support some form of backup, such as a streaming-tape drive. Some servers support other functions, such as a network-wide real-time clock/calendar, and synchronization of processes on

(continued)

**DISK CONTROLLERS**

**MAYNARD ELECTRONICS**

|                                     |         |
|-------------------------------------|---------|
| Standard Disk Controller            | \$ 115  |
| with Parallel Port                  | \$ 165  |
| with Serial Port                    | \$ 175  |
| Sandstar Modular Disk Controller    | \$ 209  |
| All Sandstar Modular Options Avail. | \$ Call |

**SOFTWARE**

**ASHTON TATE**

|           |         |
|-----------|---------|
| dBase II  | \$ 285  |
| dBase III | \$ Call |
| Framework | \$ Call |

**FOX & GELLER**

|                                       |         |
|---------------------------------------|---------|
| Quickcode II or III                   | \$ 169  |
| dGraph (Requires Graphics Card)       | \$ Call |
| dUtil (Utilities For dBase II or III) | \$ Call |

**FUNK—Sideways**

|  |       |
|--|-------|
|  | \$ 49 |
|--|-------|

**HAYES—Smartcom II**

|  |       |
|--|-------|
|  | \$ 99 |
|--|-------|

**IMSI—4 Point Graphics (Rated #1)**

|  |       |
|--|-------|
|  | \$ 89 |
|--|-------|

(Inhance Lotus Graphics)

**INDIVIDUAL SOFTWARE**

|                                  |         |
|----------------------------------|---------|
| Tutorial Set (IBM PC/XT and DOS) | \$ 79   |
| Typing Instructor                | \$ 39   |
| <b>INFOCOM—Zork I, II, III</b>   | \$ 29   |
| All games available              | \$ Call |

**INFORMATION UNLIMITED SOFTWARE**

|                      |        |
|----------------------|--------|
| EasyWriter II System | \$ 195 |
| Accounts Receivable  | \$ 299 |
| Accounts Payable     | \$ 299 |
| General Ledger       | \$ 299 |
| Payroll              | \$ 369 |

**LATTICE**

|                     |        |
|---------------------|--------|
| C-Compiler          | \$ 299 |
| C-Food Smorgasboard | \$ 110 |

**LIFETREE**

|                                |        |
|--------------------------------|--------|
| Volkswriter Deluxe w/TextMerge | \$ 169 |
|--------------------------------|--------|

**LOTUS DEVELOPMENT**

|                          |         |
|--------------------------|---------|
| Lotus 1-2-3 (Version 1A) | \$ Call |
| Symphony                 | \$ Call |
| Symphony Upgrade         | \$ Call |

**MICRO DATA BASE SYSTEMS**

|              |        |
|--------------|--------|
| Knowledgeman | \$ 299 |
|--------------|--------|

**MICROPRO**

|                                                                                                                       |        |
|-----------------------------------------------------------------------------------------------------------------------|--------|
| Wordstar w/Tutorial on Disk                                                                                           | \$ 229 |
| ProPack (Wordstar/MailMerge/<br>CorrectStar/StarIndex)                                                                | \$ 329 |
| ProfessionalPlus (ProPack plus<br>TelMerge Electronic Mail System<br>Mailing List Management and<br>Business Letters) | \$ 369 |

**MICRORIM**

|                        |         |
|------------------------|---------|
| R.base 4000            | \$ 299  |
| Clout                  | \$ 139  |
| Extended Report Writer | \$ Call |

**MICROSOFT**

|                           |        |
|---------------------------|--------|
| C-Compiler                | \$ 349 |
| Flight Simulator          | \$ 35  |
| Multipan (New Version)    | \$ 149 |
| Project (Project Manager) | \$ 180 |
| Chart                     | \$ 180 |
| Word                      | \$ 239 |
| Word w/Mouse              | \$ 299 |
| Mouse w/Software          | \$ 159 |

**MICROSTUF**

|                                         |       |
|-----------------------------------------|-------|
| Crosstalk XVI (for Hayes<br>Smartmodem) | \$ 99 |
|-----------------------------------------|-------|

**MORGAN COMPUTING**

|                                                        |        |
|--------------------------------------------------------|--------|
| Trace 86 (Assembly Language Debug)                     | \$ 99  |
| Ted (Program Editor)                                   | \$ 79  |
| Professional Basic (170K Work Space<br>w/8087 Support) | \$ 235 |

**MULTIMATE INTERNATIONAL**

|           |        |
|-----------|--------|
| Multimate | \$ 269 |
|-----------|--------|

**PETER NORTON**

|                  |       |
|------------------|-------|
| Norton Utilities | \$ 55 |
|------------------|-------|

**ROESOFF**

|                         |       |
|-------------------------|-------|
| Prokey (Newest Version) | \$ 95 |
|-------------------------|-------|

**SATELLITE SOFTWARE INTERNATIONAL**

|                                 |        |
|---------------------------------|--------|
| Word Perfect (includes Speller) | \$ 269 |
|---------------------------------|--------|

**SOFTWARE PRODUCTS**

|             |        |
|-------------|--------|
| Open Access | \$ 299 |
|-------------|--------|

**SOFTWARE PUBLISHING**

|            |       |
|------------|-------|
| PFS/Access | \$ 65 |
| PFS/File   | \$ 89 |
| PFS/Graph  | \$ 89 |
| PFS/Report | \$ 79 |
| PFS/Write  | \$ 79 |

**WANG PUBLICATION**

|                                 |       |
|---------------------------------|-------|
| Random House Proof Reader (50K) | \$ 45 |
|---------------------------------|-------|

**WORDTECH SYSTEMS**

|                                         |         |
|-----------------------------------------|---------|
| dB/Compiler (True dBase II<br>Compiler) | \$ Call |
|-----------------------------------------|---------|

**OUR POLICY**

• We accept VISA, MasterCard, Money Orders, Certified Checks, Cashiers Checks, Personal Checks, Wired Funds • We do not charge your card until we ship • **No surcharge added on VISA and MasterCard** • Allow one week for personal and company checks to clear • COD maximum \$500 Cash or Certified check on delivery • Please use local phone number for order status inquiries • Prices subject to change without notice • Returns may be subject to restocking fee.

**SHIPPING (U.S.)** For monitors, and hard disk drives add 2% to all orders. Blue label and Next Day Air available. For all other items add \$4. **Most orders shipped next day.**

**When you need competitive prices, prompt service and complete support, call us.** Circle 31 on inquiry card.



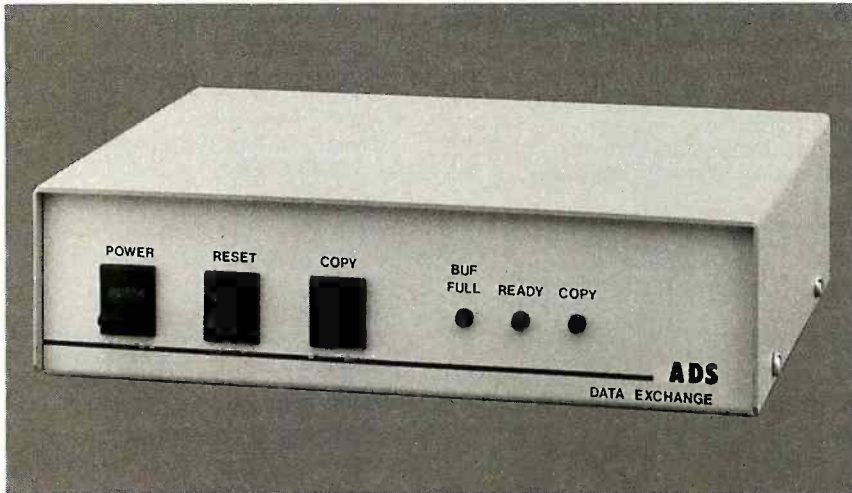
**APPLIED COMPUTER PRODUCTS INC.**

1916 Welsh Road #6, Philadelphia, PA 19115  
215-934-6990 Telex 756876 UD

**1-800-223-3860**

\*IBM is a registered trademark of International Business Machines.

# DATA EXCHANGE/64K SPOOLER



The ADS-8212 DATA EXCHANGE/64K is a computer independent interface converter and print spooler. It can be installed between virtually any computer and any peripheral.

Data can be input in either serial or parallel, stored in its 64K bytes of RAM, and output serial or parallel. Serial ports support baud rates from 50 to 19 200 and both hardware and software handshaking. The input and output ports are completely independent; input data with one protocol and baud rate and output it with a different protocol and baud rate. Selections are dip switch selectable.

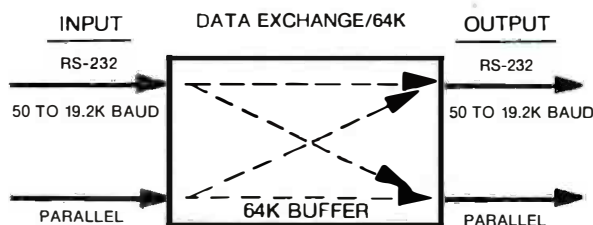
A unique feature is its ability to make unlimited numbers of copies. Hitting the copy button will send another copy to the printer. When done making copies, hit the reset button to clear the memory.

Included with the DATA EXCHANGE/64K are two 4 foot output cables, one parallel cable with standard Centronics type connector and one serial cable with standard DB 25 connector. Standard plugs are supplied for input ports.

RS-232 HANDSHAKING:  
RDY/BSY (DTR)  
Xon/Xoff  
ETX/ACK

Suggested list price: \$339.00

Dealer inquiries welcome.



Available at your local dealer or contact:

**ADS ANTEX DATA SYSTEMS**  
A Division of International Antex Inc.  
2630 California Street  
Mountain View, California 94040 ■ Phone: (415) 941-7914  
Telex: 704 969 INTERAX UD

*The disadvantage of dedicated file servers is cost, because they can no longer be used as workstations.*

the network by semaphores (flags that are typically implemented by subroutine calls to the network operating system) or lock tables.

Let's look at dedicated versus non-dedicated file servers. Clearly, with a dedicated machine, you might hope to provide high performance through dedication. The server doesn't have to worry about anything except servicing requests and is probably more secure than the nondedicated machine; if nothing else, you can lock it up in a back room somewhere and make it physically secure. It is also more secure in the sense that a user program cannot interfere with the server and crash it (as can happen with a nondedicated server).

The disadvantage of dedicated file servers is cost, because they can no longer be used as workstations. However, costs can more than be recovered because response times will be better, thus saving people's time.

I am beginning to see more and more nondedicated servers, particularly in some of the "low-cost" networks that bill themselves as being "easy to afford and easy to install." Basically, this means that the user and server processor can coexist in a single machine, so users, for example, can have PC XT's and share their hard disks with other users on the network at the same time they are running a spreadsheet program. These nondedicated servers clearly have the cost advantage because you don't have to buy a dedicated machine.

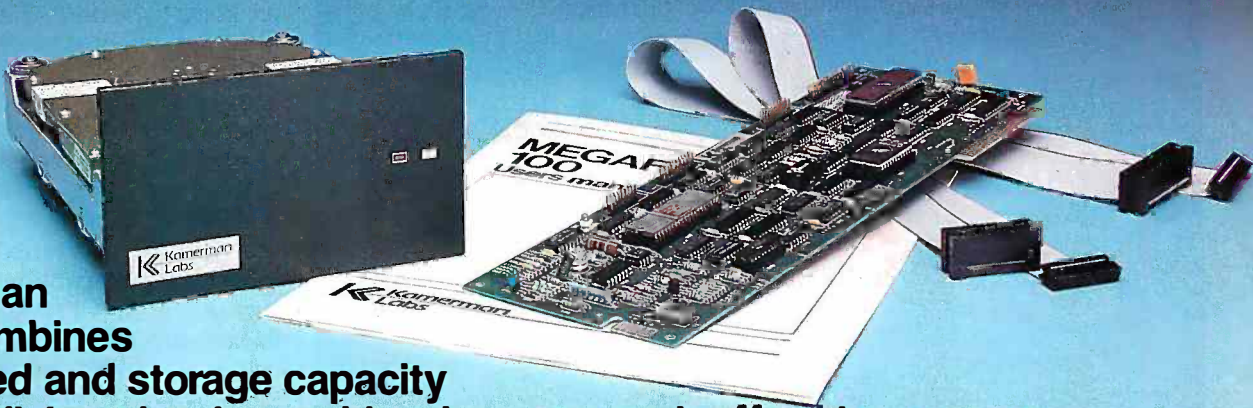
They have some disadvantages, too. Nondedicated servers require a multi-process operating system, which will generally degrade performance. An example of this degradation can be seen on the IBM PC. Every time you

(continued)

FOR THE IBM® PC, IBM® XT, COMPAQ™,  
CORONA™, CORONA™ PORTABLE, LEADING EDGE®, EAGLE PC®, TAVA™



# 10, 20, 33 Mbyte Hard Disk Systems from \$895



**Kamermeran Labs combines the speed and storage capacity of hard disk technology with prices you can't afford to pass up.**

**A dramatic leap in performance for your personal computer.**

Even the smallest Kamermeran Labs hard disk unit gives you 30 times the storage capacity of a typical floppy disk. Sophisticated business and professional data storage requirements can now be handled with ease.

Better yet, you can access data up to 10 times faster than with floppies. Spend more time working and less time waiting.

And it's easy to use. Kamermeran Labs lets you boot directly off the hard disk, just like the IBM XT.

**A complete backup solution.**

Backup of hard disk data is a critical requirement in many microcomputer applications, so Kamermeran Labs offers several reliable and cost-effective backup devices that are fully compatible with our hard disk units.

**Lower prices than ever.**

Because you deal directly with Kamermeran Labs, we offer you remarkably low prices. Finally, you can realize the full benefits of hard disk technology without the excessive costs.

**Tested and formatted.**

All Kamermeran Labs systems have been thoroughly tested and formatted before delivery.

**Full warranty and technical support.**

Kamermeran Labs backs all its products with a full one-year warranty on both parts and labor. Plus you get prompt technical support through a toll-free hotline number.

**To order, call toll-free  
800-522-2237.**

In Oregon, Hawaii and Alaska call  
503-626-6877.

IBM is a registered trademark of International Business Machines Corp.  
Compaq is a trademark of Compaq Computer Corp.  
Corona is a trademark of Corona Data Systems.

Leading Edge is a registered trademark of Leading Edge Products, Inc.  
Eagle is a registered trademark of Eagle Computers.  
TAVA is a trademark of TAVA Corporation.

All Kamermeran Labs Units come in either internal or external configurations.

Circle 214 on inquiry card.

**Kamermeran  
Labs**

8054 S.W. Nimbus, Bldg. 6, Beaverton, Or 97005  
Phone 503-626-6877

press a key on the keyboard, you generate a high-priority interrupt. If your nondedicated server machine is used by a typist, you may see the performance of the file server that happens to coexist in the same machine degrade to intolerable levels. Likewise, if suddenly 10 stations on the network try to share your disk, it may take a

very long time to recalculate your spreadsheet program.

There is also the issue of security: a programmer may be able to make direct calls to the BIOS (basic input/output system) and circumvent the server's security mechanism, gaining access to files and passwords.

Another trade-off is centralized ver-

sus decentralized file service. A centralized file service means there is one file server on the network, controlling the resources and simplifying management, so that you don't have the problem of multiple file copies existing in widely distributed places (as with decentralized file services). You may be able to take advantage of the economies of scale here: instead of buying 10 IBM PCs with 10 small hard disks, you might be able to buy one centralized file server with a large hard disk that can be shared.

However, the server is a potential bottleneck, particularly if you don't go with a high-performance processor. A lot of users on the network can try to access the file server simultaneously. Clearly, if that server should ever fail, all the disks that are on the network are going to be down. The server then becomes a central point of failure.

Most of these centralized networks use off-the-shelf IBM PC XTs as servers. Often, PC XTs that were purchased before networking was considered can be used. If something goes wrong with the PC XT, another one can often be swapped in. On the other hand, high-performance servers, such as Nestar's PLAN 4000 server (based on multibus architecture and using a 68000 processor from Motorola), can offer substantially better network disk-sharing performance.

Finally, there is a real difference between file and disk servers. The terms are often used interchangeably, but most vendors' "file" servers are really disk servers.

Disk servers service users' requests for disk I/O (input/output) at a low level. This requires a low-level modification of the users' workstations to intercept BIOS requests for reading and writing disk sectors. Thus the server is really a disk "volume" server, and file I/O is handled directly by the operating system in the PC.

File servers service users' requests for disk I/O at a higher level. This high-level modification to users' workstations is performed at a level that intercepts DOS requests for file operations, such as opening, reading, and

(continued)

## Graphics Takes A Quantum Leap Forward!



### THE INOVION PERSONAL GRAPHICS SYSTEM FEATURES:

- The most advanced color mapping capabilities available.
- 250,000 simultaneously displayable colors.
- A palette of 2.1 million colors.
- Frame Grabber/Digitizer to capture TV, VCR or Video Camera pictures.
- Quality three dimensional texture capabilities.
- Built in Icon/Menu software.
- Completely Mouse/Trackball driven
- Fonts, Brushes, Microscope, Patterns, and Rotations.

- A complete stand alone system.
- A 19" enhanced color monitor.
- 780K Graphics Memory.
- 512 x 480 pixel display with 24 bits per pixel.
- RS232C port allows access to all system functions and memory.
- NTSC composite video and NTSC RGB signal.
- 1 year warranty on graphics generator and 90 day warranty on enhanced monitor.
- Special introductory 30 day satisfaction guarantee.
- **ONLY \$3,495 complete\***.

\* Introductory Price

**INOVION**  
 195 East Gentile Street  
 Layton, Utah 84041  
 (801) 546-2850





Not long ago, *PC Magazine* called MDBS III "The most complete and flexible data base management system available for microcomputers." That's a powerful statement. But then, MDBS III is an amazingly powerful software package. So powerful, in fact, that it lets you build mainframe-quality application systems on your micro or mini. MDBS III is not for beginners. It's for application developers with large data bases or complex data interrelationships who want to define data base structures in the most natural way—without resorting to redundancy or artificial constructs. It's for professionals who can appreciate its extensive data security and integrity features, transaction logging, ad hoc query and report writing capability and its ability to serve multiple simultaneous users. And if you want the power and the glory that only the world's most advanced data management system can provide, MDBS III is for you. For information on MDBS III and our professional consulting services, write or call Micro Data Base Systems, Inc., MDBS/Application Development Products, 85 West Algonquin Road, Suite 400, Arlington Heights, IL 60005. (800) 323-3629, or (312) 981-9200. **MDBS III. ABSOLUTE POWER.**

Circle 254 on inquiry card.

# WE'LL GIVE YOU THE POWER.

# YOU TAKE THE GLORY.

closing. The server then has control over files and can enforce automatic file locking to prevent a file from being written to by two or more users simultaneously. Another advantage of file servers is that disk space for individual users does not have to be preallocated. A user's storage space can grow dynamically as space is needed.

### IBM PC LOCAL NETWORKS

Note that while the systems in table 1 are designed for the IBM PC, some may work as well with compatibles. Since more than 30 microcomputers are reasonably compatible with the IBM PC, there are more than 500 combinations of PC-compatibles and LAN systems. It is often up to the user to find out what works together and what doesn't. You should also note that all of the vendors listed plan to support the PC AT as well.

### 3COM ETHERSERIES

3Com, a privately held company that went public this spring, has a number of Ethernet products, one of which is the EtherSeries line for the IBM PC. 3Com got its start designing and selling Ethernet components, transceivers, cables, and some board-level products. In December 1982 it introduced the first Ethernet board for the IBM PC, based on the VLSI data-link controller from Seeq Technology. At that time, the board was really just a hardware product with some crude software, but now with the EtherSeries, 3Com has a systems-level product. To no one's surprise, the EtherSeries product is beginning to dominate 3Com's sales and now accounts for about 50 percent of the company's revenue.

EtherSeries is a complete Ethernet system for the IBM PC. The file server (actually a disk server) can be either a PC XT, an IBM PC made to look like a PC XT, or a 3Com machine. IBM PCs require the 3Com EtherShare software package and one EtherLink interface card. Alternatively, you can buy the higher-performance 3Com server that is based on the Altos 586 workstation, which uses a high-speed

8086 processor. The IBM PC version does not require dedication. Both versions can download the disk operating system (DOS) to diskless IBM PCs (which contain an optional boot ROM [read-only memory] on the network interface card).

EtherShare manages virtual disks at the volume level. Passwords are required to "log on," and optional passwords can be placed on volumes. Volumes can be made private for individual use only, public for use by several users in a read-only fashion, and shared for multiple read/write access. However, there is nothing implied in EtherShare that protects multiple writers from corrupting each other's data by writing to the same disk area at the same time. The application software must take advantage of semaphores and locks that are provided by EtherShare.

EtherShare can provide other server functions such as spooled virtual printing (EtherPrint) and electronic mail (EtherMail). An interesting feature of the print server is that you can have multiple users spooling data simultaneously without interfering with each other. The server maintains buffer spool files on the disk, and the first file to "close" (or time out while waiting for more print data from the network) starts printing. EtherMail runs on top of EtherShare, as does EtherPrint, so that you can have EtherMail, EtherShare, and EtherPrint all running on the same machine. EtherMail provides electronic mail for all the users on the system, sets up mailboxes for them on the file server, and can find other users mailboxes on other EtherShares in the network. So EtherShare really becomes a multi-purpose server.

### IBM CLUSTER CONTROL PROGRAM

IBM gave its "stamp of approval" to IBM PC local networks on March 1, 1984, at the same time it announced the IBM Portable PC.

IBM's Cluster Control Program is designed to be a low-cost, entry-level system, as you will see when you look at the technical specs. (The Cluster

Control Program name is somewhat deceiving; "program" refers to the entire system, not to a piece of software.) Compared to other more sophisticated, more mature networks that are available today, I see this system as primitive at best. IBM wanted to design a simple system that could be used by the "average" end user. The company didn't call it a LAN because it didn't want it compared with high-performance LANs.

The Cluster runs at a modest 375K bps (bits per second) and uses a carrier-sense multiple-access protocol with collision avoidance (CSMA/CA). It uses 75- $\Omega$  (ohm) CATV-type coaxial cable. You can run the main bus connection as far as 1000 meters instead of the typical 1000 feet, partly because of the modest data rate. The addressing structure allows as many as 64 users per cluster. In practice that number would be far less, depending on the applications and the kind of things you do.

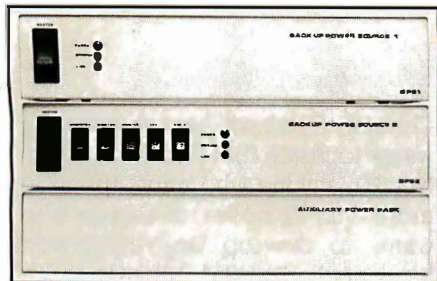
The Cluster supports the IBM PC, PC XT, PC Portable, and the PCjr. There are two different versions of the adapter, one for the PCjr and one for all the other machines. The PCjr adapter plugs into the side of the machine, which, at least in the initial shipments, contains a power supply that is inadequate to power more than the PCjr and the adapter. In order to have the Cluster adapter and a disk drive, printer adapter card, or internal modem plugged in, you must have the power-expansion adapter, which was announced this summer.

The network software requires DOS 2.1 and supports station-to-station communication; you can send files or messages back and forth between users. The package also has some diagnostics to help identify problems (for example, the network card) and it includes disk-server capabilities for the PC XT.

The disk server, like the hardware itself, also supports the IBM microcomputers previously mentioned. It requires a PC XT or a PC made to work like an XT. As an option, the IPL (initial program load) allows you to

*(continued)*

# Take control of your computer.



## The Backups™

*Backup power for peace of mind and memory.*

### Backup Power Source 1

- delivers up to 225 watts @ 120V.AC
- 40 minutes of power at 50% load
- visual and audible power interrupt alarm
- fast automatic switching

(Within 6 milliseconds of peak voltage detection)

- 2 Outlets
- AC surge suppressor
- 3 stage noise filter
- thermal output protection
- IEC power connector
- attractive metal enclosure
- 3¼" high, 16" wide, 11" deep

**\$379<sup>95</sup> complete\***

### Backup Power Source 2

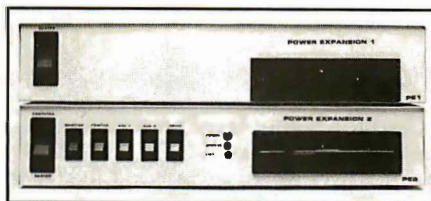
- All the features of Power Source 1 plus:
- 6 outlets controlled by front switches
- switchable visual and audible alarm
- 10 amp master switch circuit breaker
- cross suppression between all 6 outlets
- optional 2 hour auxiliary power pack

**\$499<sup>95</sup> complete\***

### Auxiliary Power Pack

- 2 hours of power at full load
- plugs directly into either of our backup units
- includes 6 rechargeable 12V power cells
- backup units keep power cells at full charge
- heavy duty power cable
- 3¼" high, 16" wide, 11" deep

**\$299<sup>95</sup> complete\***



## The Expanders™

*Control power and expand with floppy or hard disks.*

### Power Expansion 1

- 1 stage noise filter
- AC surge suppression
- IEC power connector
- attractive metal enclosure
- 3¼" high, 16" wide, 11" deep
- optional internal power supply
- optional floppy and hard disk drives

Power Expansion 1 . . . . . **\$149<sup>95</sup>\***

w/Internal Power Supply . . . . . **\$219<sup>95</sup>\***

w/Power Supply, DS/DD Drive, All Cables and Instructions. Expands XT or Compatible . . . . . **\$349<sup>95</sup>\***

w/Power Supply, Half Height 10M Hard Disk Drive, All Cables and Instructions. Expands PC or Compatible . . . **\$1149<sup>95</sup>\***

20M Drive . . . . . **\$1449<sup>95</sup>\***

20M Drive . . . . . **\$1449<sup>95</sup>\***

### Power Expansion 2

All the features of Power Expansion 1 plus:

- 6 outlets controlled by front switches
- 10 amp master switch circuit breaker
- LED ground and line indicators
- 3 stage noise filter
- cross suppression between all 6 outlets
- optional internal power supply
- optional floppy and hard disk drives

Power Expansion 2 . . . . . **\$199<sup>95</sup>\***

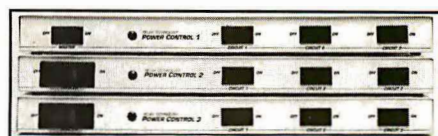
w/Internal Power Supply . . . . . **\$269<sup>95</sup>\***

w/Power Supply, DS/DD Drive, All Cables and Instructions. Expands XT or Compatible . . . . . **\$399<sup>95</sup>\***

w/Power Supply, Half Height 10M Hard Disk Drive, All Cables and Instructions. Expands PC or Compatible . . . **\$1199<sup>95</sup>\***

20M Drive . . . . . **\$1499<sup>95</sup>\***

20M Drive . . . . . **\$1499<sup>95</sup>\***



## The Controllers™

*Control power, peripherals, spikes, and glitches.*

### Power Control 1

- 4 outlets control computer and 3 peripherals
- AC surge suppressor
- attractive metal enclosure
- 1¼" high, 16" wide, 10" deep

**\$69<sup>95</sup> complete\***

### Power Control 2

- All the features of Power Control 1 plus:
- 10 amp master switch circuit breaker
- 1 stage noise filter
- IEC power connector

**\$89<sup>95</sup> complete\***

### Power Control 3

- All the features of Power Control 1 & 2 plus:
- illuminated switches
- 3 stage noise filter
- cross suppression between all 4 outlets

**\$129<sup>95</sup> complete\***

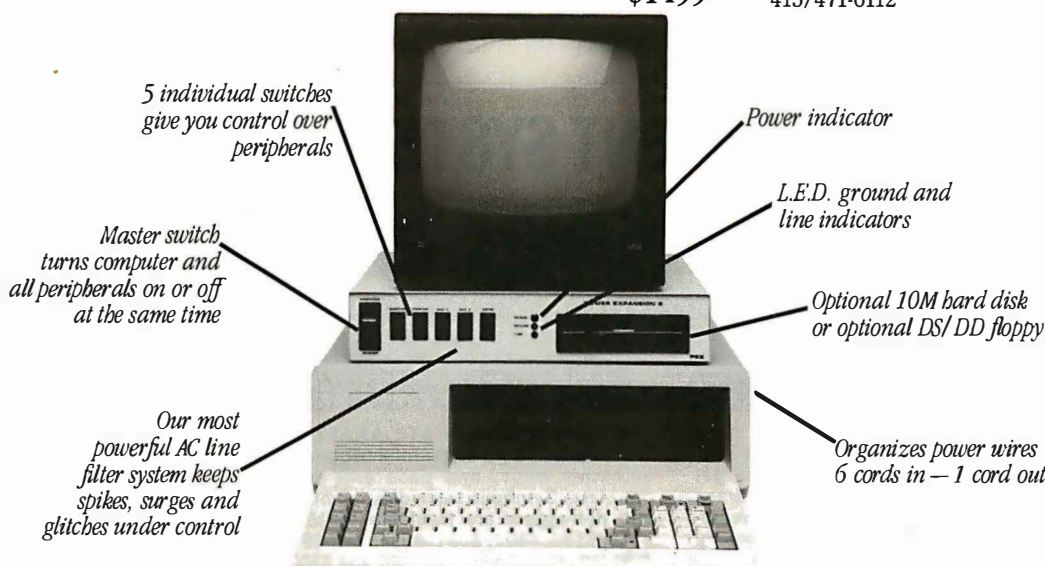
*\* All prices suggested retail.*

Available at fine computer stores everywhere, or by mail or phone. MasterCard and Visa accepted. Dealer inquiries invited.

# Relax Technology

*The company that works so you can relax and get down to business.*

3101 Whipple Rd. #25  
Union City, CA 94587  
415/471-6112



download the DOS 2.1 operating system from the PC XT right into your workstation; in fact, the PCjr is supported in this way because it does not have a disk drive when it is on the network.

The disk server supports sharing at the volume level and supports only two volumes at one time per user. You can mount only two virtual disk volumes at one time, one of which can be a public volume shared by all users on the system (read only), and the other a user's private volume. However, you'll start seeing more and more sophisticated software to support the system as third-party software vendors jump on the bandwagon.

### IBM PC NETWORK

In mid-August of this year, IBM announced its first "real LAN," the IBM PC Network. The PC Network is based on broadband technology developed by Sytek Inc. Sytek supplies the PC Network Adapter Card and the Network Translator Unit, or head end, to IBM. The Network Translator comes with a connector assembly for attaching as many as 8 IBM PCs within a radius of 200 feet. A cabling component, consisting of cable segments, a network-base expander, and various network distance kits, is used to increase the number of networked IBM PCs from 8 to 72. In addition, IBM is an OEM of Sytek for LocalNet/IBM PC protocols, modified Sytek LocalNet 20 protocols that are used in the Adapter

Card for higher-level protocol implementation.

The IBM PC Network operates at 2 megabytes per second on one channel of a midsplit broadband system for distances up to 1000 feet. With the components that are available from IBM, the maximum number of IBM PCs supported on the network is 72. These limitations, however, appear to be due to IBM marketing decisions and are not inherent in the design.

The PC Network is designed for the IBM PC, PC XT, Portable PC, and the new PC AT. Unlike the Cluster, it will not support the PCjr. It is being promoted as offering highly reliable, maintenance-free operation and has extensive self-test and diagnostic capabilities.

The Adapter Card for the PC Network uses an Intel 82586 Ethernet data-link controller chip to provide access control. An Intel 80188 microprocessor running at 6 MHz and 16K by 8 RAM (random-access read/write memory) data buffers are used for protocol processing, packet assembly/disassembly, and other control functions. A custom VLSI chip, jointly developed by IBM and Sytek, is used to implement protocols up to Level 5, the session level. Up to 16 active aliases and 32 active sessions are allowed per IBM PC. Release 3.1 of DOS will be required to support PCs on the network.

IBM representatives have stated that the PC Network Adapter Card will work on third-party installed networks.

Certainly Sytek will help anyone who wants to install IBM PCs on its LocalNet 20, anyone who wants to install more than 72 nodes, or anyone who wants to develop large integrated local networks. IBM appears to be targeting small businesses, the mass market, and large non-IBM accounts with this product. The Network Adapter Card is currently available, but the network software (DOS 3.1) will not be available until early next year.

IBM has also stated its intention to interconnect the PC Network to its token-ring network (announced, but not commercially deliverable for another two years), and that all PC Network software will also run on IBM PCs directly attached to the token ring. Thus, software developed for the PC Network will not become obsolete when IBM begins to implement its token-passing ring network. However, it is not clear how the Cluster fits into IBM's overall LAN strategy, if at all. One nice application for the broadband IBM PC network would be to support several "subnetworks" of Cluster systems.

### ORCHID TECHNOLOGY'S PCNET

Orchid Technology's PCnet is available from a number of different vendors in addition to Orchid. AST's PCnet, Santa Clara Systems' PCnet, and IDEAssociates' IDEAnet are all basically the same system.

PCnet is a CSMA-type system that

*(continued)*

## THE \$2395 DEVELOPMENT SYSTEM

Turns any personal computer into a complete micro-computer DEVELOPMENT SYSTEM. Our integrated control/display program runs under MS-DOS, CP/M, ISIS, or Apple and controls the UDL via an RS-232 port.



Up to 128K bytes of **EMULATION ROM** (8K standard) allows you to make program patches instantly. Since the target ROM socket connects data and address lines to both the analyzer and the emulator, no expensive adaptors or personality modules are needed.

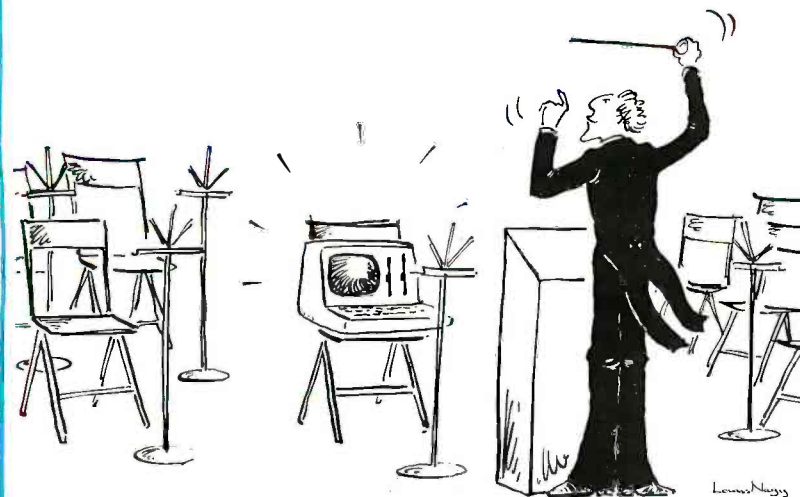
The powerful **BUS STATE ANALYZER** features four-step sequential triggering, selective trace, and pass and delay counters. Symbolic trace disassemblers and debuggers are available for Z-80, 8048, 6500, 6800, 8031, 8085, Z-8, 1802, 8088/80188, 8086/80186, R65 and 68000.

The **PROM GENERATOR** also doubles as a **STIMULUS GENERATOR**.

For further information, call or write:

**ORION** Instruments 172 Otis Ave., Woodside, CA 94062

**(415) 851-1172**



Would you hire an entire band when all you need is one instrument? Of course not.

So why use a whole orchestra of computers when all you need is one to develop software for virtually any type of micro-processor?

The secret? Avocet's family of cross-assemblers. With Avocet cross-assemblers you can develop software for practically every kind of processor — *without having to switch to another development system along the way!*

## Cross-Assemblers to Beat the Band!

### Development Tools That Work

Avocet cross-assemblers are fast, reliable and user-proven in over 4 years of actual use. Ask NASA, IBM, Xerox or the hundreds of other organizations that use them. Every time you see a new micro-processor-based product, there's a good chance it was developed with Avocet cross-assemblers.

Avocet cross-assemblers are easy to use. They run on almost any personal computer and process assembly language for the most popular microprocessor families.

### Your Computer Can Be A Complete Development System

Avocet has the tools you need to enter and assemble your software and finally cast it in EPROM:

**VEDIT Text Editor** makes source code entry a snap. Full-screen editing plus a TECO-like command mode for advanced tasks. Easy installation - INSTALL program supports over 40 terminals and personal computers. Customizable keyboard layout. CP/M-80, CP/M-86, MSDOS, PC DOS . . . . . \$150

**EPROM Programmers** let you program, verify, compare, read, display EPROMS but cost less because they communicate through your personal computer or terminal. No personality modules! On-board intelligence provides menu-based setup for 34 different EPROMS, EEPROMS and MPUs (40-pin devices require socket adaptors). Self-contained unit with internal power supply, RS-232 interface, Textool ZIF socket. Driver software (sold separately) gives you access to all programmer features through your computer, lets you download cross-assembler output files, copy EPROM to disk.

**Model 7228 Advanced Programmer** — Supports all PROM types listed. Superfast "adaptive" programming algorithm programs 2764 in 1.1 minutes.

**Model 7128 Standard Programmer** — Lower-cost version of 7228. Supports all PROM types except "A" versions of 2764 and 27128. Standard programming algorithm programs 2764 in 6.8 minutes.

| Avocet Cross-assembler | Target Microprocessor | CP/M-80   | CP/M-86 IBM PC, MSDOS** |
|------------------------|-----------------------|-----------|-------------------------|
| XASM04 <i>NEW</i>      | 6804                  | \$ 250.00 | \$ 250.00               |
| XASM05                 | 6805                  | 200.00    | 250.00                  |
| XASM09                 | 6809                  | 200.00    | 250.00                  |
| XASM18                 | 1802/1805             | 200.00    | 250.00                  |
| XASM48                 | 8048/8041             | 200.00    | 250.00                  |
| XASM51                 | 8051                  | 200.00    | 250.00                  |
| XASM65                 | 6502/65C02            | 200.00    | 250.00                  |
| XASM68                 | 6800/01, 6301         | 200.00    | 250.00                  |
| XASM75                 | NEC 7500              | 500.00    | 500.00                  |
| XASM85                 | 8085                  | 250.00    | 250.00                  |
| XASM400                | COP400                | 300.00    | 300.00                  |
| XASMF8                 | F8/3870               | 300.00    | 300.00                  |
| XASM28                 | Z8                    | 200.00    | 250.00                  |
| XASM280                | Z80                   | 250.00    | 250.00                  |
| XMAC682 <i>NEW</i>     | 68200                 | 595.00    | 595.00                  |
| XMAC68K <i>NEW</i>     | 68000/68010           | 595.00    | 595.00                  |

**Model 7956 and 7956-SA Gang Programmers** — Similar features to 7228, but program as many as 8 EPROMS at once. 7956-SA stand-alone version copies from a master EPROM. 7956 lab version has all features of stand-alone plus RS-232 interface.

**EPROM:** 2758, 2716, 2732, 2732A, 2764, 2764A, 27128, 27128A, 27256, 2508, 2516, 2532, 2564, 68764, 68766, 5133, 5143. **CMOS:** 27C16, 27C32, 27C64, MC6716. **EEPROM:** 5213, X2816A, 48016, I2816A, 5213H. **MPU (w/adaptor):** 8748, 8748H, 8749, 8749H, 8741, 8742, 8751, 8755.

|                |                                      |               |
|----------------|--------------------------------------|---------------|
| <b>7228</b>    | <b>Advanced Programmer</b>           | <b>\$ 549</b> |
| <b>7128</b>    | <b>Standard Programmer</b>           | <b>429</b>    |
| <b>7956</b>    | <b>Laboratory Gang Programmer</b>    | <b>1099</b>   |
| <b>7956-SA</b> | <b>Stand-Alone Gang Programmer</b>   | <b>879</b>    |
| <b>PDV</b>     | <b>Driver Software</b>               | <b>95</b>     |
| <b>481</b>     | <b>8748 Family Socket Adaptor</b>    | <b>98</b>     |
| <b>511</b>     | <b>8751 Socket Adaptor</b>           | <b>174</b>    |
| <b>755</b>     | <b>8755 Socket Adaptor</b>           | <b>135</b>    |
| <b>CABLE</b>   | <b>RS-232 Cable (specify gender)</b> | <b>30</b>     |

**HEXTRAN Universal HEX File Converter** — Convert assembler output to other formats for downloading to development systems and target boards. Also useful for examining object file, changing load addresses, extracting parts of files. Converts to and from Intel, Motorola, MOS, RCA, Fairchild, Tektronix, TI, Binary and HEX/ASCII Dump formats. For CP/M, CP/M-86, MSDOS, PC DOS . . . . . \$250

Ask about UNIX.

**AVOCET'S SUPERB 68000 CROSS-ASSEMBLER** — With exhaustive field testing completed, our 68000 assembler is available for immediate shipment. XMAC68K supports Motorola standard assembly language for the 68000 and 68010. Macros, cross-reference, structured assembly statements, instruction optimization and more. Linker and librarian included. Comprehensive, well-written manual. XMAC682 for MK68200 has similar features.

Call us toll-free for some straight talk about development systems.

**1-800-448-8500**

(in the U.S. Except Alaska and Hawaii)

VISA and Mastercard accepted. All popular disc formats now available — please specify. Prices do not include shipping and handling — call for exact quotes. OEM INQUIRIES INVITED.

\*Trademark of Digital Research \*\*Trademark of Microsoft

**AVOCET SYSTEMS INC.™**

**DEPT. 1284-B**  
**804 SOUTH STATE STREET**  
**DOVER, DELAWARE 19901**  
**302-734-0151 TELEX 467210**

**SOFTWARE GALORE**  
**THE ULTIMATE PLACE**  
**FOR YOUR COMPUTER**  
**SOFTWARE & COMPONENTS**

|                             |          |
|-----------------------------|----------|
| LOTUS 123                   | \$299.00 |
| D BASE II                   | 399.00   |
| FRAMEWORK                   | 419.00   |
| SYMPHONY                    | 425.00   |
| WORDSTAR PRO PACK           | 349.00   |
| MULTIMATE                   | 259.00   |
| SAMNA II & III              | CALL     |
| OPEN ACCESS                 | 369.00   |
| THINK TANK                  | 129.00   |
| IUS II SYSTEM               | 179.00   |
| MULTIPLAN                   | 132.00   |
| CROSSTALK                   | 119.00   |
| C-COMPIER MS                | 219.00   |
| FORTRAN MS                  | 239.00   |
| EXECUVISION                 | 279.00   |
| STATE OF THE ART ACCOUNTING | CALL     |
| CONDOR III                  | 329.00   |
| R BASE 4000                 | 279.00   |
| SUNDEX                      | 109.00   |
| COMPUERVE STARTER KIT       | 19.95    |

■ **PRINTERS** ■

|                |         |
|----------------|---------|
| RITE MAN LQ 20 | 269.00  |
| RITE MAN PLUS  | 289.00  |
| RITE MAN 15    | 475.00  |
| EPSON FX 80    | 395.00  |
| EPSON FX 100   | 645.00  |
| OKI DATA 92P   | 475.00  |
| OKI DATA 93P   | 665.00  |
| EPSON LQ 1500  | 1195.00 |
| NEC 3550       | 1595.00 |
| SHIBATA P1351  | 1345.00 |

■ **MODEMS** ■

|                 |        |
|-----------------|--------|
| ANCHOR MARK XII | 235.00 |
| HAYES 1200B     | 379.00 |
| HAYES 1200      | 459.00 |

■ **ACCESSORIES** ■

|                |       |
|----------------|-------|
| <b>KOALA</b>   |       |
| APPLE/FRANKLIN | 84.00 |
| ATARI          | 72.00 |
| COMMODORE      | 72.00 |
| IBM            | 84.00 |
| APPLE FAN      |       |
| COOL + TIME    | 69.00 |
| DANA FAN       | 39.00 |

■ **MICROTEK (GRAPHICS BOARD)** ■

|                                |        |
|--------------------------------|--------|
| RV 6 11C                       | 59.00  |
| DUMPLING GX                    | 65.00  |
| GX 1K BUFFER                   | 139.00 |
| GX 32K BUFFER                  | 159.00 |
| AST SIX PACK 64K               | 259.00 |
| PARADISE MULTIFUNCTION BOARD   | 279.00 |
| 64K MEMORY UPGRADE 3 (S) DRIPS | 45.00  |

■ **TAXAN & AMDEK MONITOR** ■

|                    |        |
|--------------------|--------|
| IBM MONO AMBER 122 | 145.00 |
| IBM MONO GREEN 121 | 135.00 |
| COLOR 420          | 465.00 |
| 310A (IBM)         | 159.00 |

■ **DISK DRIVE** ■

|                 |        |
|-----------------|--------|
| RANA ELITE I    | 199.00 |
| RANA ELITE II   | 339.00 |
| RANA ELITE III  | 389.00 |
| CONTROLLER CARD | 79.00  |
| TANDON (IBM)    | 159.00 |
| GDC             | 219.00 |
| 10 MG HARD DISK | 795.00 |

DEF: DUN & BRAD STREET  
 IBM  
 ROCKWELL INTERNATIONAL  
 HUGES AIRCRAFT

1-800-423-6326

IN CALIFORNIA

**VISA** (213) 827-1851

VISA M/C



4079 GLENCOE AVE.  
 MARINER DEL REY, CA 90292

**IF YOU SEE IT ADVERTISED FOR LESS  
 CALL FOR LOWEST QUOTE !**

uses coaxial cable as a transport medium. It also supports collision detection and is software-intensive. The network board has no VLSI or central processor. It requires constant attention from the PC's processor to support all the data-link functions to form the packet, ship it, watch for collisions, etc. Benchmarks for PCnet are beginning to run slower than other systems, due in part to overhead to support the networking function, as well as Orchid's proprietary multi-process operating system. Again, the network board provides only a physical interface between the IBM PC and the network. It also turns out that PCnet really runs at the raw data rate of 880K bps—not 1 megabit per second, as stated in Orchid's brochures.

PCnet uses 75-Ω CATV-type coaxial cable. It can run as long as 3000 or 7000 feet, depending on the cable type.

PCnet is available with a number of options. You can get a multifunction memory board, some ports, and a diskless board that allows you to boot from the network, eliminating the need for floppy-disk drives at the workstation.

Like most of the other systems, PCnet does not require a dedicated disk server. You can have two different types of workstations: user PCs and shared PCs. User PCs cannot share their peripherals (with the exception of a printer) with other users on the network. On the other hand, you can make your peripherals, such as a hard disk on a PC XT, available to other users.

PCnet supports a distributed semaphore system. The semaphore table is maintained at each and every machine in the system. This also adds overhead to the system because tables at all PCs must be updated when they change. One of the more interesting features on the system is the remote execution command, which allows you, for example, to compile a Pascal program on a remote machine in the network.

You must be careful when sharing peripherals in PCnet. It is possible to mix output on a printer being shared

by more than one person because there is no implied semaphore locking: either you have to build a network print utility that uses the distributed semaphore system or you have to have everyone who wants to use a shared printer use a procedure that says, "Try to lock the printer by entering a semaphore lock command from the keyboard before you try to print. If it's in use, try later. Unlock the semaphore when done."

AST now has a lower-cost version of PCnet available called PCnet II, which runs at 800 bps, uses a collision-avoidance scheme, and is software-compatible with PCnet. AST has also developed its own more efficient software for PCnet II.

**UNGERMANN-BASS NET/ONE  
 PERSONAL CONNECTION**

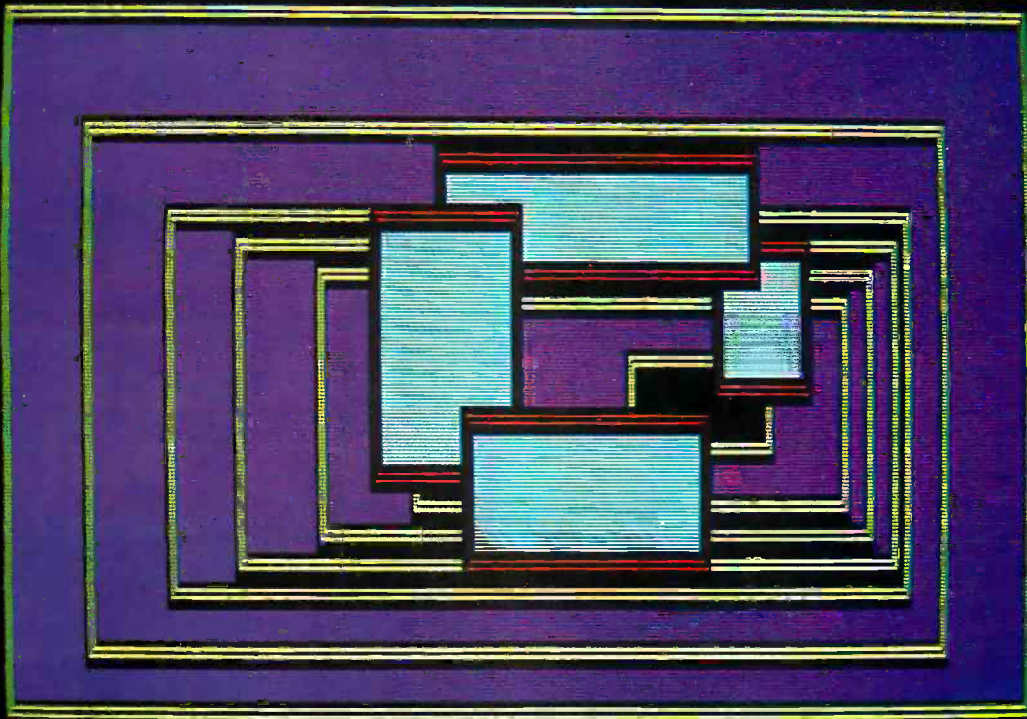
Ungermann-Bass has built a reputation with its Ethernet products, which make up the Net/One product line. These products are basically intelligent boxes that enable you to connect any computer, mainframe, or personal computer to Ethernet. The first products supported terminals in mainframe environments connected via Ethernet, which allowed users to establish virtual terminal connections with a host.

The newest Net/One product is the Net/One Personal Connection for the IBM PC, introduced at the end of last year. This product puts Ungermann-Bass head to head with 3Com; it is aggressively priced as well. It is a true Ethernet system and employs the high-level Xerox Network Systems (XNS) protocols. It is also the first true LAN for PCs to offer a broadband option.

Like most of the other systems based on the IBM PC, the servers are all designed around the PC XT. They are available as a file server, a print server, and an SNA (Systems Network Architecture) Gateway. Multiple servers of the same or a different type are allowed on the same network and do not have to be dedicated.

The network-interface card is called the Network Interface Unit (NIU), a

(continued)



WHEN YOU BUILD A HOUSE... YOU DON'T NEED TO MAKE THE WINDOWS YOURSELF. NOW... THE SAME IS TRUE WHEN YOU'RE WRITING CODE.

#### Windows With A View Toward The Future

The Window Machine™ occupies only 12K! Written in tight, fast Assembler, it performs like a racing engine... with more power than you'll probably ever need. Yet, it's an engine designed to fit in the vehicle of your choice... from a "stripped-down" 128K IBM PC to a fully loaded AT. The programs you write today will run on the broadest range of machines possible... now, and in the future.

#### Windows Bigger Than Your Screen?

Here's where the VSI part of our name fits in. VSI means Virtual Screen Interface. Behind each window, there's a much bigger picture. VSI defines virtual screens rather than just windows. The window itself shows whatever portion of its virtual screen you wish to exhibit at any given point in your program. Each screen can be up to 128 x 255 (columns x rows, or rows x columns). And there are more than 100 screen primitives at your command.

#### Multilingual Windows

You can order The Window Machine with the language interface of your choice: C, Pascal, Compiled Basic, Fortran, Cobol, or PL1. We've even recently completed

These are coders' windows... designed to be built into the programs you are writing. They can overlap, move anywhere on the screen, grow, shrink, vanish or blink. They can be bordered in anything from a simple line to flashing asterisks... or even no border at all. And you can have up to 255 of them at a time! Color or monochrome... of course!

## Why did Simon & Schuster, 3COM, Tymshare, and Revlon choose VSI—The Window Machine?

(and how come you can buy it for such a low price?)

**\$59.95**

an interface for Turbo Pascal\*, so that now true, full-featured windowing can be utilized with this fine compiler. (Turbo's own built-in "windowing" procedure is extremely limited).

#### Windows That Won't Break You

We decided to save you a lot of money. So, we left behind fancy binders, monogrammed slip cases and plastic presentation boxes. Instead, you'll find an extremely powerful tool and a 200 page manual written with an eye toward simplicity, clarity and completeness. (We

\*Turbo Pascal is a Trademark of Borland International

figured if you wanted ribbons and bows you could always add them yourself.)

And by offering you the product ourselves, we were able to cut out all the middlemen and save you a tremendous amount of money.

## VSI The Window Machine™

Available for the IBM PC, XT, AT, IBM Compatibles, and the Wang, T.I., HP 150, and Tandy 2000.

#### The Window Machine Includes:

- Zoom Windows
- Multiple Virtual Screens (up to 255)
- Choice of Borders (including flashing borders)
- Support for all Color and Monochrome Video Attributes (no graphics card required)
- Built-in Diagnostics
- And much, much more

**ORDER YOUR COPY OF VSI—THE WINDOW MACHINE TODAY For Visa, MasterCard and American Express orders call toll free: 1-800-227-3800 ext. 986**

The Window Machine\* \$59.95 Shipping and handling included

#### LANGUAGE INTERFACE:

Lattice  Realia  Cobol  Microsoft Basic Compiler  Microsoft Fortran  PL1  Microsoft Pascal  Turbo Pascal (full featured true windowing)

#### COMPUTER

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip Code \_\_\_\_\_

Check  Money Order  VISA  MasterCard  American Express

Card # \_\_\_\_\_ Exp. Date \_\_\_\_\_

\*California residents: tax included. Orders outside the USA: please add \$5 for shipping and handling.



**AMBER SYSTEMS**  
1171 S. Saratoga-Sunnyvale Road  
San Jose, CA 95129

AMBER SYSTEMS, INC. 1171 S. Saratoga-Sunnyvale Road, San Jose CA 95129

FOR DEALER INQUIRIES: CALL OUR 800 NUMBER

# JUKI® 6300: THE SPEED OF A BEE AT ONE HONEY OF A PRICE— \$995!

It's the buzz of the industry—our new letter-quality printer that zips along at **40 characters per second** and sells for less than a thousand dollars! Its 13" print line will handle your spreadsheets and every imaginable kind of correspondence—plus graphics! Quiet, too—less than 60 dbA. And the 3K buffer memory (expandable to 15K) lets you use your computer for other purposes while the JUKI is printing. Compatible with most computers. (You can even get an optional tractor feed and cut-sheet feeder for it!) Now you know why JUKI printers are humming in offices all over the world!



## JUKI®

**The worker.**

JUKI INDUSTRIES OF AMERICA, INC.

### NATIONAL HEADQUARTERS:

DA DIVISION  
299 Market St., Saddle Brook, NJ 07662  
(201) 368-3666

### WEST COAST:

CALIFORNIA DIVISION  
3555 Lomita Blvd., Torrance, CA 90505  
(213) 325-3093



board that contains an on-board, high-performance VLSI Ethernet data-link controller from Intel. It also has an on-board, high-performance Intel 80186 microprocessor, 8K bytes of ROM, and 128K bytes of RAM. It requires an external Ethernet transceiver (3Com offers a built-in transceiver). The network interface card is a complete microcomputer on a board, dedicated to handling the XNS protocols and the data-link function. It turns out that this card is more powerful than the IBM PC itself! A less-powerful, less-expensive version is available; it lacks the 80186 and its support RAM and ROM.

A broadband version of the Net/One Personal Connection is totally software-compatible with the baseband Net/One and can also run on existing CATV installations. It runs at 5 megabytes per second and consists of an RF (radio frequency) modem board that plugs into a slot on the IBM PC with a jumper to the baseband board.

Ungermann-Bass entered into an agreement with Davong, through which Ungermann-Bass acquired sorely needed network software to make its system work. Davong has developed a stable networking product called Multilink (also for the IBM PC), which has excellent software to go with it. This will also enable the Net/One Personal Connection to support CP/M-86 and the UCSD p-System, as well as MS-DOS.

### MIXING IBM PCs WITH OTHER MACHINES

Let's take a look at two systems that support not only more than one type of personal computer but also more than one type of operating system. So far, all of the systems we've looked at work only with the IBM PC (and some compatibles) and only support the MS-DOS operating system (with the exception of Net/One).

### CORVUS

Corvus started by selling the first 5¼-inch add-on Winchester drives for personal computers. The first networking product from Corvus was

called the Multiplexer, but it was not a true LAN. It was simply a device that allowed you to share a hard disk by partitions. Along came Omninet, a true LAN. Omninet uses CSMA with positive acknowledgment (often called CSMA/PA); hence, Omninet can ensure reliable packet transmission and reception by waiting a brief instant for an acknowledgment from a receiving node after sending a packet. This improves network performance substantially.

Omninet supports more kinds of personal computers than any other network; it has versions for the IBM PC, Apple II, Corvus Concept, TI Professional, DEC Rainbow, and S-100 systems. In addition, a number of other manufacturers are offering it as an option with their personal computers.

The Omninet's address limitation is 63 nodes; once again, the number would be less in actual practice, depending on the applications. And it runs at 1 megabit per second over twisted-pair wire. The total cable cannot exceed 1000 feet without repeaters (an active junction box); up to 4000 feet is possible with repeaters.

The network interface board, called a transporter, contains an on-board 6801 microprocessor to handle the network communication details. It supports DMA as well as interrupts.

Omninet uses a disk server that is actually a single-board Z80-based microcomputer with a built-in network interface. The server is available as a stand-alone box that connects to an external Corvus drive or is built into a 5¼-inch Winchester disk assembly. Corvus is actually the first vendor to integrate a network controller into a disk drive. As many as eight drives with the built-in Omninet interface can be attached to the network.

The software to support networking is called Constellation. The early version was called Constellation I and supported only the Apple II. Constellation II is for IBM and for all the other types of microcomputers. It supports not only different types of PCs but different operating systems as well. On the Apple, you can run Apple

Pascal, DOS 3.3, and CP/M; on the IBM PC, you can run DOS 1.1, 2.0, CP/M-86, or the UCSD p-System.

Security on Omninet is minimal. A user name and password are required to boot up a personal computer on the network. Once users are on the network, they must also have access to the volumes they want to use (a "system manager" decides who can access what volumes).

Corvus supplies a Spool utility that enables you to spool files to printers as well as other (compatible or non-compatible) personal computers. Users with the same personal computers can, of course, share the same volumes directly. Again, nothing prevents users from writing to the same file at the same time and corrupting data, but semaphores are available for users or programmers.

Corvus was one of the first companies in the microcomputer network business to recognize a need to back up data. Two years ago it introduced a product called Mirror, which lets you dump a mirror image of a Corvus hard disk to a standard videotape recorder. Corvus also has a product called The Bank, a high-capacity (200-megabyte) tape-cartridge drive that interfaces directly to Omninet. The Bank can be used as a backup to the disk server and can also be directly accessed by workstations in the manner of a slow disk server.

One of the more interesting Omninet products is the SNA Gateway. The Gateway allows workstations to run terminal-emulation software and establish a virtual connection with a remote host. More than one user can use the Gateway at the same time. It supports 3270 terminal protocols as well as SNA/SDLC (synchronous data-link control) communications protocols to the host.

### NESTAR

Nestar was the first third-party vendor to produce a true personal computer LAN. It was called the Cluster/One Model A for Apple computers, and it made its debut in 1980. The Cluster/One is not being sold anymore, now that Nestar is pushing its PLAN 4000

**FOR 15 YEARS,  
WE'VE BEEN  
MAKING  
THE WORLD'S  
MOST POPULAR  
MODEMS.**

**NOW YOU CAN  
BUY ONE.**

Introducing the Maxwell Modem™ from Racal-Vadic.

It's not your fault you didn't buy one sooner. You couldn't. Unless you happened to be a major corporation. They're the ones who buy the most modems. And the modems they buy most are ours.

Now we've taken everything we know about modems and made one you can buy.

The Maxwell Modem.

It's designed expressly for personal computers. And the people who use them. It's rugged. Reliable. And it even operates over low-quality phone lines that other modems can't handle.

But best of all, it's uncomplicated. So you don't have to know how one works to work one. There's no control panel to control. No switches to switch.



The Maxwell Modem and George are trademarks of Racal-Vadic. IBM is a registered trademark of International Business Machines Corp. ©1984, Racal-Vadic.

Instead, every feature makes sense. Auto-dialing. Auto-answer. And complete unattended operation.

Our communications software is just as accommodating. It's called George." And we've made George so simple to use you may never have to open your manual.

The Maxwell Modem comes in two different versions and two different speeds: Internal modems for the IBM PC and compatibles, and desktop models for virtually every personal computer. Both are available with speeds of 300- or 1200-bps.

And every Maxwell Modem has diagnostic features built in. So we can test your modem right over the phone from our Remote Diagnostic Center. We'll even pay for the call.

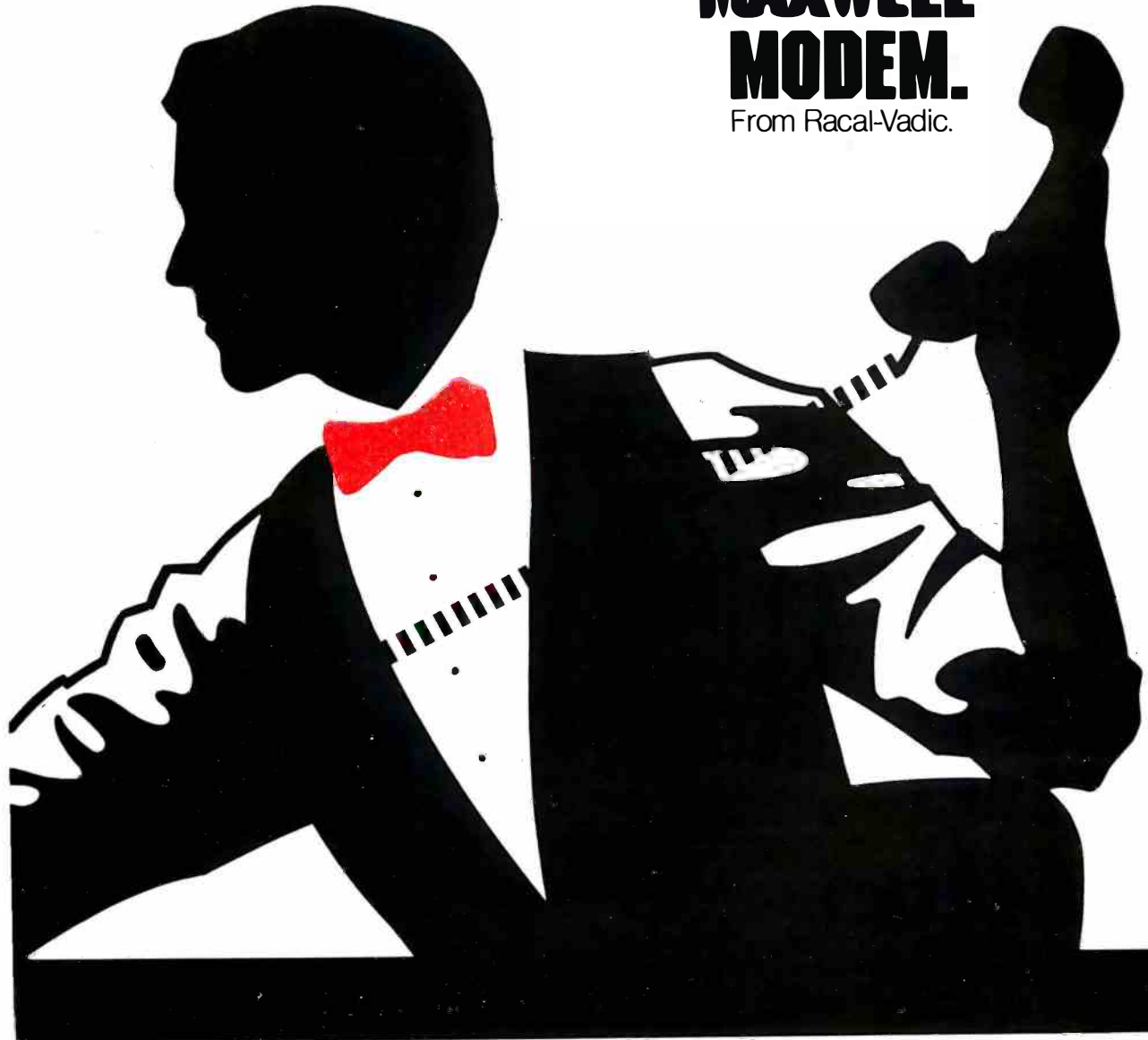
So where can you get your hands on a Maxwell Modem? To find our dealer nearest you, just do what modems do.

Call 800-4-VADICS.

Racal-Vadic, 1525 McCarthy Blvd., Milpitas, CA 95035.

# THE MAXWELL MODEM.

From Racal-Vadic.



system. PLAN 4000 is based on the Arcnet token-passing protocol with XNS protocols at a higher level; it is about four to five times faster than the Cluster/One in end-to-end throughput. In addition, it now supports the IBM PC.

As for the Datapoint Arcnet specifications, the PLAN 4000 network communicates at the raw data rate of 2.5 megabits per second over RG-62 (3270-type) coaxial cable. A VLSI data-link controller (from Standard Microsystems) handles this low-level communication. IBM PCs in this system can be up to 22,000 feet (approximately 4 miles) apart. Active repeaters (equivalent to the Datapoint HUBs), which also connect the workstations to the network, are required every 2000 feet. Each PLAN 4000 can support as many as 254 workstations, but again, a more practical number is lower.

Nestar has preserved a lot of application and server software developed for the Cluster/One and transported it to the PLAN 4000. Because of its early development, Nestar has more servers than any other vendor. These servers include file (actually a disk server), print, 3270, 3278, SNA, telex, file transfer, and gateway (between PLAN systems).

The file server is a high-performance server machine that uses the Motorola 68000 processor and is based on a multibus design. It has a built-in streaming-tape drive for backup, disk capacity of more than 500 megabytes, and a built-in modem port for remote diagnostics. Passwords are supported at the directory and volume levels (the file server supports a tree-like hierarchy of directories and volumes). PC-DOS 2.0 and the UCSD p-System operating systems are supported. With Apple IIs or IIIs, Apple

Pascal, DOS 3.3, and CP/M are supported.

Unfortunately, this "Mercedes" of file servers is rather expensive: \$20,000 for 60 megabytes of hard-disk memory. A lower-cost version, the PLAN 3000, supports only one disk of up to 60 megabytes. The PLAN 2000 is for OEMs and is essentially a board-level product that includes software for a disk server based on the PC XT.

The gateway server is currently unique to Nestar among the personal computer network vendors. It allows real-time communication between two PLAN 4000 networks. For example, they might be on two different floors. You can actually transfer data at 2.5 megabits per second between systems; in fact, if you had two PLAN 4000 systems with a gateway server, you could establish virtual connections with disks on other network file servers and use them as if they were local. Nestar overcomes the addressing limitation by assigning each network interface card that ships out of the factory a unique Ethernet address (Ethernet has a 48-bit address space, so each manufacturer can have its own portion of it). This address is used by the gateway. So you can actually have two stations on two different networks with the same Arcnet address, differentiated by their Ethernet address. The gateway does support the connection of more than two systems.

### SOFTWARE

Personal computer LANs have some interesting capabilities that tend to not make software manufacturers happy. If you take your application and load it onto a hard disk or a shared disk, everybody on the network can run it. Manufacturers, at least until now, have licensed their software to run on a single central processor.

As LANs become more prevalent you will begin to see software manufacturers offering network-wide licensing strategies. Rather than charging the price of 10 copies of VisiCalc to

(continued)

## C the world from the Lattice perspective.

As a program designer, you know that it's essential to establish the right perspective. If you've chosen the C language perspective, then why not join the many professionals who use the Lattice family of C compilers and associated tool kits?

Our compilers provide the complete C language and the portable UNIX function library across a broad range, including MS-DOS, PC-DOS, CP/M-86, CP/M-80, and a variety of 68000 environments. Our cross-compilers operate on VAX/VMS, IBM/MVS, and all UNIX systems.

More than three dozen tool kits are available from us and other vendors, providing capabilities such as graphics, databases, CRT forms entry, and window management. No more need to re-invent the wheel for each application!

Contact us to learn more about the Lattice perspective on C program development.



**LATTICE®**

P.O. Box 3072  
Glen Ellyn, IL 60138  
312/858-7950  
TWX 910-291-2190

# SuperSoft Languages When Performance Counts

A programmer's most important software tool is the language compiler or interpreter he uses. He has to depend on it to work and work well.

At SuperSoft, we believe it. That's why we offer three excellent compilers: SuperSoft FORTRAN, SuperSoft C, and SuperSoft BASIC. They answer the programmer's need for rock solid, dependable performance on microcomputers.

## SuperSoft FORTRAN

With large code and data.

SuperSoft FORTRAN version 2.0 with large code and data space is now available under MS DOS and PC DOS. It gives you the power to compile extremely large FORTRAN programs on micros. It allows double precision and complex numbers, full IEEE floating point, and a full range of other important features for the serious FORTRAN programmer.

Both 8087 support and a RATFOR preprocessor are optionally available.

FORTRAN (CP/M-80 & 86, MS DOS, PC DOS): \$425

Small model under PC DOS and

MS DOS: \$325

8087 support: \$50

RATFOR: \$100

## SuperSoft C

SuperSoft C is a high-powered, full-featured C compiler designed for serious C applications. It is fast – both in compilation and execution, and it is packed with more than 135 library functions (all delivered in source code form). SuperSoft C produces optimized assembly code, and object code can be ROMed.

SuperSoft C (for CP/M-80, CP/M-86, MS DOS, PC DOS): \$350



## SuperSoft BASIC

The SuperSoft BASIC compiler lets you get serious with business and financial programs. It uses BCD math to give you highly accurate results for demanding applications. SuperSoft BASIC is a true native code compiler that is generally compatible with Microsoft's BASIC interpreter. And an additional bonus – no run time license fee is required.

SuperSoft BASIC Compiler (for MS DOS, PC DOS, and CP/M-86): \$300

Also available for programmers:

Star-Edit, a full-featured programmer's text editor: \$225.00  
Disk-Edit, an invaluable programmer's disk data editor: \$100.00



To order call: **800-762-6629**

In Illinois call **217-359-2112**

In conjunction with SuperSoft, SuperSoft FORTRAN was developed by Small Systems Services, Urbana, IL, a leader in FORTRAN development.

Japanese Distributor: ASR Corporation International, TBL Building, 7th Floor, 1-19-9 Toranomon, Minato-Ku, Tokyo 105, Japan Tel. 03-05025550. Telex 222-5850 ASRTYO J.

European Distributor: SuperSoft International Ltd., 50 The Pantiles, Tunbridge Wells, Kent, England TN2 5TE. Tel. 0892 45433. Telex: 95441 Micro-G.

PC DOS is a trademark of International Business Machines.

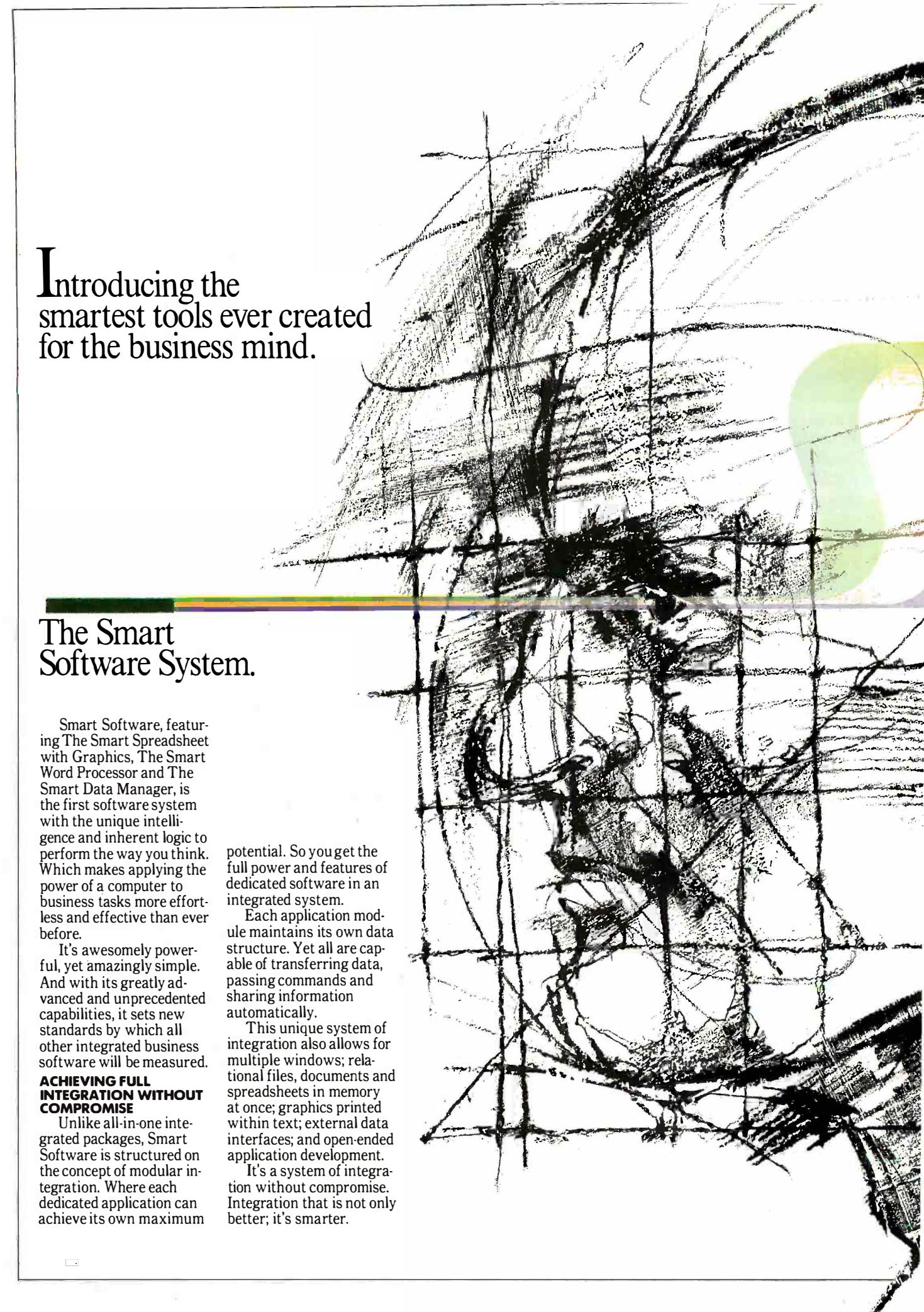
MS DOS is a trademark of Microsoft.

CP/M-80 and CP/M-86 are trademarks of Digital Research, Inc.

Circle 359 on inquiry card.

# SuperSoft

SuperSoft, Inc., 1713 S. Neil St.,  
P.O. Box 1628, Champaign, IL 61820



Introducing the  
smartest tools ever created  
for the business mind.

## The Smart Software System.

Smart Software, featuring The Smart Spreadsheet with Graphics, The Smart Word Processor and The Smart Data Manager, is the first software system with the unique intelligence and inherent logic to perform the way you think. Which makes applying the power of a computer to business tasks more effortless and effective than ever before.

It's awesomely powerful, yet amazingly simple. And with its greatly advanced and unprecedented capabilities, it sets new standards by which all other integrated business software will be measured.

### **ACHIEVING FULL INTEGRATION WITHOUT COMPROMISE**

Unlike all-in-one integrated packages, Smart Software is structured on the concept of modular integration. Where each dedicated application can achieve its own maximum

potential. So you get the full power and features of dedicated software in an integrated system.

Each application module maintains its own data structure. Yet all are capable of transferring data, passing commands and sharing information automatically.

This unique system of integration also allows for multiple windows; relational files, documents and spreadsheets in memory at once; graphics printed within text; external data interfaces; and open-ended application development.

It's a system of integration without compromise. Integration that is not only better; it's smarter.



### **CREATING CUSTOM APPLICATIONS BY SIMPLE MENU SELECTION**

Perhaps the most significant aspect of Smart Software is its unique "project processing" capability. It allows the user to set up customized projects, like a monthly sales report system or multi-year business plans, simply by doing them once.

There's no need to learn a complex programming language. The user merely makes simple English command selections. Smart Software then remembers to complete the project in the same way again at the touch of a button. Not by memorizing keystrokes (like a macro), but by automatically learning your custom sequence of commands and freely adjusting to changes and edits.

No other integrated system has a capability that even comes close to Smart Software's project processing.

### **HELPING PEOPLE TO WORK SMARTER, NOT HARDER**

Smart Software was created to work for you, relentlessly. Structured to integrate between applications, automatically. And designed to perform multifaceted business projects, brilliantly.

See your local computer dealer for a demonstration, or call 800-GET SMART to order a Smart demonstration disk.\*\*

### **SETTLING THE EASE OF USE VERSUS POWER DILEMMA**

Smart Software puts to rest the ease of use versus power dilemma with an exclusive feature called "confidence levels."

At confidence level one, beginners don't face intimidating options; yet level three provides experts with all the power they want.

This feature enables Smart Software to grow in sophistication as the user's confidence increases or needs expand. Even more importantly, a variety of users in the same company, with different experience, can each work comfortably at their own level of ability with the same applications.

This one, innovative idea could revolutionize the way all business software is designed to work. And only Smart Software has it.

**S**mart Software is currently available for the IBM PC, IBM PC/XT, the new IBM PC/AT and IBM compatibles.

Circle 191 on inquiry card.



\*Lotus 1-2-3, WordStar and dBase II are registered trademarks of Lotus Development Corporation, MicroPro International Corporation, and Ashton-Tate, respectively. In Kansas, call (913) 383-1089.

\*\*The \$10 charge for the disk is refundable with the purchase of any Smart Software.

use it on a 10-node network, the company can charge you for two or three copies and give you a network-wide license. 3Com, for example, already offers network licenses of VisiCalc and VisiFile. Application vendors are also coming up with schemes (sometimes in concert with vendors of LANs) to control the number of copies of one program running at one time.

**OPERATING SYSTEMS**

A number of software houses are beginning to offer network-operating systems that will operate on a number of different personal computer local networks. These vendors include Softech (Liaison), Novell (NetWare/OS), Digital Research (DR Net), Applied Intelligence (PC/NOS), and Phoenix Software (PAXNET).

Let's take a closer look at Digital Research's DR Net and Novell's NetWare/OS.

**DIGITAL RESEARCH DR NET**

DR Net (available by the time this article is published) is going to preserve compatibility, at least at some level, with all the CP/M operating systems.

The various operating systems are going to have different roles to play in the DR Net system. As with the other network-operating-system vendors, Digital Research would like to see an operating system for a wide variety of networks with a user interface that remains unchanged, so users don't really care which network they are on.

Because Digital Research preserved compatibility among all versions of CP/M, 8- and 16-bit systems can in fact share the same files on the same network.

The basic idea of DR Net is illustrated in figure 1. The NDOS, a cap on top of the operating system, performs as a true file server rather than a disk server. NDOS takes a look at each DOS request that comes through. If it's for a local peripheral, the request is passed down to the local operating system and through the local I/O system and straight out to the network hardware. From there it goes out to a server, comes back to the requester, and passes back to the application. As many as 16 users can be supported

at a server simultaneously. And because it's a file server, users are able to put password protection on individual files.

Digital Research did, in fact, put record-locking facilities into some of its earlier operating systems, particularly MP/M. And it has included those on the CP/M-86 and Concurrent CP/M-86 products. So you can have multiuser file sharing with record locking. And because this is built into the operating system, the application programs don't necessarily have to use a semaphore scheme to support a multiuser application.

Some of the operating systems, particularly the more primitive ones, can only be requesters. For instance, CP/M-80 and CP/M-86 are basically only requester operating systems; MP/M, on the other hand, whether 8-bit or 16-bit, actually was designed to provide file sharing to CP/M systems.

**NOVELL NETWARE/OS**

Novell NetWare/OS software is portable across a number of different networks. Novell currently has eight different versions of NetWare, applying to different network hardware. The versions are NetWare/D for Davong's Multilink, NetWare/E for 3Com's EtherLink board, NetWare/G for Gateway's G-NET (also referred to as the Novell NetWare/X system), NetWare/N for Nestar's PLAN 2000, NetWare/O for the Omninet transporter, NetWare/P for Proteon's proNET token-ring system, NetWare/PC for Orchid's PCnet, and NetWare/S for Novell's NetWare/S system. All of these systems use the PC XT (with the exception of NetWare/S, which uses a 68000-based file server) as a (true) file server.

One thing to keep in mind is that you cannot mix and match NetWare with the other vendors' server products and have them communicate with each other. Although one of the nicest file servers around, NetWare is a highly proprietary, closed system. The search for a system that integrates everyone's networking hardware and software goes on.

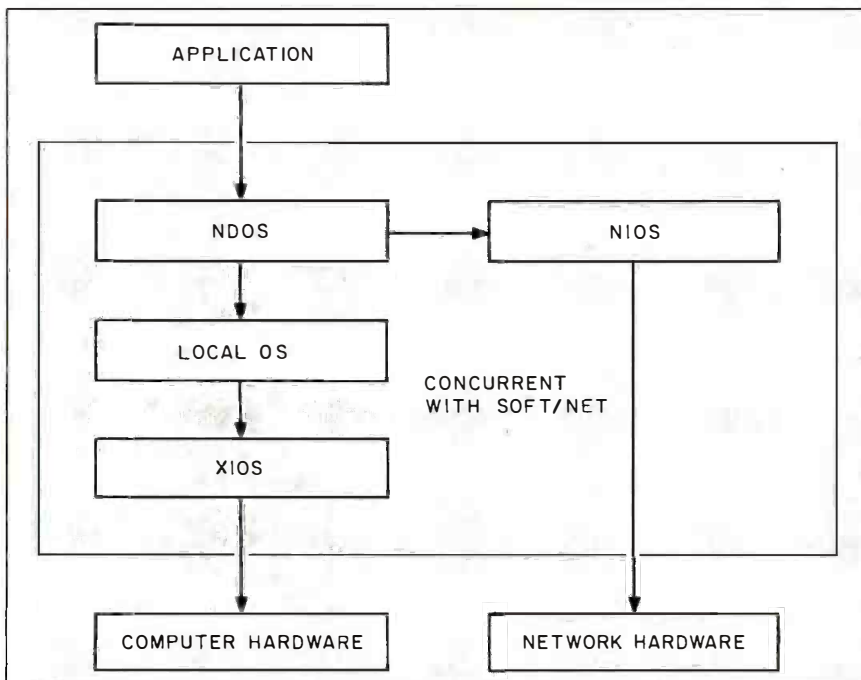


Figure 1: The structure of DR Net, in which NDOS is a true file server.

(continued)



# Introducing TransMIT the software that makes communication simpler.

Let's compare. On the top left is TransMIT's simple, single-step Let's Communicate first screen versus the competition's What do I do now? first screen. Which would you rather use?

That's just the beginning of what makes TransMIT the software that makes communication simpler.

Compare the dramatic differences between TransMIT and the competitor. Differences such as TransMIT's optional Menu-Driven Command Prompts for the novice or Abbreviated Prompts for the expert. Or TransMIT's ability to send electronic messages automatically and unattended to a multitude of other systems.

Compare the process language. The competitor requires its users to learn a computer language before communicating. TransMIT's process programming uses basic English words.

It's so simple, anybody can communicate the very first time.

TransMIT's modular design allows new concepts to be implemented with ease. It even allows a microcomputer to serve as a terminal to a mainframe or mini.

Best of all, TransMIT allows communications with virtually any RS 232-C compatible system. Remarkable.

| FEATURES                                             | TransMIT | COMPETITION |
|------------------------------------------------------|----------|-------------|
| On-Line Menu-Driven HELP (Single Key)                | YES      | NO          |
| 40-Entry Telephone Directory w/Configuration Loading | YES      | NO          |
| Menu-Driven Process Files Creation                   | YES      | NO          |
| Menu or Command Prompt Options                       | YES      | NO          |
| Electronic Mailbox                                   | YES      | NO          |
| Processes Multiple Files with a Single Command Line  | YES      | NO          |
| On-Line Communication Parameter Selection*           | YES      | YES         |
| Save & Reload Custom Communication Parameters*       | YES      | YES         |
| XModem File Transfer Protocol*                       | YES      | YES         |
| True Break Signal*                                   | YES      | YES         |

\*Industry Standard Features

Compare for yourself. When it comes to simplicity, flexibility, features and endurance, TransMIT is the better choice. If you act now, we'll even make it a better buy. Call today.

TransMIT™ is available for IBM PC and Dimension 68000, Z100 and Apple versions under development. VT 100, ADM3 and other terminal emulations available.

Retail: \$225.00

**Introductory Price: \$175.00**

**TransMIT "Trade-Up" Plan: \$150.00**

Visa, MasterCard acceptable.

Send us a photocopy of the registration and serial number of your current communications software and receive an additional \$25 discount off the \$175 Introductory price. Trade-Up offer and introductory price good thru January 15, 1985.

ATTENTION MANUFACTURERS AND OEMs: Call for details concerning porting TransMIT to your machine. Dealer inquiries invited.



# TransMIT™

MICRO INNOVATIVE TECHNOLOGY, INC.  
229 W. Bute Street, Suite 627, Norfolk, Virginia 23510

We Put The Future At Your Fingertips

```
Mode=term Config=030071F Prt=off 1 Buf=200 F9=HELP 00:00:00
```

## OURS.

```

CROSSTALK - XVI Status Screen
Name: CROSSTALK defaults (Hayes Smartmodem) Loaded: B:STD.WTK
Number: Capture: Off

Communications parameters:
Speed: 300 Parity: None Duplex: Full
Data: 8 Stop: 1 Emulate: None
Port: 1 Mode: Call

Filter settings:
Debug: Off LFast: Off
TRbx: Off BLank: Off
INfilter: On OUTfilter: On

Key settings:
Ctrl: Esc Command: ETX (^C)
Switch: None Break: End

Send control settings:
CWait: None
LVait: None

Available command files:
1) NEWUSER 2) POPCOM 3) SET12000 4) SETUP 5) STD

```

```
Command?_
```

## THE COMPETITION.

Crosstalk is a trademark of Micro Stuff.

**Software Hotline: (804) 622-5988**  
**Electronic Bulletin Board: (804) 622-6844**

TransMIT™ is a trademark of Micro Innovative Technology, Inc.

*Its unfortunate that all of the IBM PC LANs are incompatible with each other.*

as they process, they will move the heads on the hard disk like an elevator so that the heads won't be thrashing back and forth. The heads move by processing pending requests in an order that minimizes disk-head movement. Currently, only one server is supported per network, but it can be used in a dedicated or nondedicated mode.

Let's take a look at some of the capabilities of the NetWare/OS file server. NetWare puts a cap on top of DOS, much like DR Net. NetWare implements a number of functions in the server to increase its performance. For instance, it dedicates a large portion of memory as a disk cache and performs elevator-seeking on the hard disk. You can queue up requests, and

On the PC XT server Novell put in its own multiprocess operating system, as illustrated in figure 2. A lot of processes are taking place at one time. For instance, server processes are provided so that six pending requests are possible. NetWare/OS has a disk read/write process that manages the cache. It also writes out

blocks that have been modified and are sitting in the cache. Print spooling is a background task that can support as many as three printers at the server (PC XT). NetWare/OS also has a console-handling process that supports a wide variety of commands that you can enter from the console at the server itself. All these processes interact to form the NetWare/OS file (and print) server.

Because NetWare/OS is a true file server, a file can be automatically locked while it's open so that the server won't let somebody else open the same file. Another interesting feature is a broadcast command that can be entered at the console or user's personal computer. This lets a user send a one-line message to the other active stations on the network; it will appear on the twenty-fifth line of the personal computer's display.

**CONCLUSIONS**

It's unfortunate that all of the IBM PC LANs are incompatible with each other and that many use highly proprietary software. Eventually, there is going to be a shakeout, and survival for some vendors may mean revamping their product lines or building gateways to the more "accepted" personal computer LANs. It's also unfortunate that so many vendors have a lot of hype in their advertising and marketing. And users may find that, in the long run, inexpensive systems actually cost more in terms of lost productivity due to poor response times when several personal computers are involved.

There are still several missing pieces to IBM PC local networks (which can be found in mainframe systems), such as system accounting functions, performance monitoring, and management tools. And standards are lacking at all levels, although more and more vendors are implementing de facto standards.

I'd like to conclude with six cautions. First, be leery of vendors' performance claims. Raw data rates of the network can be deceiving if the system has poor hardware and complex

*(continued)*

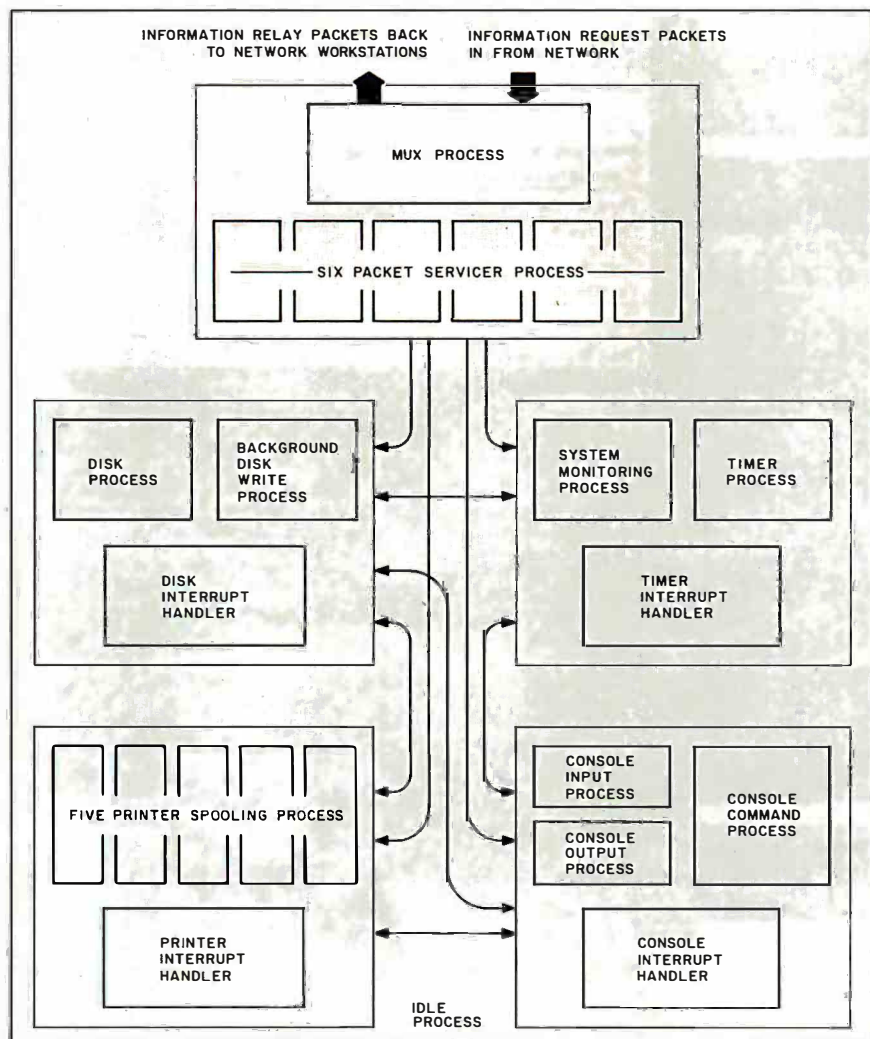


Figure 2: Novell's own multiprocess operating system in NetWare/OS.





## The Quick Silver Fox™ Jumps Over The Big Blue Dog.

We really hate to pick on the big guys but compared to the Silver Fox your basic IBM-PC™ is an overpriced dog.

### 256k RAM

Why? Well, for starters, your basic Silver Fox comes with 256k of RAM which acts like a disk drive so that more of your software is accessed at the speed of light rather than the speed of a mechanical drive head.

### 1.6 Megabytes

You also have more than twice as much software to access because the Silver Fox comes with dual 800k disk drives for a total of 1.6 Megabytes. Yet the Silver Fox can read and write to all popular PC formats.

### 13 Free Programs

1. MS-DOS
2. HAGEN-DOS™
3. M-DISK
4. WordStar™
5. EasyWriter
6. DataStar
7. ReportStar
8. FILEBASE
9. CalcStar
10. Color Graphics Basic
11. MailMerge
12. SpellStar
13. 25 Games, graphics and utilities

The best free software bundle in the business, and the Fox will run some programs written for the IBM-PC like dBase II and Multiplan, and programs written for Sanyo's new MBC-550 series.

### Reliability

Because the Silver Fox is born on a totally automated production line in Japan it is inherently more reliable than

systems built by hand. The Fox is burned and tested for 14 days in Japan, and further tested after final assembly here in the good old U.S. of A.

### One Year Warranty

The Silver Fox is built better so we can back it with a limited, one-year warranty, four times longer than IBM. We're Scottsdale Systems and since 1980 we've shipped over \$10,000,000 of microcomputer equipment directly to microcomputer users.

Because we deal directly with users, we think we have a better idea of what you want. So the Silver Fox includes graphics with twice IBM's resolution, a printer port, a keyboard with a big return key, and a 12", high-resolution monitor as standard equipment.

Of course, you could spend \$4729 at Computerland for an IBM-PC that will perform almost as well as a Silver Fox. But why bother when you can call

**1-800-FOR-A-FOX**

and get your

**\$1398**

to perform like \$4729?

For additional information call 1-800-367-2369, or in AZ, AK, or HI call (602) 941-5856. Or write Silver Fox Computers, 617 N. Scottsdale Road #B, Scottsdale, AZ 85257.

IBM-PC price is based on a phone quote from the Mesa, AZ Computerland on July 30, 1984. Price included 256k RAM, dual 360K drives (BOOK's weren't available), software, and a graphics monitor.

Trademarks: Silver Fox and Hagen-DOS. Scottsdale Systems Ltd. IBM-PC, International Business Machines Corporation. Wordstar, Calcstar, Mailmerge, Spellstar, and Infostar, Micropro International. MS-DOS, Multiplan, Microsoft Corporation. Filebase, EWDP Software, Inc. dBASE II, Ashton-Tate.

Ordering: Telemarketing only. Silver Fox price is for cash, F.O.B. Scottsdale, price subject to change, product subject to limited supply. Visa, Mastercard add 3%, AZ residents add 6%. Returned merchandise subject to a 20% restocking fee. Personal/company checks take up to 3 weeks to clear. No C.O.D.'s or A.P.O.'s.

software to support it.

Second, beware of the "low" cost: \$500 to \$800 per connection may not be the dominant cost when you consider that every networking system will have at least one shared hard disk, which is typically a \$6000 PC XT. And recall that installation of the cable typically costs far more than the cable itself.

Third, watch out for software integrity. Some networks introduced a year or so ago still have bugs. Also, the more "distributed" types of systems (sharing any personal computer's resources anywhere on the network) tend to be shaky because of the complexity of the multitasking networking software. And these systems typically require 64K to 128K more bytes of RAM for every personal computer than the "nondistributed" types.

Fourth, don't be surprised if your favorite stand-alone software package doesn't run on a local network. These packages are designed for stand-alone personal computers, are often copy-protected, often make assumptions about the local environment, and are clearly not designed for multi-user environments. However, most software that uses standard BIOS calls works satisfactorily when used in a network, provided that users aren't manipulating the same files.

Fifth, watch out for conflicts between the network board and other add-on boards. There are only a few DMA and interrupt channels in the IBM PC, and many third-party vendors use them. So don't be surprised if you have to remove your favorite hardware board as well!

Finally, no system available today is truly turnkey. For example, the vendors don't tell you about the hidden costs in a system such as personnel costs. Somebody has to install that network. People have to be trained. Someone has to maintain and manage the system. ■

*This article is based on the upcoming Architecture Technology "Personal Computer Local Networks Report," which will be available at the time of this printing.*

# Circuit-Board-Design Without the Tedium

smARTWORK™ lets the design engineer create and revise printed-circuit-board artwork on the IBM Personal Computer.

Forget tape. Forget ruling. Forget waiting for a technician, draftsman, or the CAD department to get to your project. smARTWORK™ software turns your IBM Personal Computer into a professional, high-quality drafting tool. It gives you complete control over your circuit-board artwork — from start to finish.

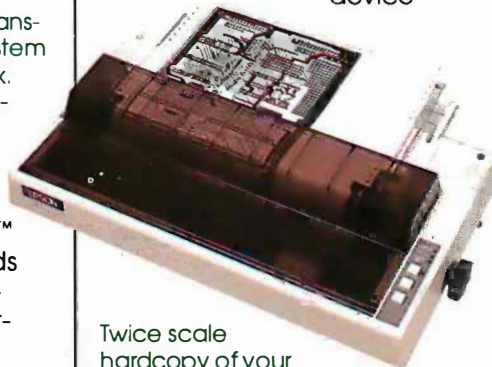


smARTWORK™ transforms your IBM PC into a CAD system for printed-circuit-board artwork. Display modes include both single-layer black and white and dual-layer color.

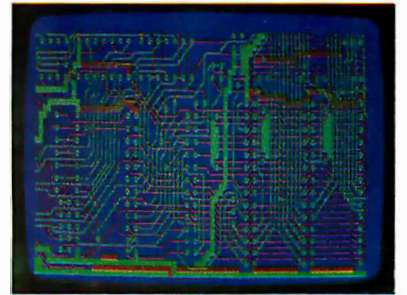
What makes smARTWORK™ so smart is that it understands electrical connections. Conductor spacing is always correct, lines don't become too narrow, and connecting lines do not intersect other conductors. smARTWORK™ can automatically find and draw the shortest route between two conductors. Or you can specify the route.

smARTWORK™ is the only low-cost printed-circuit-board artwork editor with all these important advantages:

- Complete interactive control over placement and routing
- Quick correction and revision
- Production-quality 2X artwork from pen-and-ink plotter
- Prototype-quality 2X artwork from dot-matrix printer
- Easy to learn and operate, yet capable of sophisticated layouts
- Single-sided and double-sided printed-circuit boards up to 10 x 16 inches
- Multicolor or black-and-white display
- 32 user selectable color combinations; coincident points can be displayed in contrasting colors.
- Can use optional Microsoft Mouse as pointing device



Twice scale hardcopy of your artwork is produced using the Epson dot-matrix printers or the Houston Instrument DMP-41 pen-and-ink plotter. Quick 1X check plot is also available from Epson printers.



Dual-layer color display of a 2" by 4" section of a 10" by 16" circuit board

## The Smart Buy

At \$895, smARTWORK™ is an exceptional value, particularly when compared to conventional engineering workstation costs.

Call or write us for more information on smARTWORK™. We'll be glad to tell you how smARTWORK™ helps us design our own circuit boards and what it can do for your business.

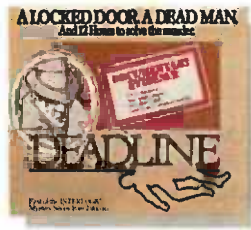
Send a purchase order, or major credit card number, and smARTWORK™ can be working for you next week.

## System Requirements

- IBM PC or XT with 192K RAM, 2 disk drives and DOS Version 2.0
- IBM Color/Graphics Adapter with RGB color or b&w monitor
- Epson MX-80/MX-100 or FX-80/FX-100 dot-matrix printer
- Houston Instrument DMP-41 pen-and-ink plotter (optional)
- Microsoft Mouse (optional)



"smARTWORK" and "Wintek" are trademarks of Wintek Corporation.





# AND NOW FOR SOMETHING INCOMPLETELY DIFFERENT!

Incomplete, yes. But it's not just because we're always bringing out new stories in the Infocom interactive fiction collection. Nor is it simply due to the fact that with all the writing and re-writing, honing and perfecting that we put into every one of our stories, our work is seemingly never done.

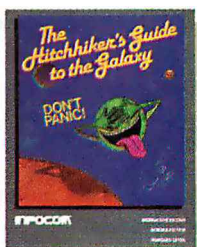
The real reason is: an Infocom work of fiction can never be complete until you become a part of it.

You see, as hard as we work at perfecting our stories, we always leave out one essential element—the main character. And that's where you enter in.

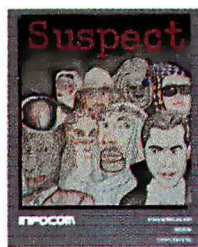
Once you've got Infocom's interactive fiction in your computer, you experience something akin to waking up inside a novel. You find yourself at the center of an exciting plot that continually challenges you



In **CUTTHROATS**™ the plot involves a motley band of hardbitten salts who get wind of a shipwreck laden with sunken treasure near the remote island where you live. In exchange for your diving skills, they offer you a piece of the action. Your challenge: survive them, the perils of the deep, and escape with the treasure and your life. Good luck!



**THE HITCHHIKER'S GUIDE TO THE GALAXY**™ by Douglas Adams is the most mind-boggling story we've ever published. In the person of Arthur Dent, you'll chortle as your planet is demolished. You'll yelp with laughter as your life is threatened by a galaxy of horrors. Your sides will positively split as you search the universe for... well, you'll find out. Maybe.



In **SUSPECT**™, our newest mystery thriller, you're a reporter who gets the scoop on the society event of the year—the murder of a Maryland Blue Blood at a fancy costume ball. Great! Except you're the prime suspect. And if you can't find the real killer, your next by-line could be in the obituaries.

with surprising twists, unique characters (many of whom possess extraordinarily developed personalities), and original, logical, often hilarious puzzles. Communication is carried on in the same way as it is in a novel—in prose. And interaction is easy—you type in full English sentences.

But there is this key difference between our tales and conventional novels: Infocom's interactive fiction is active, not passive. The course of events is shaped by the actions you choose to take. And you enjoy enormous freedom in your choice of actions—

you have hundreds, even thousands of alternatives at every step. In fact, an Infocom interactive story is roughly the length of a short novel in content, but because you're actively engaged in the plot, your adventure can last for weeks and months.

In other words, only you can complete the works of Infocom, Inc.

Because they're stories that grow out of your imagination.

Find out what it's like to get inside a story. Get one from Infocom. Because with Infocom's interactive fiction, there's room for you on every disk.

## INFOCOM™

Infocom, Inc., 55 Wheeler Street, Cambridge, MA 02138

For your: Apple II, Atari, Commodore 64, CP/M8™, DECmate, DEC Rainbow, DEC RT-11, IBM PC™ and PCjr, KAYPRO II, MS-DOS 2.0™, NEC APC, NEC PC-8000, Osborne, Tandy 2000, TI Professional, TI 99/4A, TRS-80 Models I and III.

\*Use the IBM PC version for your Compaq, and the MS-DOS 2.0 version for your Wang or Mindset.

CUTTHROATS and SUSPECT are trademarks of Infocom, Inc. THE HITCHHIKER'S GUIDE TO THE GALAXY is a trademark of Douglas Adams.

# Top Modem



- Hayes Compatible • More Features • Only \$495

The best price/performance ratio of any 212A modem on the market today for under \$500! That puts ProModem 1200 on top of the stack. Compare the 26 features. You'll see why. Only ProModem offers all 26. 15 are exclusive.

They're important features. The Real Time Clock/Calendar for example. Used with Applications Programs, or the OPTIONS PROCESSOR, gives you pre-set timed operation of the modem. Also, time and duration records of all calls. The convenient HELP command makes ProModem easy to use. It promptly displays the Instructions Menu whenever there's a question about what to do next. With Call Progress Detection, you can "tell" ProModem to do things like automatically "Redial When Busy."

It's the only modem that lets you expand into a full telecommunications center with add-ons. The OPTIONS PROCESSOR gives you Data Store and Time Base Continuity with battery backup, Personal/Business Telephone Directory, and Automatic Receipt/Transfer Buffer, expandable to 64K. The OPTIONS PROCESSOR also enables ProModem to operate unattended, with or without your computer.

The optional 12-character ALPHANUMERIC DISPLAY indicates modem operating status, system diagnostics, message status, phone numbers, and real time clock data. . . to name just a few.

Together, these standard and optional features give you a sophisticated electronic mail and communications capability unmatched by any other modem in this class. And, there's more. See your local dealer for additional information and a demonstration. He'll show you why ProModem 1200 is tops.

## ProModem 1200 from ...

# PROMETHEUS

Prometheus Products, Inc., 45277 Fremont Blvd., Fremont CA 94538, (415) 490-2370

NOW AVAILABLE

- ProModem plug-in cards for IBM PC and Apple II
- ProCom Software

### 212A Modem Comparison Chart \*

#### STANDARD FEATURES

- 300/1200 Baud (212A)
- Intelligent Microprocessor
- Tone and Pulse Dialing
- Hayes Command Compatible (Works with Smartcom<sup>TM</sup>)
- Additional telephone jack with exclusion switching
- Analog loop back self test
- Self Test at Power Up
- Call Progress Detection (Busy, Dial Tones, Trunk Busy, etc.)
- Speaker and External Volume Control
- Full Complement of Status Lights
- 8 Switch Selectable power-up defaults
- Adaptive Dialing
- Auto Redial on Busy
- Ergonomically designed easy to read front display panel
- Internal Stand-Alone Power Supply
- Built in Real Time Clock/Calendar
- Help Command
- 300 baud connect while maintaining 1200 baud RS-232 link

#### PRO

|   |   |   |   |   |
|---|---|---|---|---|
| ✓ | ✓ | ✓ | ✓ | ✓ |
| ✓ | ✓ | ✓ | ✓ | ✓ |
| ✓ | ✓ | ✓ | ✓ | ✓ |
| ✓ | ✓ | ✓ | ✓ | ✓ |
| ✓ | ✓ | ✓ | ✓ | ✓ |
| ✓ | ✓ | ✓ | ✓ | ✓ |
| ✓ | ✓ | ✓ | ✓ | ✓ |
| ✓ | ✓ | ✓ | ✓ | ✓ |
| ✓ | ✓ | ✓ | ✓ | ✓ |
| ✓ | ✓ | ✓ | ✓ | ✓ |
| ✓ | ✓ | ✓ | ✓ | ✓ |
| ✓ | ✓ | ✓ | ✓ | ✓ |
| ✓ | ✓ | ✓ | ✓ | ✓ |
| ✓ | ✓ | ✓ | ✓ | ✓ |
| ✓ | ✓ | ✓ | ✓ | ✓ |
| ✓ | ✓ | ✓ | ✓ | ✓ |
| ✓ | ✓ | ✓ | ✓ | ✓ |

ANCHOR 1200  
US ROBOTICS PASSWORD

HAYES STACK

NOVATION SMARTCAT+

#### EXPANDABLE OPTIONS

- Automatic Receiver Buffer
- Automatic Transmit Buffer
- On-board Personal/Business Directory
- Buffer, Expandable to 64K
- Auto Logon Macros
- Auto message transmission to groups of numbers
- Records call duration
- 12-character Alphanumeric Display

\*Comparison made by Prometheus on the basis of the best information available to Prometheus at time of printing.





# HIGH-SPEED DIAL-UP MODEMS

BY KIM MAXWELL

## *The promise and peril of faster data transmission*

*Editor's note: "Baud" and "bits per second" are often used interchangeably and, as an imprecise indicator of speed, you can probably get away with using either term since it's such a widespread practice. In actual fact, however, baud is an indicator of symbols per second on the telephone line where the symbols can have more than two states. Bits per second refers to the information rate between the terminal and the modem. In this article, Mr. Maxwell uses baud and bits per second in their precise meanings.*

MODEMS ENABLE transmission of computer data over ordinary telephone lines. Modems today cover a vast range of speeds, but the most common types are very slow. At least 70 percent of all modems are used on the switched-telephone network. Two types predominate among switched-network units: AT&T (Bell) 103 compatibles for speeds up to 300 bps (bits per second) and AT&T 212 or Vadic 3400 types for speeds up to 1200 bps. Faster modems for the switched network—at 2400, 4800, and even 9600 bps—have been produced, but they are not in general use because they require unusual protocols or simply cost too much. For leased or dedicated lines, modem

speeds have reached as high as 14,400 bps.

### THE SPEED FACTOR

For certain applications, speeds higher than 1200 bps are either desirable or mandatory. I will discuss some of these applications, examine why it is difficult to make modems faster, and then look into the technological future for some indication of things to come. First, though, let's develop some practical understanding of speed. Because each character sent from a computer requires 10 bits, 300 bps translates to 30 cps (characters per second), and 1200 bps translates to 120 cps. A fast typist snapping out text at 100 words per minute produces data at approximately 10 cps, or 100 bps. The average person can read text traveling across a screen at 300 bps, and a speed reader might be able to follow 1200 bps if he didn't blink.

Standard modems, at 300 and 1200

.....  
Kim Maxwell, president and founder of Racal-Vadic (1525 McCarthy Blvd., Milpitas, CA 95035), developed the first full-duplex 1200-bps modem. He received his bachelor's degree in philosophy from Stanford University.

bps, handle applications at keyboard or reading speeds nicely. Calling a bulletin board, reading electronic mail, looking up a stock report, entering information into a database, or doing a simple database inquiry requires no more speed than is currently available. But what happens when you try to transfer files, fill a screen from a remote computer, send long documents, or create graphics? Time becomes more critical. For comparison, let's develop the time required at various speeds to send a full screen, a full floppy disk, and Herman Melville's novel *Moby Dick*.

An 80-character by 25-line screen displays 2000 characters, which is also the approximate number of characters in a single page of double-spaced text. A floppy disk contains about 356,000 characters, and *Moby Dick* has approximately 2.5 million characters. Table 1 gives the time required to send each unit at standard data rates ranging from 300 to 9600 bps.

What does this arithmetic mean to users? A salesperson on the road who needed to download a disk's worth of applications programs and data from the home office would spend more

(continued)

## *Seldom, if ever, is data sent and received simultaneously.*

than two hours in communications before she could start working with the information if she used the standard 300-bps modem built into current portables. However, if she used a 9600-bps modem, she could accomplish the same job in less than 10 minutes.

Consider a programmer using his personal computer at home as a terminal for interactive programming on his corporate computer, and the system sends full screens rather than single characters (very typical today, given IBM's preference for full-screen communications). At the common speed of 1200 bps, he waits 17 seconds per screen, which is intolerable and virtually precludes home programming. An economical 4800- or 9600-bps modem would make programming at home possible for many computer professionals. For situations like this, increased speed means a direct increase in productivity.

While sending character files and screens creates problems for slow-speed modems, transmitting graphics over dial-up lines can be staggering. In some full-color graphics systems, each pixel requires 16 bits; a screen of 150,000 pixels requires 2.4 million bits. Painting a screen under these circumstances takes 33 minutes at 1200 bps and 4 minutes at 9600 bps. Of course, simpler systems, such as black and white with one or two levels of gray, go much faster. But even at 2 bits per pixel, a 1200-bps modem paints a screen in 4 minutes, while a 9600-bps modem gets it done in 30 seconds.

So why aren't faster modems used? Cost, technology, and compatibility. Table 2 lists the prevailing standard and the 1984 cost range for switched-network (full-duplex, explained later) modems from 300 to 9600 bps.

### CURRENT STANDARDS

Compatibility only concerns signals on the telephone line, but it is vital to assure intercommunication between modems made by different companies. Bell established de facto standards at 300 and 1200 bps, and these modem types are widely supported

by data networks such as Tymnet and Telenet. The standard at 2400 bps was established by an international standards group called CCITT (Consultative Committee on International Telephone and Telegraph), which is an agency of the United Nations. Bell (now AT&T-IS [Information Systems]) helped write V.22 bis (bisynchronous) and V.32 and has announced its 2400-bps modem in compliance with the CCITT recommendation. However, no major network offers dial-in service at 2400 bps on a widespread basis yet. Only one company markets a product in this country at 4800 bps, and it conforms to no international or accepted national standard. Although no commercial V.32 modems are currently available, you can expect to see some in 1985. They will cost several thousand dollars each, and you will need two of them.

For several years surveys of modems available have included 4800- and 9600-bps modems from many reputable manufacturers. Why can't they be used on the switched network, instead of waiting for V.32 or something else to be invented? Two terms supply the answer: "two-wire" and "full-duplex." While the bulk of switched networks comprises carrier systems that use separate paths to send and receive signals, the end connection to a modem or telephone uses a single two-wire line that carries signals in both directions. Higher-speed modems listed in recent surveys were designed for leased lines, which usually bring two two-wire lines, or a so-called "four-wire" line, to the modem, creating separate signal paths for sending and receiving data.

Full-duplex means having the capability of sending and receiving data in both directions simultaneously. (Note that a two-wire line is inherently full-duplex. You can talk and listen at the same time; the brain separates the mouth from the ear.) For historical reasons, modems used on the switched-telephone network must be full-duplex if they are expected to operate in a general-purpose environment. That fact is both sad and ironic.

(continued)

Table 1: The transmission times for various documents at different baud rates.

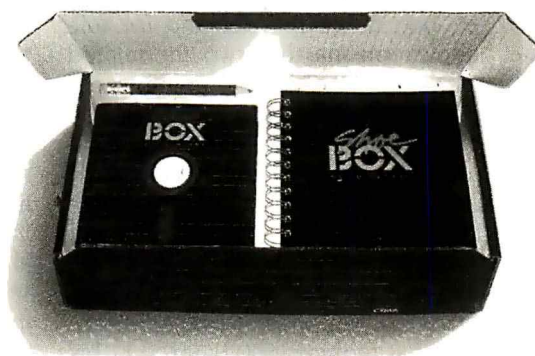
| Speed (bps) | Screen  | Floppy Disk | Moby Dick |
|-------------|---------|-------------|-----------|
| 300         | 66 sec  | 3.2 hr      | 23 hr     |
| 1200        | 17 sec  | 48 min      | 5.75 hr   |
| 2400        | 8.3 sec | 24 min      | 2.9 hr    |
| 4800        | 4.2 sec | 12 min      | 1.4 hr    |
| 9600        | 2.1 sec | 6 min       | 43 min    |

Table 2: Approximate cost of different speed full-duplex modems.

| Speed (bps) | Standard | Cost Range   |
|-------------|----------|--------------|
| 300         | AT&T 103 | \$60-\$350   |
| 1200        | AT&T 212 | \$450-\$700  |
| 2400        | V.22 bis | \$800-\$1400 |
| 4800        | none     | \$2500       |
| 9600        | V.32     | n/a          |

We decided not to burden this ad with the usual ostentatious, self-indulgent software hype, not to dwell on the fact we've contained four accounting modules on a single diskette for total integration of the most powerful accounting package available for small business, nor to stress the sophistication, creativity, clarity and conciseness of the program's remarkably proficient reporting capabilities, nor to mention the tutorial, the queuing files, or even the fact we've put an incredible \$395 retail price on it. No, as our professional peers, we realized you'd prefer a more subtle marketing approach.

Nice Box.



The Shoebox Accountant.™ A complete accounting system for small business. 2160 East Brown Road, Mesa, Arizona 85203. 1-800-292-2962. **CYMA**®

## *Echo cancellation rescues the received signal from the transmit signal.*

Seldom, if ever, is data sent and received simultaneously; typically, communication is half-duplex—sending, then receiving, then sending, and so on. And given appropriate protocols and buffer management, half-duplex modems would work fine on the switched-telephone network.

### FULL-DUPLEX TRANSMISSION

But terminals were initially connected to computers directly, with separate paths to send and receive data. Communications interfaces and software therefore assumed a full-duplex connection. The first switched-network modem, introduced by Bell in the early sixties, provided full-duplex operation by dividing the telephone line into two subchannels, sending in one channel and receiving in the other. Communications interfaces and software did not have to change in order to be used with Bell's first modem. The cost of converting all the networks, computers, and terminals now installed to half-duplex would be prohibitive.

So switched-network modems (generally) must provide full-duplex data transmission over two-wire circuits that have a frequency range (bandwidth) from 300 to 3400 Hz. How? First, the modem modulates a carrier; that is, it changes the state of a carrier signal, in different ways for dif-

ferent modems. The modulated signal requires a bandwidth (measured in Hz), or range of frequencies, greater than the rate of change (modulation) of the carrier (the baud rate). A 300-baud modem needs at least 300 Hz, a 1200-baud modem needs at least 1200 Hz, and a 9600-baud modem needs at least 9600 Hz. But the switched network only provides 3100 Hz of bandwidth. How can 9600 bits per second possibly squeeze through? By recognizing that modulation can be far more complex than simply switching between two frequencies to send 1s and 0s. For example, you can switch among 4 phases, or 8 phases, or even 16 phases of a carrier. If you use 16 phases (or states defined some other way), you can organize input data into groups of 4 bits and assign 1 phase to each group. Now the carrier can change state at 2400 baud while the incoming data can be going 9600 bps, and it fits.

Fitting, of course, is not quite enough, since the demand for full-duplex means that two modulated carrier signals must fit, going in opposite directions. Modems up to 2400 bps create full-duplex communications the way Bell did originally, by dividing the line into two separate channels. The cost, though, is speed. To squeeze two 1200-bps channels into one line, Bell (and Vadic before it) used a four-phase modulation system that requires 600 baud. V.22 bis modems also use 600-baud channels for 2400 bps. The 4800-bps modem mentioned above actually sends data in a band that overlaps the receive band; interfering signals are sup-

pressed by a technique known as echo cancellation. Modems compatible with V.32 send and receive 9600 bps (at 2400 baud) in the same band, at the same time. Again, echo cancellation rescues the received signal from the interfering transmit signal.

Table 3 gives the baud rate and carrier states for the standard modems available today or expected soon. As bit rates increase, so does complexity, in geometric proportion. More carrier states dictate more sophisticated demodulators. At 2400 bps and above, the modem requires an adaptive equalizer to counteract effects of poor-quality telephone lines. Echo cancellation at 4800 and 9600 bps nearly doubles the signal processing requirements. A V.32 needs to perform 2.4 million multiplications per second; an IBM PC can produce about 100,000 per second.

But as indicated by prices of computers and memory, increasing complexity has not deterred progress. Affordable prices follow in due time. Until two years ago, no one manufactured a single-chip AT&T 103 modem, the simplest variety in general use. Now several semiconductor companies offer them. By the end of 1984, at least one single-chip 1200-bps modem that is both AT&T 212- and Vadic 3400-compatible will be available in small quantities, along with several implementations using two or more chips. Some of the multichip versions include the AT&T 103 and dialing circuits. Several more single-chip versions should surface during 1985 and 1986 from semiconductor companies and modem manufacturers.

In 1985 modem manufacturers like Racal-Vadic will visit upon the world two- or three-chip versions of V.22 bis for 2400-bps operation, using a commercial or custom signal processor and custom VLSI (very-large-scale integration). We will also unleash V.32, but probably not inexpensive enough for the casual personal computer user. They will cost more than the personal computer itself, but the investment will be worth it for many professionals. ■

Table 3: Baud rate and number of carrier states for common modem bit rates.  
\*V.32 modulation includes redundancy for error correction.

| Bit Rate (bps) | Baud Rate | Carrier States |
|----------------|-----------|----------------|
| 300            | 300       | 2              |
| 1200           | 600       | 4              |
| 2400           | 600       | 16             |
| 4800           | 1200      | 16             |
| 9600           | 2400      | 32*            |

# Gifford's Multiuser Concurrent DOS.<sup>™</sup> The net that works!

Gifford has the network solution. It's simple, fast, secure, complete, and it works. Multiuser Concurrent DOS is based on Digital Research's Concurrent DOS, the only major microcomputer operating system specifically designed for networking.

Users can share disks and printers transparently, and can also take advantage of true multiuser features like file and record lockout. And Gifford has added a bundle of features that makes Multiuser Concurrent DOS easy to install and use. It lets you get right to work.

## Our net is ARCNET.<sup>™</sup>

Multiuser Concurrent DOS utilizes Datapoint's ARCNET, the most popular network hardware in the industry. It's reliable, economical, and fast—so you can add users without overloading the network.

You can network up to 255 single and multiuser systems. You can connect single or multiuser Gifford or CompuPro<sup>™</sup> systems as well as IBM PC-XTs.<sup>\*</sup> Dual processor Gifford and CompuPro systems can run thousands of 8 or 16 bit CP/M or MP/M applications. PC-XTs can run 16 bit CP/M and MP/M programs as well as most popular MS-DOS applications, such as Lotus 1-2-3.<sup>™</sup>

## Gifford adds to your net worth.

Our enhancements of Concurrent DOS make it possible to get more and better work done in less time. Network-wide features include electronic mail, event calendar, inter-terminal communication, user time accounting and usage report generation, telecommunications, user expandable HELP facility,

reminder messages, message of the day, automatic startup and shut-down procedures, and easily prepared files for initializing terminals, printers, and network nodes.

Gifford's Virtual Terminals<sup>™</sup> increase productivity

by offering full-screen concurrency; you can run up to four programs simultaneously from one physical terminal.

## The safety net.

Multiple users can mean multiple security problems. Gifford's security enhancements include

login account names and encrypted passwords to control

access to the system. Users can be further restricted to specified terminals, user areas, programs, or nodes on the network. You're also safe from excessive down time, since the modular network architecture gives you immunity from single point failure.



## Gifford nets a big one: Simplicity.

If you've gone through the ordeal of typing as many as seven commands just to get on and off a network,

Gifford has your number.

A single, menu-driven network command handles all your network options. Everything you need is right in front of you. The net effect is simplicity—and sanity.

If you'd like to see how Gifford's Multiuser Concurrent DOS can solve your networking problems, or if you'd like to know about Gifford's selection of multiuser systems and software options, call (415) 895-0798.

Or write us at the address below.

We'll send you a free networking brochure and give you the name of the nearest dealer.

Multiuser Concurrent DOS is a trademark of Gifford Computer Systems. Concurrent DOS is a trademark of Digital Research, Inc. ARCNET is a trademark of Datapoint Corporation. IBM PC-XT is a registered trademark of IBM Corporation. CompuPro is a registered trademark of CompuPro Corporation. Lotus 1-2-3 is a trademark of Lotus Development Corp. Virtual Terminals is a trademark of Gifford Computer Systems.

**GIFFORD**  
COMPUTER SYSTEMS  
A subsidiary of Zitel Corporation

2446 Verna Court  
San Leandro, CA 94577  
(415) 895-0798 TELEX: 704521  
Houston, TX (713) 680-1944

**THE MULTIUSER COMPANY<sup>™</sup>**

# DATAEASE™

*"I was very impressed with its overall performance and capabilities... excellent interactive and data quality assurance capabilities... relatively easy to master..."*

Bill Jacobson  
BYTE, October 1984

DATAEASE is the most complete information management system available. While literally hundreds of systems claim to offer simple solutions to complex business information needs, rave reviews from our clients, application developers and the media confirm DATAEASE as the only product which delivers on this promise.

*"DATAEASE received the highest 'Overall Evaluation' rating of the five fully relational programs tested by Software Digest in its report on 20 IBM PC database and file management programs appearing in the March 1984 issue of The Ratings Newsletter."*

*The Ratings Newsletter  
Software Digest, 1984*

Well over 10,000 business clients worldwide — large and small — say DATAEASE's power and ease-of-use greatly increases pro-

ductivity. In fact in September of 1984, MIS, Inc. (a leading supplier of software to corporate America) sold more DATAEASE programs than any other database management systems — ahead of dBASEIII®, Symphony™, Framework™ and Rbase™ 4000!

*"DATAEASE is a true winner — on technical merit alone, DATAEASE would put dBASEIII out of business."*

*Business Computer Systems  
April 1984*

DATAEASE is the ideal combination of power and ease-of-use. With or without programming skills, you can harness the full power of your micro to create forms and custom menus; sort, group and calculate statistical information; update and link files; access

## BYTE Review Comparison Chart

|                                | DATAEASE    | Condor | dBASE II |
|--------------------------------|-------------|--------|----------|
| Menu driven                    | Yes         | No     | No       |
| Built-in programming language  | No          | No     | Yes      |
| Command/Batch file processing  | Yes         | Yes    | Yes (1)  |
| Custom screen generator        | Yes         | Yes    | Yes      |
| Password protection            | Yes         | No     | No       |
| Prevents duplicate entries     | Yes         | No     | No       |
| Data field masking             | Yes         | No     | Yes (1)  |
| Lookup file capabilities       | Yes         | No     | Yes (1)  |
| Maximum capacities             |             |        |          |
| Files open concurrently        | No limit    | 1      | 2        |
| Data-entry forms per file      | No limit    | 1      | 1        |
| Records per file               | 65,535      | 65,534 | 65,535   |
| Fields per record              | 255         | 127    | 32       |
| Characters per record          | 8000        | 1024   | 1000     |
| Characters per field           | 255         | 127    | 254      |
| Active Index keys              | 255         | 1      | 7        |
| Quick report generator         | Yes         | Yes    | Yes      |
| Complex report writer          | Yes         | Yes    | No       |
| Color capabilities             | Yes         | No     | (2)      |
| Uses IBM PC function keys      | Yes         | No     | No       |
| Program file disk space needed | 590K (3)    | 270K   | 96K      |
| Random-access memory required  | 192K        | 128K   | 128K     |
| List price                     | \$595       | \$650  | \$495    |
| Available formats              | Most 16-bit | Most   | Most     |
| Format tested                  | PC-DOS      | PC-DOS | PC-DOS   |
| Version tested                 | 2.10        | 2.11   | 2.40     |

NOTES: (1) Requires programming. (2) Very limited capabilities, requires programming. (3) Program files may be located on more than one disk.

forms to generate standard or custom reports; interchange data with mainframes and popular programs . . . and much more.

*"It's the best thing since peanut butter!"*  
**Nicholas D. Lentner, Purchasing Agent**  
**State University of New York**

**Finding DATAEASE.** Demonstrating and supporting database management systems is a difficult task. That's why we've made DATAEASE only available through highly competent retailers such as participating ComputerLand stores. Contact us directly regarding our Dealer or Corporate Programs. Or for information on The SOFTEASE™ Family of Products (DATAEASE™, WORDEASE™, GRAPHEASE™ and DOSEASE™).

Circle 346 on inquiry card.

## DATAEASE BYT-12/84

### Demonstration Diskette

Check one:  IBM PC  WANG  DEC  TI  
 Check attached for \$10. Send information package with demonstration.  
 Send information only.

Name: \_\_\_\_\_

Title: \_\_\_\_\_ Phone: \_\_\_\_\_

Company: \_\_\_\_\_

Street: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

**Software Solutions, Inc., 305 Bic Drive**  
**Milford, CT 06460 • 203-877-9268 • Telex: 703972**

For information call:

**800-243-5123**

Canada  
 Logiquest, Inc., Montreal; 514-397-9651

Scandinavia  
 West Soft A/S, Alesund, Norway; (47) 71-41141

South Africa  
 Dataflex, Craighill; 11724-6555

United Kingdom  
 Sapphire Systems, Essex; 01-544-0582

West Germany  
 Markt & Technik, Munich; 089-4613-0

# Free Storage!



## A radical $\sqrt{9}=3$ offer in extra length High Density Data Cartridges.

DEI® now offers you the perfect formula for data storage with our new nine pack configuration. And to make this an absolute value; with the purchase of each nine cartridges we'll include a durable and practical storage container. First, you'll have the finest high density cartridge that money can buy. Second, our extra length 5 fifty5' cartridges have 23% more

high density storage capacity at 6400 and 10,000 fpi. And finally, our three separate shrink wrap packages will allow you to maximize your department inventory and provide flexibility when working with small quantities. This is, of course, a

limited offer, so call your nearest listed DEI distributor today. When it comes to 1/4" technology... DEI® has the answers!



10150 Sorrento Valley Road ■ San Diego, CA 92121-1699

DEI and DEI are registered trademarks of Data Electronics, Inc.

### Authorized DEI Resale Locations:

**EASTERN REGION:** Acknowledge, Inc., MA (617) 620-8843 ■ COMARK, IL (312) 941-2676 ■ Crown Computer Products, NY (518) 438-0600 ■ EDP Supply, NH (603) 893-6118 ■ Eastern Data Products, NJ (201) 225-7300 ■ Global Computer Supplies, NY (516) 485-1000 ■ Manchester Equipment, NY (516) 435-1199 ■ MISCO, NJ (201) 264-8200 ■ Nashua Plus, NH (603) 880-2323 ■ Paragram Sales, VA (703) 356-0808 ■ Word Systems, Inc., VA (703) 620-0300

**SOUTHWESTERN REGION:** Bluebird Systems, CA (619) 438-2220 ■ Challenge Computer, CA (415) 785-1300 ■ Computer Media Products, CA (619) 565-7802 ■ Computer Ribbons, CO (303) 295-0851 ■ Data Documents, CA (818) 965-3323 ■ Data Equipment Supplies, CA (213) 923-9361 ■ Emerald Systems, CA (619) 270-1994 ■ I.D.E.A., CA (408) 745-1911 ■ International Memory Products, CA (213) 450-0132 ■ Kalleen's Inc., CA (415) 459-5382 ■ L.H. & Associates, CA (213) 543-5068

**SOUTHERN REGION:** American Computer Supply, TX (214) 243-3232 ■ Automated Computer Systems, FL (305) 594-3819 ■ Business Data Products, Inc., TX (512) 453-5129 ■ National Information Products, Inc., TX (713) 956-2121 ■ Stannard Computer Systems, TX (214) 423-7553 ■ Step Computer Media, TX (512) 822-2376

**NORTHWESTERN REGION:** Indel-Davis, OK (918) 587-2151 ■ Spencer Systems, KS (913) 268-5244 ■ Western Paper Company, WA (206) 251-5300



# WRITING COMMUNICATIONS IN BASIC

BY BARRY J. ARNOW

## *Easy terminal emulation and file transfer*

ALTHOUGH THERE ARE a considerable number of off-the-shelf packages to link microcomputers, as well as many for linking microcomputers to mainframe computers, even the most user-friendly programs can be confusing if you lack the appropriate communications knowledge. Experienced programmers on both the microcomputer and the mainframe sides often lack fundamental information in data communications. For this reason, some of the buzzwords are defined in the accompanying glossary.

The rather sophisticated configuration in figure 1 illustrates the use of several sets of terminals linked via terminal controllers to a special front-end computer that handles the communications. These communications links to the front-end processor can be made through any number of media. Though the future promises such technological wonders as optical fibers and laser data transmission, most current links use ordinary telephone lines, either dedicated or regular switched (dial-up lines). Essentially there are three possible methods for modulating a signal over

a telephone line. Representing each signal as a wave, you can either change the frequency, modify the amplitude, or perform a "phase shift," which is a sudden jump to another point on the wave.

The most widely used technique for modulation is the frequency shifting of Bell 103 and compatible modems. In this method, the originating station uses frequencies of 1070 Hz and 2225 Hz for 0s and 1s, respectively, while the answering station uses 2025 Hz for the 0s and 2225 Hz for the 1s.

The BASIC programming I discuss here is for asynchronous, as opposed to synchronous, communications. Variations in the asynchronous protocol, such as 7- or 8-bit characters, parity used, and the number of stop bits, must be established for communications to take place. (The problems

.....  
Barry J. Arnow (31 Marshall Dr., Edison, NJ 08817) is a professor of computer science and does consulting in microcomputer training and communications-software development. He has a B.A. from Temple University, an M.S. from the University of Akron, and a Ph.D. from Rutgers University.

associated with packaged software generally occur in these variations. The defaults might vary from package to package, and the user might not know how to supply the required information.)

### DUMB-TERMINAL EMULATION

Microcomputers can be used in communications because they can emulate terminals. Once this emulation is established, you can easily extend programs to transfer files and perform uploading and downloading with mainframes.

The logic for terminal emulation is depicted in the flowchart in figure 2. The host or front-end computer expects to receive certain control characters in addition to the data characters. The BASIC program in listing 1, which runs on an IBM Personal Computer (PC), illustrates a standard use of such control characters. The terminal sends the character, which is stored with an ASCII (American Standard Code for Information Interchange) code 19 in the variable XOFF\$, to the host or front-end com-

(continued)

# DISCOUNT

1 - 800 - 354 - 2985

## HOT LINE

GUARANTEED LOW PRICES  
MON - SAT 8 - 5

### SUPER SALE

OKI 92P - \$369 STAR 10X - \$235  
HAYS 1200B - \$399 LOTUS 123 - \$295

### MODEMS

#### HAYS

1200 - \$475 MICROMODEM - \$225

#### U.S. ROBOTICS

PASSWORD - \$310 IBM PC - \$320

### COMPUTERS

#### ALTOS

586-20 - \$5895 586-40 - \$7395

#### SANYO

550-1 - \$699 555-2 - \$1049

### PRINTERS

#### C-ITOH

F10 - \$899 8510 - \$1175

#### DATASOUTH

DS180 - \$1099 DS220 - \$1459

#### DIABLO

620 - \$725 630 - \$1675

#### EPSON

FX80 - \$439 FX100 - \$659

#### NEC

3510 - \$1215 3550 - \$1519

#### OKIDATA

82 - \$299 93 - \$589

#### SILVER REED

400 - \$269 770 - \$839

#### TELEVIDEO

TPC II - \$1729 1605 - \$1699

### SOFTWARE

#### LOTUS

123 - \$295 SYMPHONY - \$439

#### MICROPRO

Wordstar - \$189 Wordstar Pro - \$295

D Base II - \$279 Friday - \$175

Multiplan - \$139 Supercal III - \$200

MBSI - \$325 TCS - \$75

### BOARDS

#### AST

Six Pac - \$259 Combo + - \$259

#### QUADRAM

Quadlink - \$449 Quadboard - \$279

### TERMINALS

#### TELEVIDEO

914 - \$515 925 - \$699

#### WYSE

50 - \$495 75 - \$565

### DISCOUNT COMPUTER

4655 N. ORACLE RD. #207  
TUCSON, ARIZONA 85705

Prices Subject To Change.

## WRITING IN BASIC

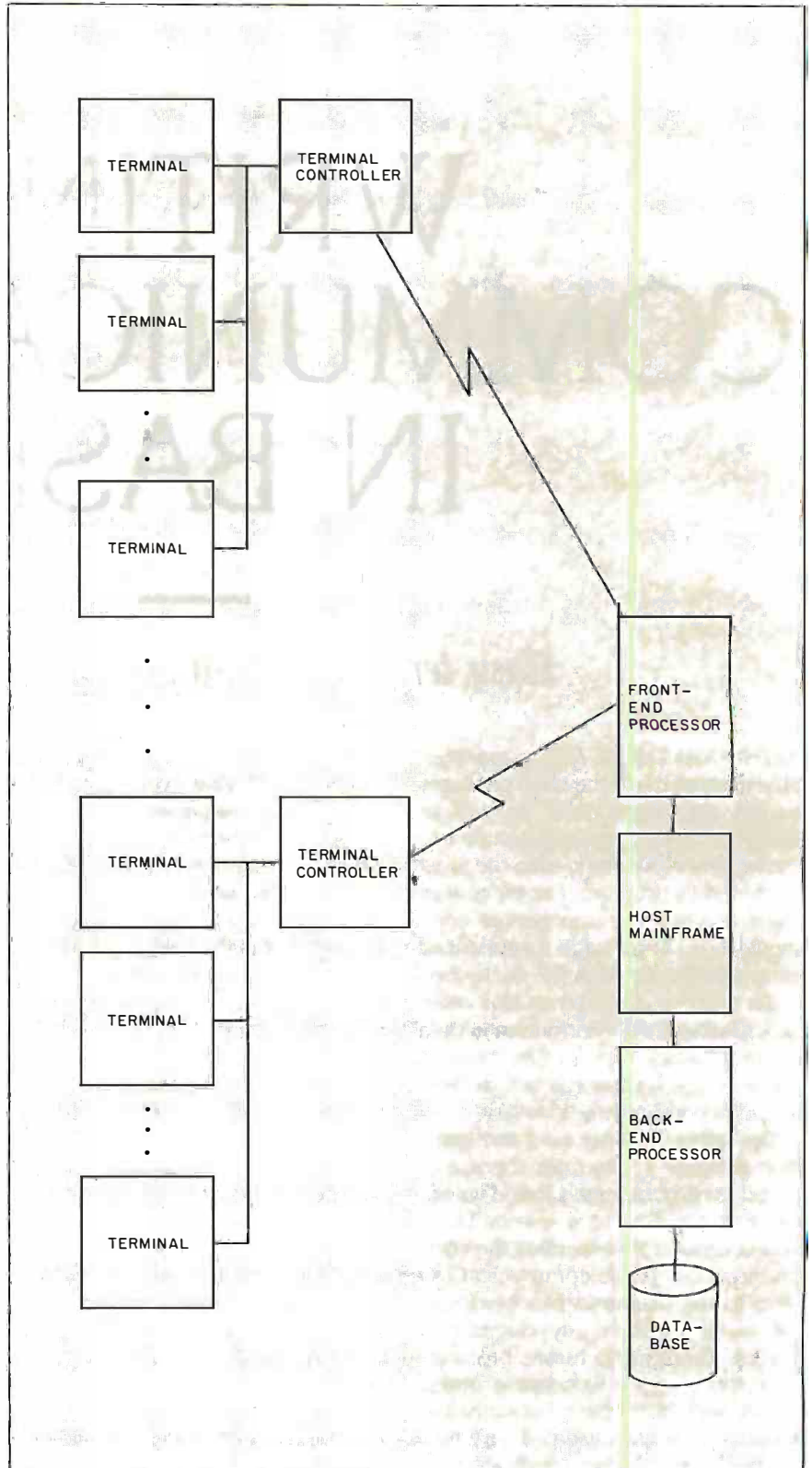


Figure 1: System configuration illustrating the use of more than one set of terminals linked via terminal controllers to a front-end computer handling communications.

puter when the receiving buffer contains more than 225 characters. The computer is expected to recognize the XOFF\$ and to stop transmitting so that the terminal can catch up. When the receiving buffer is empty, the terminal tells the computer to resume transmission by sending it an XON\$ or an ASCII code 17. The host or front-end computer may in turn send these and other control characters after every line of data, making it necessary for the terminal to edit incoming information.

At speeds of 1200 bps (bits per second) or less, it is unlikely that the receiving buffer will ever have more than 225 characters. If it does, however, you can increase its 256-byte default size when you activate BASICA on the IBM PC. Needless to

say, a tightly coded and efficient program is very important in terminal emulation. It becomes even more crucial when such programs are enhanced to send and receive files since the I/O (input/output) performed slows the programs considerably.

**FILE TRANSFERS**

The terminal-emulation program in listing 1 reads the data being sent to the host or front-end computer from the keyboard and displays the incoming data on the screen. To send an existing data file from a disk, you must change the program statement that reads the keyboard entry so it reads the disk file instead. Similarly, to receive a file from another computer, the terminal program must write incoming data to a disk file as well as

to the screen. Essentially, all that separates file-transfer programs from terminal-emulation programs is reading from or writing to a disk rather than a keyboard or a screen. However, some kind of coordination is necessary between the sending and the receiving programs. You may—in fact, you should—include error-checking and error-handling routines as part of the protocol, but they are omitted from the listings here for the sake of simplicity.

The flowcharts in figure 3 and the corresponding BASIC programs for the IBM PC in listings 2 and 3 detail the minimum ingredients for a file transfer. The sending program waits for a prompt from the receiving program before transmitting a record.

(continued)

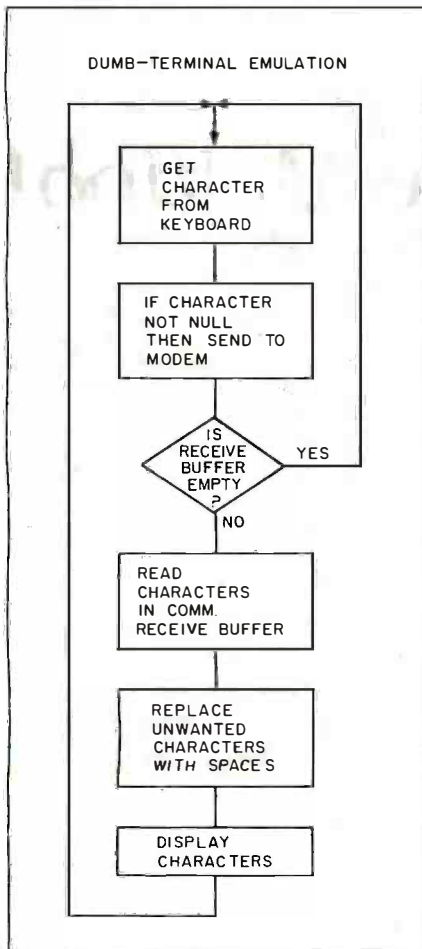


Figure 2: A flowchart of the logic for terminal emulation. See code in listing 1.

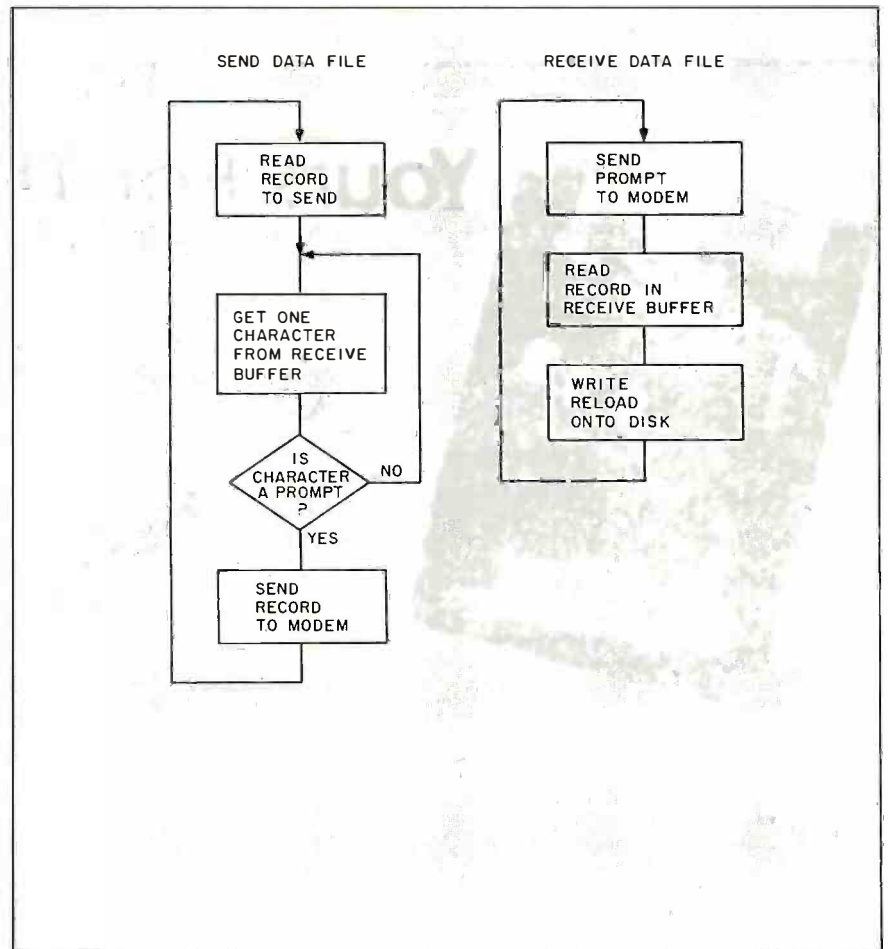


Figure 3: Flowcharts detailing the logic for sending and receiving files, respectively. See listings 2 and 3.

Listing 1: *The BASIC code needed to accomplish terminal emulation on an IBM PC. See figure 2 for the flowchart.*

```

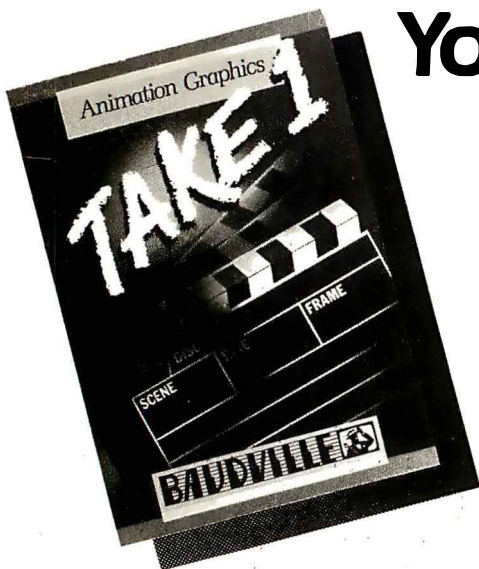
10 ON ERROR GOTO 200
20 CLS
30 WAITING = 0
40 XON$ = CHR$(17)
50 XOFF$ = CHR$(19)
60 OPEN "com1:300,e,7" AS #1
70 B$ = INKEY$
80 IF B$ <> "" THEN PRINT #1, B$;
90 IF EOF(1) THEN 70 : REM EOF(1) means receive buffer is empty
95 REM Check to see if receive buffer has more than 225 characters
100 IF LOC(1) > 225 THEN WAITING = 1: PRINT #1, XOFF$;
110 A$ = INPUT$(LOC(1), #1)
115 REM Check incoming data for unwanted characters
120 FOR I = 1 TO LEN(A$)
130 D = ASC(MID$(A$, I, 1))
140 IF (D = 17 OR D = 19 OR D = 127) THEN MID$(A$, I, 1) = " "
150 NEXT I
160 PRINT A$;
170 IF LOC(1) > 0 THEN 70
180 IF WAITING THEN WAITING = 0: PRINT #1, XON$;
190 GOTO 70
200 RESUME

```

The receiving program in turn sends a prompt to the sending program before it reads the incoming record from the receiving buffer. The particular prompt character used by these programs is a "?", although a better choice would be a control character, such as XON\$ (ASCII 17). Why? In the unlikely possibility that a record consisting of a single question mark is transmitted through the modem in half-duplex mode, the sending program would mistake the character's echo as a prompt for the next record.

How do two programs actually begin the file-transfer process? In the examples in this article, the receiving program waits for the sending program to transmit the string RUN. The first piece of information sent is the name of the file the receiving program will use. After this "handshaking," the actual file transfer begins.

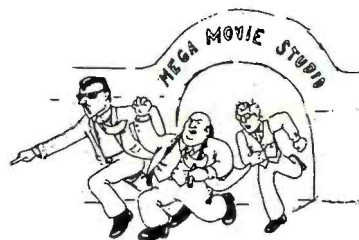
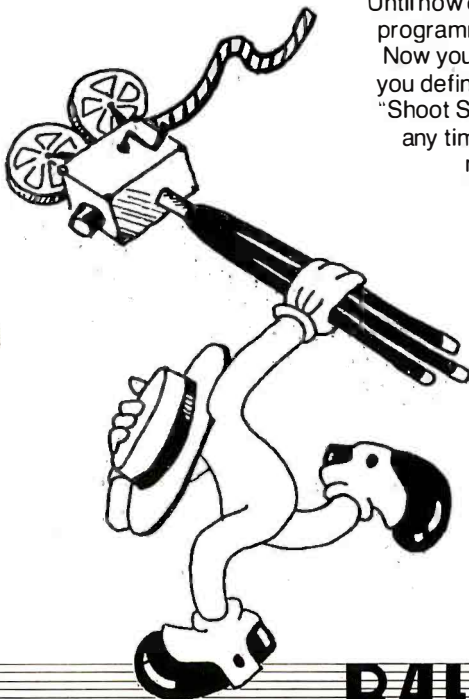
(continued)



# Yours For The Making!

*Stunning animation that's fast, smooth, and flicker free!*

Until now only moviestudios and a handful of programmers could make computer movies. Now you can too! With easy to use TAKE 1, you define animation shapes & movements, "Shoot Scenes" frame-by-frame, add text at any time, and then combine the scenes to make a complete movie. Perfect for presentations & demos.



**See Your Dealer...**

or for direct orders enclose \$59.95 plus \$3.00 for shipping & handling. Mastercard and Visa accepted.

**616/957-3036**

Take 1 requires an APPLE IIc, IIe, II+ with 64K. APPLE is a registered trademark.



1001 Medical Park Dr. S.E. Grand Rapids, MI 49506 Phone 616/957-3036

# How to get a daisywheel printer for as little as \$328.



The Transtar 120  
by **Vivitar**®

Get in touch with Winslow Sales. We made a special purchase of top quality Transtar daisywheel printers by Vivitar—and we're passing the savings on to you! While they last, you can order a \$550 Transtar 120S with serial interface for an incredible **\$328**... or the parallel interface 120P for only **\$378**. The portable 120 weighs in at a compact 19 pounds. Plug it in to your personal computer, and watch it quietly purr along at 14 cps. Or, for even bigger savings, order the \$699 Transtar 130S with serial

interface for just **\$448**... or the parallel interface 130P for only **\$478**. Both the 120 and 130 series give you four auto-load positions. They are fully compatible with leading word processing packages, and produce subscript, superscript, underlining and true boldface (with Diablo 1610/1620 routines). Both feature true letter quality daisywheel characters. And because Transtar is backed by Vivitar Corporation, you'll get a generous six-month limited factory warranty on parts and labor,\* with

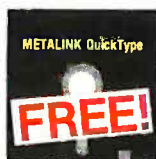
convenient service at four regional centers. You also get a telephone support number you can call if you need help using your printer. And, last but not least, you get an unconditional **no-risk, money-back guarantee** from Winslow Sales. Put your Transtar to the test for a full 30 days... then return for a complete refund if you're not satisfied. No questions asked. To get your Transtar daisywheel printer, just call toll-free today, or mail the coupon below. This offer ends when our supplies are exhausted—so order now. Before this great deal gets away.



**\$699 Transtar 130S...now \$448!** The 120's "big brother" offers 18 cps print speed, extra-wide carriage for 17-inch forms, even proportional spacing for just **\$448!** Or, with parallel interface, order the 130P for only **\$478!**

**WINSLOW SALES**

credit card orders call toll-free **1-800-821-6349** and ask about multi-purchase discounts!  
or write: **WINSLOW SALES** 2120 116th N.E., Bellevue, WA 98005



With each printer we'll include free **METALINK QuickType** software on a 5¼" floppy that turns your computer keyboard into an electronic typewriter. Supplies limited, so act now!

Please send me: Transtar 120  Serial Interface **\$328** Transtar 130  Serial Interface **\$448**  
 Parallel Interface **\$378**  Parallel Interface **\$478**  
Plus \$12.00 shipping and handling for each printer (Add 8.1% Sales Tax in Washington State)

Include my FREE QuickType; my Computer is:

Brand/Model \_\_\_\_\_ Operating System \_\_\_\_\_

My check is enclosed for \$ \_\_\_\_\_

Please charge my  VISA  MasterCard  American Express

Account Number \_\_\_\_\_ Exp. Date \_\_\_\_\_

Signature \_\_\_\_\_

Please send me more information about Transtar printers

Name \_\_\_\_\_

Company Name \_\_\_\_\_

Street \_\_\_\_\_ Apt./Suite \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ ZIP \_\_\_\_\_

Phone (in case there's a question about my order) (\_\_\_\_\_) \_\_\_\_\_

\*For a free copy of the manufacturer's warranty, write: Winslow Sales, 2120 116th N.E., Bellevue, WA 98005  
Circle 386 on inquiry card.

Listing 2: *The BASIC code required for an IBM PC to send a data file to the host or front-end computer. The applicable flowchart is shown in figure 3.*

```

10 ON ERROR GOTO 280
20 CLS
30 INPUT "TYPE FILENAME TO BE TRANSFERRED";NM1$
40 INPUT "TYPE NAME AT DESTINATION COMPUTER (IF DIFFERENT)";NM2$
50 IF NM2$="" THEN NM2$=NM1$
60 OPEN "com1:300,e,7" AS #1
65 REM Transmit RUN command to receiving program
70 PRINT#1, "RUN"
80 A$=INPUT$(1,#1)
90 IF A$<>"?" THEN 80
100 REM Transmit the name of the file to the receiving program
110 PRINT#1, CHR$(34);NM2$;CHR$(34)
120 REM Begin file-transmission phase
130 OPEN NM1$ FOR INPUT AS #2
140 IF EOF(2) THEN 220
150 LINE INPUT #2,A$
160 SUM=SUM+1
170 V$=INPUT$(1,#1)
180 IF V$<>"?" THEN 170
190 PRINT#1, A$
200 PRINT A$
210 GOTO 140
220 IF A$="EOF" THEN SUM=SUM-1 : GOTO 260
230 V$=INPUT$(1,#1)
240 IF V$<>"?" THEN 230
250 PRINT #1, "EOF"
260 PRINT:PRINT "TRANSFER COMPLETE NUMBER OF RECORDS SENT
 WAS "; SUM
270 END
280 RESUME

```

Listing 3: *The BASIC code necessary for an IBM PC to receive a data file from the host or front-end computer. The flowchart for this code is provided in figure 3.*

```

10 ON ERROR GOTO 220
20 OPEN "com1:300,e,7" AS #1
25 REM Wait for RUN command from sending program
30 PRINT "STANDING BY TO RECEIVE"
40 IF EOF(1) THEN 30
50 INPUT #1, A$
60 IF LEFT$(A$,3)<>"RUN" THEN 30
65 REM Get the name of the file from the sending program
70 PRINT #1, "?"
80 INPUT #1, NM$
90 PRINT "THE FILE WILL BE SAVED UNDER THE NAME ";NM$
100 PRINT : PRINT "WAITING FOR DATA TRANSFER TO BEGIN" :PRINT
105 REM Begin file-receiving phase
110 OPEN NM$ FOR OUTPUT AS #2
120 PRINT#1, "?"
130 LINE INPUT #1, A$
140 IF A$="EOF" THEN 190
150 SUM=SUM+1
160 PRINT A$
170 PRINT #2,A$
180 GOTO 120
190 CLOSE #2
200 PRINT:PRINT "THE NUMBER OF RECORDS RECEIVED WAS ";SUM
210 END
220 RESUME

```

*You can command almost any system to wait for data from the user.*

#### UPLOADING AND DOWNLOADING

In the case of uploading and downloading, the file transfers are between microcomputers and mainframes rather than two microcomputers. With minor modifications, the send program in listing 2 can work as an upload program. Although you must expect some variations with different systems, you can give virtually any system a command to wait for data from the user. For example, in CMS (Conversational Monitor System), you can issue an INPUT command from within the editor. In UNIX, the command is `CAT > filename`. In Super Wylbur, the command COLLECT has a similar effect. Once the mainframe is in this wait state, you can upload a file with the send program—without the handshaking but with the appropriate change in the prompt or turn-around character. At the completion of the upload, the terminal-emulation program lets you issue a command that takes the mainframe out of the "data-collection" state. Then the data can be saved or processed.

The receive program in listing 3 can, again with minor modifications, download files from a mainframe to a microcomputer. First, the download program issues a command (TYPE in CMS, `CAT filename` in UNIX, and LIST in Super Wylbur) to the mainframe to list the file to be downloaded. Then the program simply saves everything that the mainframe sends by reading the data in the receiving buffer and writing it to the disk. You might want to build blocks of data or records before you write the data to the disk in order to edit it before you copy it. (Similarly, you can easily filter or change records before you transmit them with the upload program.)

Extending the terminal-emulation program to transmit certain characters

*(continued)*

*Only from Topaz...*

# Powermaker<sup>®</sup> Micro UPS

Uninterruptible, computer-grade power  
— at half the cost



It's in a class by itself.

For about half the cost of other Unin<sup>®</sup>terruptible Power Systems, you can now get the same degree of protection with our Powermaker Micro UPS. This remarkable new system eliminates computer problems caused by blackouts, brownouts, voltage sags and power-line noise.

Providing up to 75 minutes of continuous computer-grade power, our Powermaker Micro UPS is compatible with microcomputers and PC's. It's fully automatic, maintenance-free, portable and compact. It fits neatly alongside or under your desk or workstation. And because you can't always tell when you've lost primary power, our little UPS even features an audible line-loss alarm.

But best of all is the price. The Powermaker Micro UPS is priced right and is ready for immediate shipment. Find out more about our Powermaker Micro UPS. Call us at (619) 279-0831, or contact your local Square D distributor.

**TOPAZ<sup>®</sup>**  
*Excellence in Computer Power*

**SQUARE D COMPANY**

# ERG/68000 MINI-SYSTEMS

- Full IEEE 696/S100 Compatibility

## HARDWARE OPTIONS

- 8MHz, 10 MHz, or 12 MHz 68000/68010 CPU
- 68451 Memory Management
- Hardware Floating Point
- Multiple Port Intelligent I/O
- 64K/128K Static RAM (70 nsec)
- 256K/512K/1MB Dynamic RAM (150 nsec)
- Graphics-Digital Graphics CAT-1600\*
- DMA Disk Interface
- SMD Disk Interface
- 1/4" or 1/2" Tape Backup
- 5 1/4" or 8" Floppy Disk Drives
- 5MB-474MB Hard Disk Drives
- 7/10/20 Slot Back Plane
- 20 or 30A Power Supply
- Desk Top or Rack Mount Encl.

## SOFTWARE OPTIONS

- 68KFORTH<sup>1</sup> Systems Language
- CP/M-68K<sup>2</sup>O/S with C, 68K-BASIC<sup>1</sup>, 68KFORTH<sup>1</sup>, FORTRAN 77, EM80 Emulator, Whitesmiths' C, PASCAL
- IDRIS<sup>3</sup> O/S with C, PASCAL, FORTRAN 77, 68K-BASIC<sup>1</sup>, CIS COBOL<sup>4</sup>, INFORMIX<sup>5</sup> Relational DBMS
- UNIX<sup>6</sup> SYS V O/S with C, PASCAL, FORTRAN 77, BASIC, RM COBOL<sup>7</sup>, ADA<sup>8</sup>, INFORMIX<sup>5</sup>, Relational DBMS
- VED 68K Screen Editor
- Motorola's MACSBUG and FFP Package

Trademark <sup>1</sup>ERG, <sup>2</sup>Digital Research, <sup>3</sup>Whitesmiths, <sup>4</sup>Micro Focus, <sup>5</sup>RDS, Inc., <sup>6</sup>Bell Labs, <sup>7</sup>Ryan McFarland, <sup>8</sup>U.S. DoD, <sup>9</sup>Digital Graphic Systems

30 Day Delivery - OEM Discounts



since 1974

**Empirical Research Group, Inc.**  
P.O. Box 1176  
Milton, WA 98354  
(206) 872-7665

## WRITING IN BASIC

# GLOSSARY OF COMMUNICATIONS TERMS

**ASYNCHRONOUS COMMUNICATION:** each character transmitted is preceded by a special "start" bit and followed by one (or possibly two) "stop" bits; each time a character is pressed at the terminal keyboard, it is transmitted through the communications line.

**DATA RATE:** the rate at which signals can be transmitted.

**FRONT-END PROCESSOR:** a special communications computer linked directly to a host mainframe.

**FULL-DUPLEX COMMUNICATION:** the use of two different sets of frequencies by the originating and answering stations, enabling communications to take place in both directions at the same time.

**FULL-DUPLEX MODEM:** units that transmit a character without echoing it back to the sender; the echoing is done by the receiving station.

**HALF-DUPLEX COMMUNICATION:** enables communications in only one direction at a time.

**HALF-DUPLEX MODEM:** the modem echoes back every character it transmits; doubling of characters may be seen when both the modem and the receiving station echo back the characters.

**HANDSHAKING:** the establishment of the communications link.

**HOST COMPUTER:** the microcomputer or mainframe with which you want to communicate; the host is usually the controlling member of the communicating pair—you send to it, you receive from it, and you emulate a terminal connected to it.

**LINE DISCIPLINE:** the control of data movement across the communications line.

**MODEM:** a device necessary to convert the 1s and 0s of computers to different signals that can be transmitted over phone lines.

**MODULATION:** changing signals to distinguish between 1s and 0s.

**PROTOCOL:** agreed-upon rules and controls followed by the software to establish and maintain communications; protocol consists of handshaking and line discipline.

**SYNCHRONOUS COMMUNICATION:** an entire block of data (such as a full screen) is transmitted at one time; the data is usually preceded by several "synchronization" bytes and a special STX (start-of-text) byte and is usually followed by a special ETX (end-of-text) byte; fewer overhead or nondata bits are transmitted with synchronous than with asynchronous communications, so the line is used much more efficiently.

and to test for responses by the mainframe is also the basis for automatic log-on programs. Masking out account numbers and passwords and saving the programs in a protected form can also help provide a small measure of system security, which continues to be a major concern for individuals and corporations alike.

## SUMMARY

Communications between microcomputers or between microcomputers

and mainframes is a relatively simple project as long as you have a certain level of communications know-how. Listings 1, 2, and 3 provide short BASIC routines to accomplish terminal emulation, file sending, and file receiving, respectively. Understanding the terminology in various manuals can also be a great help. With the initial basics under your belt, you should be able to make that first stab at communications—"Watson, come here. I want you." ■





CALL TOLL FREE 1-800-251-1212  
 TENNESSEE RESIDENTS 1-800-342-8398  
 NASHVILLE RESIDENTS 615-366-3900



This merchandise is available only by mail

**BUSINESS PACKAGES FOR IBM**

|           |                                          |          |           |                                           |          |
|-----------|------------------------------------------|----------|-----------|-------------------------------------------|----------|
| 503300CMT | Money Pak (Volume 1 and 2) by Eagle      | \$229.83 | 521815CMT | Home Accountant by Continental            | \$99.87  |
| 514935CMT | Money Decision (volume 1) by Eagle       | \$129.83 | 105098CMT | First Class Mail by Continental           | \$79.87  |
| 503292CMT | Money Decision (volume 2) by Eagle       | \$129.83 | CTFIBMKUW | Typefaces by Alpha Software               | \$74.87  |
| 106849CMT | Tax Preparer by Howard Software          | \$169.83 | 530543CMT | Win Wallstreet: Complete System by Summa  | \$369.87 |
| 503607CMT | Dollars and Sense by Monogram            | \$99.84  | 530527CMT | Win Wallstreet: Forecast by Summa         | \$139.87 |
| 106534CMT | Milestone by Digital Marketing           | \$229.87 | 530519CMT | Win Wallstreet: Data Manager by Summa     | \$115.93 |
| 503334CMT | Quickcode by Fox and Geller              | \$158.83 | 530535CMT | Win Wallstreet: Accountant by Summa       | \$199.87 |
| 108274CMT | Supercalc II by Sorcim Corporation       | \$229.87 | 509182CMT | CPM/86 (PC/XT) by Digital Research        | \$39.87  |
| 503342CMT | dGraph by Fox and Geller                 | \$189.73 | 106542CMT | Market Analyzer by Dow Jones              | \$229.87 |
| 0001DKUW  | dBase II by Ashton Tate                  | \$379.82 | 106971CMT | T.I.M. by Innovative Software             | \$259.87 |
| 100100KUW | EasyWriter by IUS                        | \$139.87 | 105627CMT | Infostar by MicroPro                      | \$244.89 |
| SPC1KUW   | PC Tutor by Comprehensive Software       | \$49.87  | 510016CMT | Data Capture by Southeastern Software     | \$89.93  |
| 512046CMT | Koala Pad Touch Tablet by Koala          | \$89.93  | 524306CMT | Checkbook Register by Software Publishing | \$15.87  |
| 508234CMT | PC Mouse by Mouse Systems                | \$199.87 | 524314CMT | Business Inventory by Software Publishing | \$15.87  |
| 515429CMT | Advanced D. B. Master by Stoneware       | \$379.87 | 524363CMT | Home Inventory by Software Publishing     | \$15.87  |
| 507434CMT | Legal Office Manager by Applied Software | \$139.87 | 524348CMT | General Ledger by Software Publishing     | \$15.87  |

**EDUCATIONAL AND TRAINING PACKAGES FOR IBM**

|           |                                           |         |           |                                       |         |
|-----------|-------------------------------------------|---------|-----------|---------------------------------------|---------|
| 524926CMT | Professor Dos by Individual Software      | \$39.00 | 503219CMT | Managing your Business with Supercalc | \$44.87 |
| 105338CMT | Instructor by Individual Software         | \$29.93 | 523886CMT | Wordstar Training                     | \$44.87 |
| 109488CMT | Managing your Business with Multiplan     | \$44.87 | 529685CMT | Training Base II by ATI               | \$49.95 |
| 109496CMT | Managing your Business with Visicalc      | \$44.87 | 503243CMT | PC Pal Version 1.1 by Comprehensive   | \$39.87 |
| 109470CMT | Managing your Business with Lotus 1, 2, 3 | \$44.87 | 503284CMT | Spellcopter by Designware             | \$27.83 |

**ENTERTAINMENT PACKAGES FOR IBM**

|           |                                                |         |           |                             |         |
|-----------|------------------------------------------------|---------|-----------|-----------------------------|---------|
| 106088CMT | B-1 Nuclear Bomber by Avalon Hill Game Company | \$13.87 | 106880CMT | Deadline by Infocom         | \$34.87 |
| 106062CMT | Andromeda Conquest by Avalon Hill Game Company | \$15.87 | 106864CMT | Suspended by Infocom        | \$34.87 |
| 106997CMT | Quotrix by Infost                              | \$24.87 | 106229CMT | Apple Panic by Broderbund   | \$18.93 |
| 523837CMT | PacMan by Atari                                | \$19.87 | 522144CMT | Cyborg by Sentient Software | \$19.87 |
| 523852CMT | Donkey King by Atari                           | \$19.87 | 504027CMT | Gorgon II by Sirius         | \$6.97  |
| 503201CMT | Serpentine by Broderbund                       | \$19.93 |           |                             |         |

**BUSINESS PACKAGES FOR APPLE**

|           |                                                     |          |           |                                              |          |
|-----------|-----------------------------------------------------|----------|-----------|----------------------------------------------|----------|
| 520635CMT | Money Pac (Money Decisions Volume 1 and 2) By Eagle | \$229.83 | 530501CMT | Win on Wall Street: Complete System by Summa | \$369.87 |
| 107615CMT | Personal Investor by PBL                            | \$95.83  | 530485CMT | Win on Wall Street: Forecaster by Summa      | \$149.87 |
| 106096CMT | Accounts Receivable by BPI                          | \$249.87 | 530477CMT | Win on Wall Street: Data Manager by Summa    | \$114.87 |
| 106146CMT | Payroll by BPI                                      | \$249.87 | 530493CMT | Trader's Accountant by Summa                 | \$197.83 |
| 106831CMT | Tax Preparer by Howard Software                     | \$99.83  | 508317CMT | Beagle Basic by Beagle Brothers              | \$21.87  |
| 521179CMT | Dollars and Sense by Monogram                       | \$99.84  | 513275CMT | Flex Test by Beagle Brothers                 | \$17.87  |
| 105734CMT | Wordstar/CPM by MicroPro                            | \$219.87 | 508846CMT | Alpha Plot by Beagle Brothers                | \$23.97  |
| 508309CMT | Friday by Aston Tate                                | \$179.83 | 513317CMT | Pronto Dos by Beagle Brothers                | \$17.87  |
| 537498CMT | Flashcalc (IIE and IIC) by Visicorp                 | \$79.83  | 513234CMT | Dos Boss by Beagle Brothers                  | \$14.87  |
| 106534CMT | Milestone by Digital Marketing                      | \$179.87 | 513259CMT | Frame Up by Beagle Brothers                  | \$17.87  |

**EDUCATIONAL PACKAGES FOR APPLE**

|           |                                         |         |           |                                            |         |
|-----------|-----------------------------------------|---------|-----------|--------------------------------------------|---------|
| 509356CMT | Spellcopter by Designware               | \$21.97 | 501783CMT | Word Master by DLM                         | \$23.87 |
| 509620CMT | Alien Counter/Face Flash by Milliken    | \$23.87 | 512954CMT | Toddler's Tutor by Silicon Valley          | \$18.93 |
| 509638CMT | Jar Game/Chaos by Milliken              | \$23.87 | 513309CMT | Double Cake by Beagle Brothers             | \$21.87 |
| 509653CMT | Golf Classic/Batling Bug by Milliken    | \$23.87 | 513101CMT | Meet the Presidents by Versa               | \$25.87 |
| 107631CMT | Preschool IQ Builder by (PDI)           | \$17.83 | 501809CMT | Fraction Factory by Springboard            | \$19.87 |
| 503714CMT | Memory Builder Concentration by (PDI)   | \$17.83 | 515049CMT | Juggles Rainbow by Learning Company        | \$19.87 |
| 503722CMT | Reading Comp: What's Different by (PDI) | \$17.83 | 515056CMT | Bumble Game by Learning Company            | \$25.87 |
| 503730CMT | Quantitative Comparisons by (PDI)       | \$17.83 | 515064CMT | Bumble Plot by Learning Company            | \$25.87 |
| 107672CMT | Step by Step I by (PDI)                 | \$64.87 | 515072CMT | Gertrude's Secrets by Learning Company     | \$28.93 |
| 107680CMT | Step by Step II by (PDI)                | \$64.87 | 515080CMT | Gertrude's Puzzles by Learning Company     | \$28.93 |
| 512558CMT | Computer Preparation for the SAT by HBJ | \$53.87 | 515098CMT | Rocky's Boots by Learning Company          | \$33.87 |
| 521849CMT | Demolition Division by DLM              | \$23.87 | 522102CMT | Moptown Parade by Learning Company         | \$25.87 |
| 105155CMT | Dragon Mix by DLM                       | \$23.87 | 515106CMT | Magic Spell by The Learning Company        | \$23.87 |
| 501775CMT | Word Radar by DLM                       | \$23.87 | 504209CMT | Sticky Bear Numbers by Weekly Reader/Xerox | \$25.87 |
| 512087CMT | Verb Viper by DLM                       | \$23.87 | 504217CMT | Sticky Bear A B C by Week Read/Xerox       | \$25.87 |

**ENTERTAINMENT PACKAGES FOR APPLE**

|           |                                             |         |           |                                                 |         |
|-----------|---------------------------------------------|---------|-----------|-------------------------------------------------|---------|
| 524850CMT | Donkey Kong by Atari                        | \$19.87 | 509208CMT | Swashbuckler by Datamost                        | \$21.83 |
| 523811CMT | Centipede by Atari                          | \$19.87 | 509265CMT | Aztec by Datamost                               | \$24.83 |
| 514175CMT | PacMan by Atari                             | \$19.87 | 106559CMT | SNAKE Attack by Datamost                        | \$15.87 |
| 523829CMT | Defender by Atari                           | \$19.87 | 524942CMT | Suspended by Infocom                            | \$33.87 |
| 522029CMT | Serpentine by Broderbund                    | \$18.93 | 503565CMT | Dino Eggs by Micro Lab                          | \$24.83 |
| 106245CMT | Sea Fox by Broderbund                       | \$18.93 | 503599CMT | Death in the Caribbean by Micro Lab             | \$24.87 |
| 106179CMT | Apple Panic by Broderbund                   | \$18.93 | 107219CMT | Miner 2049er by Micro Lab                       | \$23.97 |
| 508655CMT | Chivalry by Weekly Reader/Xerox             | \$29.97 | 524058CMT | Chess by Odesta                                 | \$48.97 |
| 508648CMT | Fat City by Weekly Reader/Xerox             | \$25.83 | 503631CMT | Checkers by Odesta                              | \$29.87 |
| 500132CMT | Monster Mash by Datamost                    | \$17.93 | 107482CMT | Frogger by Sierra                               | \$23.87 |
| 512988CMT | Wizprint by Sir-Tech                        | \$14.97 | 509794CMT | Dark Crystal by Sierra On Line                  | \$25.93 |
| 500215CMT | Star Maze by Sir-Tech                       | \$21.83 | 509802CMT | Mr. Cool by Sierra On Line                      | \$19.93 |
| 532515CMT | Pooyan by Datasoft                          | \$19.93 | 107524CMT | Jawbreaker by Sierra On Line                    | \$19.93 |
| 512780CMT | Sammy Lightfoot by Sierra on Line           | \$21.93 | 107599CMT | Ulysses and The Golden Fleecy by Sierra on Line | \$23.97 |
| 512798CMT | Apple Cider by Sierra on Line               | \$20.93 | 524173CMT | Cyborg by Sentient Software                     | \$19.87 |
| 501916CMT | Lunar Leeper by Sierra on Line              | \$19.83 | 503896CMT | Congo by Sentient Software                      | \$15.87 |
| 106070CMT | Andromeda Conquest by Avalon Hill           | \$13.97 | 503904CMT | Goldrush by Sentient Software                   | \$15.87 |
| 106161CMT | Alien Rain by Broderbund                    | \$17.83 | 509950CMT | Jellyfish by Sirius Software                    | \$7.97  |
| 106203CMT | David's Midnight Magic by Broderbund        | \$24.87 | 503920CMT | Freefall by Sirius Software                     | \$7.97  |
| 106187CMT | Arcade Machine by Broderbund                | \$39.97 | 503953CMT | Plasmania by Sirius Software                    | \$8.93  |
| 508887CMT | Gumball by Broderbund                       | \$19.93 | 509976CMT | Gruds in Space by Sirius Software               | \$8.93  |
| 106153CMT | AE by Broderbund                            | \$23.87 | 108175CMT | Repton by Sirius Software                       | \$8.93  |
| 508952CMT | Fender Bender by California Pacific         | \$15.87 | 108191CMT | Space Eggs by Sirius Software                   | \$21.93 |
| 508960CMT | Brainteaser Boulevard by California Pacific | \$15.87 | 515445CMT | Shamus by Synapse Software                      | \$18.93 |
| 508978CMT | Ultima/Akalabeth by California Pacific      | \$24.87 | 515452CMT | Picnic Paranoia by Synapse Software             | \$18.93 |
| 509083CMT | Micropainter by Datasoft                    | \$23.82 |           |                                                 |         |

**HARDWARE**

|           |                                                  |          |             |                                                    |          |
|-----------|--------------------------------------------------|----------|-------------|----------------------------------------------------|----------|
| 103853CMT | Amdek Color III Monitor                          | \$299.87 | RAM48DPD    | Axlion 48K Memory Module for Atari 1400            | \$99.97  |
| 533851CMT | Color III RGB Adaptor                            | \$34.83  | DM1403DPD   | Data 20 Word Manager for Commodore 64              | \$53.97  |
| 508101CMT | Amdek Color I Plus                               | \$269.87 | VP6801DPD   | Panasonic A-4 Type Digital Plotter                 | \$999.97 |
| 522425CMT | Plantronics Color Plus Colorboard Plus Composite | \$399.87 | AT88DDADPD  | Percom Doubler For AT88 (Atari 400/800)            | \$99.97  |
| 104125CMT | Epson HX20 (116K) Computer                       | \$489.93 | AT88S1PDDPD | Percom Doubler Density Drive w/parallel port       | \$299.97 |
| 104109CMT | Epson Micro Cassette Drive                       | \$99.83  | RF40S1DPD   | Percom Single Disk Drive (180K) (Atari 400/800)    | \$329.97 |
| 508184CMT | CDC 320KB Disk Drive                             | \$179.87 | RF44S1DPD   | Percom 2-Headed Single Disk (360K) (Atari 400/800) | \$389.97 |
| 104257CMT | STB Ramprint IBM                                 | \$24.87  | 1016DPD     | Timex 16K RAM Module (TS1000 & TS1500)             | \$4.97   |
| MW100DPD  | Printer for Timex TS1000 Computer                | \$12.97  | COLOR1DPD   | Amdek 13" Color Monitor                            | \$199.97 |

**Points To Remember:**

While Supplies Last  
 Prices subject to change without notice.



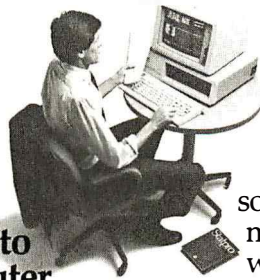
Prices do not include shipping, handling or applicable sales taxes.

P.O. Box 25130 Nashville, Tennessee 37202





# BIG TIME STATISTICS GO SMALL



**Statpro™ brings the power of mainframe statistics to your personal computer.**

Until now, serious statistical analysis meant mainframes, computer centers and a lot of extra work for you.

Enter Statpro, the most powerful statistical software system ever developed for personal computers.

It lets you do almost everything you do on a mainframe on your IBM® or Apple® personal computer. Including descriptive statistics, regression, ANOVA, factor and cluster analysis, to name just a few capabilities.

And Statpro's awesome power isn't limited to number crunching. You can plot all your results in four-color graphics, such as scatter, triangle and regression plots, dendrograms, histograms and pie charts.

What's more, Statpro has sophisticated database management capabilities which make entering, manipulating, transforming and editing data quick and easy.

Most important of all, you get this incredible power in one integrated, fully documented, easy-to-use package for only \$795.

Discover Statpro's capabilities for yourself. Call us toll-free today to order a Statpro demonstration package. We'll have it on its way to you within 24 hours.

## 800-322-2208

In Massachusetts call (617) 423-0420.  
Or call your local dealer.

 **Wadsworth  
Professional Software**

Statpro is a trademark of Wadsworth Professional Software, Inc. Apple is a registered trademark of Apple Computer, Inc. IBM is a registered trademark of International Business Machines Corp.

# LOOKING FOR THE PERFECT PROGRAM

BY DAVID BARR AND GEORGE DEW. ROGERS

## *Communications performance criteria*

EVER HAD THIS NIGHTMARE? You badly need a survey of all the published spreadsheet software reviews. If you get it, you enhance your reputation at work by recommending the most powerful program on the market. You've decided to be courageous and phone the mainframe database, long distance, and pay the crippling hourly rate. It will cost you a few dollars, but it will be more than worth it if you get that next promotion.

Everything goes well for once. You boot up your terminal-emulation software, dial the 14-digit number, sign on, and the host computer actually recognizes the password they gave you when you phoned in your credit-card number the day before. The database seems relatively easy to search, as you feverishly enter the right keywords with one eye on the clock. The host pauses, and you visualize banks of giant hard disk-paks spinning with a chorus of high-pitched hums as read/write heads seek back and forth, picking out the information you want. Then the first titles begin to scroll by on your screen, obediently piling up in a RAM (random-access

read/write memory) buffer so you can dump them to a disk file after the session.

But what's the matter with these titles? There's the odd one on spreadsheets, but nothing like you were expecting. Looks like you used the wrong keyword.

Well, no problem. At the start of the session, the host computer said you could abort any function by pressing the Break key. Break key? Your micro-computer certainly doesn't have one of those. You dash for your terminal-emulation software's instruction manual and thumb your way through it. Meanwhile, all that information you don't need is scrolling serenely off the top of your screen. Finally you find an

.....  
*David Barr is a biologist who uses computers in his research and for personal enjoyment. He can be reached at Department of Entomology, Royal Ontario Museum, Toronto, Ontario M5S 2C6, Canada.*

*George deW. Rogers is a chemist and professional conservation scientist who has been hacking the Apple since it first appeared. He can be reached at 12 Tyndall Ave., Apt. C, Toronto, Ontario M6K 2E2, Canada.*

obscure reference to Break. Supposedly, if you key in the sequence Escape Shift-7, your software will send out an ASCII (American Standard Code for Information Interchange) 127 character (7F hexadecimal), recognized as a Break by some systems. You try it but the host keeps spilling out information you don't need or want.

Now it's panic time. You've already been on the air 20 minutes, you've had a buffer overflow (you're not even capturing that garbage anymore), and those credit-card dollars are totalling up faster than the dials on the pump at the gas station. What to do?

You could just pull the plug. However, not only does that offend your sense of elegance, but you remember the sign-on warning that any improper sign-off could result in your being billed for a full hour or more of expensive mainframe time. Feeling doomed you sit bolt upright, bathed in a cold sweat. And then you wake up. It was all a dream. You didn't pour all that money down a dry hole. Yet the frustrations and unnecessary ex-

*(continued)*

pense encountered with the wrong terminal-emulation program are real. Which one is for you? It's almost a full-time job deciding which features you want and which are just superfluous frills.

**FEATURES—WHAT DO YOU REALLY WANT/NEED?**

Maybe the best way for you to start is to decide just what you want your communications program to do. If, like us, you're interested in learning about your computer while using it, your wish list might go something like this. You want to communicate with a wide variety of host computers that answer their own phones. You want to use freely any functional programs available on those host systems. You must be able to send information from your disks or RAM. And you want to send information generated by a program running on your machine while you are connected to the host.

Additionally, your communications software must capture and save usable information sent from a computer at the other end of the phone line. You might want text, for example, ready for your favorite word processor.

Last, but not least, you will eventually want your modem-oriented software to send information between two serially hard-wired computers. It's this latter function that leads us to suggest you should really be thinking about communication, not just terminal emulation.

We've used everything from the earliest commercial microcomputers with their severely restricted memories to new lap-size portables, and high-powered jobs with hard disks and RAM disks. We have spent (or misspent) countless hours communicating with all kinds of hosts, and we've used dedicated, dumb terminals as well as microcomputers that were configured as both dumb and smart terminals. As a consequence, we've spent more time than we care to remember scratching our heads and wondering why nothing will work.

Along the way we've developed

highly personal, and maybe slightly opinionated, views of what we'd like to see in the ideal communications program. So have a look at our wish list and tell us if there's any commercial program that can do everything we want. At the very least, our ideas may give you some guidelines as to what to seek as you select communications software.

**SIGNING ON**

Unless you're wired directly to the object of your communicative affections, you're going to have to deal with "Ma Bell." There is a whole set of communications software features involved with getting connected to a host system and successfully logging on. But there are often other signals that the host requires for recognition, such as a specified number of carriage returns, control characters, or assorted punctuation marks. Remembering all of these, plus the telephone numbers to establish the connection in the first place, can be tedious at best. It is next to impossible if you skip around a lot and change your passwords regularly for improved security. Thus the macro command or "macro."

Most software manufacturers use their own names for macros, but, in general, they let you establish a disk file with telephone numbers and a whole sequence of stored commands (including pauses to wait for host response). Macro commands can be used to activate a modem with dialing capability and then automatically satisfy the expectations of the prospective host at a single keystroke. A macro may seem like a frill before you buy your first communications program, but if you do much telecommunicating, you'll soon come to look upon it as money well spent. Watch out, however, for the macro that permanently redefines some of your keys. It's disconcerting to type a message, only to find that every ? fires out your password.

Your microcomputer also has to match the type of data signals sent out with those expected by the host.

*(continued)*

The bottom line in data communications is getting information from one computer to another as quickly as possible without errors. In most cases, this operation consists of retrieving, organizing, appending to, and directing data. Since computers, for the most part, whir away autonomously upon our desks, any dialogue between two or more of them must be extremely regimented and specifically defined. Time and protocol are the critical factors.

Communication is a real-time event. Electronic signals or data, when transmitted, take a finite amount of time to travel from source to destination. In order for one computer to retrieve data sent by another, it has to know the duration of each data bit and the rate at which new bits arrive. Sharing this basic knowledge, the computers are assured of transferring data discretely and without fragmentation.

Working with the instructions from a communications program, the computer translates the data bits into meaningful information. The translation is governed by rules and standards with which both sending and receiving computers comply. These rules and standards define the protocol, which is the mechanism for packaging, routing, and unpackaging data.

That's all there is to it, really. Protocol tells the computer what the information is and what to do with it, and time tells it when it will be there. Provide a computer with those two elements and you give it the ability to communicate. Naturally, implementing a communications program with the abstract principles of time and protocol on the reality of chips and wires gets complicated, but keeping these two concepts in mind should make the complexity manageable and understandable.

**TWO METHODS**

Communication takes place with one of two basic temporal methods: asynchronous and synchronous. With the asynchronous method, the arrival and departure of data is timed by a general clock that sets a rate, called *baud*, that measures the speed of the data transmission in bits per second. The actual arrival and departure of ASCII (American Standard Code for In-

# THE BARE NECESSITIES

BY LARRY FELSER

formation Interchange) characters is signalled by information appended to the raw data. With the synchronous method, data transmission is timed by the same baud clock but, in addition, the conversing computers share a common clock and thus are able to time character arrival and departure without each character having to carry such signals intrinsically.

Using the asynchronous method, each character sent down the communications line carries its own clock bits. The start bit tells the receiving computer that the eight bits of an ASCII character are coming in. The stop bit tells the receiving computer that the entire character has arrived. Before being sent out the communications port, each character must be supplied with a start bit at the front of its eight bits and a stop bit at the rear.

Although precise clock synchronization is not required with asynchronous transmissions, the sending and receiving computers must agree on a baud rate. All elements in the communications setup must be set to the same baud, including modems, computers, and software.

## SYNCHRONOUS EXCHANGE

Data communication with the synchronous method is more time-restrictive but requires no appended data bits to indicate character arrival. In addition to the data transferred, two synchronously conversing computers share a consistently oscillating modulated signal, called the clock signal. Typically, in the micro world, this clock signal is supplied by the modems and transferred for the duration of the link in parallel with the data stream. The clock tells each computer when to sample the data, ensuring only whole bits are received. In the initiation of a synchronous transfer, the sending computer first sends one or more "sync" characters. The receiving computer uses these characters to "synchronize watches" with the sending computer. In this manner, the receiving computer knows when to expect the next character.

For example, computer A is in Maryland and computer B is in New Hampshire. B is going to send data to A synchronously. They first determine what baud to use;

this, for the most part, is a function of the modems. They also have to determine what protocol to use, which we'll cover later. Once the baud and protocol have been set, B calls A. The first character B sends down the line is a sync character, which is simply an agreed-upon ASCII code or its EBCDIC (extended binary-coded-decimal interchange code) equivalent. Parallel to the data stream is the clock signal, which determines the data sampling rate. A will be looking for B's sync character and will not accept actual data until the sync arrives. Once A has received this character, it then knows at what time every other character of B's transmission will arrive, since B, in its data stream, will never leave the line idle. During points in the transmission when no data is sent, B will send "pad" characters; these pads are inserted to keep the line in sync at all times. This is the key to efficient synchronous transmission. Since B has first told A its character arrival sequence with the sync characters, and since A is assured that there will always be characters on the line, there is no need for each character to indicate its arrival.

This type of timing allows entire blocks of characters to be sent at once, which is very efficient. However, the protocol for size, start and end points, contents, and sequence of a block in a series of transmitted blocks must be defined. In addition, assurance must be given that the data transmission has been executed without error. With the synchronous method, organization, control, and assurance of data is the job of protocol.

## PROTOCOLS

There are two main types of synchronous protocol: byte-synchronous and bit-synchronous. The distinction is that bit-oriented protocols recognize and interpret individual bits of the data stream, whereas byte-oriented protocols deal only in whole 8-bit characters. (SDLC/Synchronous Data Link Control| SNA [Systems Network Architecture] is an example of bit-synchronous protocol.) Bit-synchronous communication deserves a book of its own and I won't attempt to cover it here.

Byte-synchronous or bisync protocols

come in many varieties. They were first developed on mainframe computers, generally for connecting many separate terminals to the same CPU (central processing unit). The protocols are distinguished both by the type of terminals used and the task to be carried out. For example, the most common terminals, IBM's 3270 series, were designed to communicate interactively with the CPU. Most 3270 terminals communicate using bisynchronous 3270 protocol. Other devices transfer batch jobs to, and results from, a host CPU. Batch jobs are programs or data that are transferred to the mainframe computer all at once and queued up to be run by the CPU noninteractively with the user. For this type of task an entirely different protocol was developed. A very common member of this set of protocols is Bisynchronous 3780, again taking its name from a line of IBM terminals and peripheral devices.

## ENTER MICROCOMPUTERS

Within the last few years, microcomputers have dropped in price to the point of being competitive with commonly used terminals. A natural progression in the modern office is toward giving individuals the power and flexibility of a personal computer as opposed to the shared resources of a single mainframe computer. Indeed, many offices that could never afford computing in the past can now purchase a complete computer system for a price comparable to that of a three-year-old Ford with bad tires.

As sensible an alternative as this may seem, many companies are reluctant to give up their mainframe processing, with its years of investment and the ability to tap into the often vast and omnipresent capabilities of host computers. The solution is to provide micros with the ability to emulate terminals and thus be able to converse with and utilize mainframe applications, while retaining the quality of being personal computers.

.....  
 Larry Felser has a B.S. in Mechanical Engineering from Cornell University and is director of engineering operations for IE Systems Inc., 112 Main St., Box 359, Newmarket, NH 03857.

This gets us into the rather technical world of baud rate, parity, and other aspects of data format. [See the text box "The Bare Necessities" by Larry Felser, on page 201, for an explanation of communications formats and protocol.]

The baud rate is a bandwidth-oriented indicator of the speed (in

characters per second) that data is sent over the phone lines. (See "High-Speed Dial-Up Modems" by Kim Maxwell, page 179, for the difference between bit rate and baud rate.) The capability of your machine to communicate at different speeds depends on the characteristics not only of your modem but also of your communica-

tions software. Most host computers of our experience can still be accessed at 300 baud (approximately 30 characters per second). Increasingly, more can also communicate at 1200 baud. Because 1200-baud modems are becoming more widely available at a reasonable price, we predict it will increasingly become the standard in the future. Eventually you won't be able to access new systems unless you can transmit at the higher rate. You had better take a look at whether the program you are contemplating can switch baud rates, either automatically or manually.

The rest of the topic of communication format, namely data length, parity, and number of stop bits, is pressingly important. If you can't seem to make a new host listen, chances are your software is not sending data appropriately. Change one or more of the basic format variables and, as if by magic, the host will understand you. Obviously, the ideal communications program will allow you to set these variables independently (and without having to resort to machine-language programming).

Even better would be a microcomputer communications program that would detect the host's data format and tell you if you have to change your format. Best of all, the program would perform the change automatically, perhaps just informing you of what has happened for future reference.

### USING THE HOST

After you're logged on and the host is responding nicely to your queries for information, your next major concern is to have the complete freedom of the host's software. Depending on your host system's sophistication, this software may range from a simple set of menus to word processors, spreadsheets, adventure games, or compilers for languages like Pascal, C, and APL. The rub is, the more diverse your desired host programs, the greater your need to send special signals. Such signals can range to some of the more exotic extras in the

(continued)

## What do you get when you cross 1200 baud, free on-line time, and extra features at a price Hayes can't match?

### Data Rate?

The MultiModem gives you a choice—either 1200 or 300 bits per second. So you can go on-line with the information utilities. Check out bulletin boards. Dial into corporate mainframes. Swap files with friends.

### On-Line Time?

With the MultiModem you get CompuServe's DemoPak, a free two-hour demonstration of their service, and up to seven more free hours if you subscribe. You also get a \$50 credit towards NewsNet's business newsletter service.

### Features & Price?

Of course, the MultiModem gives you automatic dial, answer, and disconnect. Gives you the Hayes-compatibility you need to support popular communications software programs like Crosstalk, Data Capture, our own MultiCom PC, and dozens of others. Gives you a two-year warranty, tops in the industry.

Circle 276 on inquiry card.

# MultiModem.

### But Better?

Yes. The MultiModem gives you features the Hayes Smartmodem 1200™ can't match. Features like dial-tone and busy-signal detection for more accurate dialing and redialing. Like a battery-backed memory for six phone numbers. All at a retail price of just \$549—compared to \$699 for the Smartmodem.

What do you get? The new MultiModem, from Multi-Tech Systems. Isn't this the answer you've been looking for?

For the name of your local distributor, write **Multi-Tech Systems, Inc.**, 82 Second Avenue S.E., New Brighton, MN 55112. Or call us at (612) 631-3550.



**MultiTech**  
Systems

The right answer every time.

Trademarks—MultiModem, MultiCom PC, Multi-Tech Systems, Inc.—CompuServe, CompuServe Information Services, an H & R Block company—NewsNet, NewsNet, Inc.—Crosstalk, Microstul, Inc.—Data Capture, Southeastern Software—Smartmodem, Hayes Microcomputer Products, Inc.



LOMAS DATA PRODUCTS INVITES YOU TO:

# SHARE THE THUNDER.

## The S100-PC-TM offers the following standard features:

- High performance THUNDER186 8Mhz 80186 processor
- 512K bytes of RAM (expandable to 1Mbyte)
- 4 serial ports to support up to four users
- 3 Centronics compatible parallel ports
- Concurrent DOS operating system allows execution of both CP/M-86 and MS-DOS (PC-DOS) programs
- 5¼" IBM-PC compatible floppy drive
- 40 Mbyte high performance Winchester drive
- Attractive 10 slot desktop enclosure

In addition, a number of options are available including: larger Winchester drives, more user ports, 80286 processor, graphics support and additional operating systems (MS-DOS and CP/M-86).

## S100 BUS boards products & support for the system integrator . . .

All of LDP boards are fully tested to exacting standards and carry a one year warranty. We specialize in 16-bit products & support the major operating systems for 16-bit processors: CP/M-86\*, CONCURRENT CP/M-86\*, and MS-DOS (PC-DOS).

### ■ THUNDER186 — THE ONLY COMPLETE S100 BUS, 16 BIT SINGLE BOARD COMPUTER AVAILABLE TODAY.

Concurrent CP/M-86, which in addition to running CP/M-86 programs, runs MS-DOS programs. Comes complete, ready to plug into an enclosure and run. 256K bytes of RAM only . . . . . **PRICE \$1595.00**

### ■ LIGHTNING ONE\*\*\*8086/8088 CPU

8086 or 8088, with 8087 and 8089 coprocessors. Up to 10 MHZ operation . . . . . **PRICES start at \$425.00**

### ■ HAZITALL SYSTEM SUPPORT BOARD

2 serial, 2 parallel ports, battery protected clock calendar. Hard disk controller host interface . . . . . **PRICE \$325.00**

### ■ LDP 128/256K DYNAMIC RAM

Advanced dynamic RAM with LSI controller for failsafe operation, parity **PRICE 128K—\$495.00, 256K—\$795.00**

### ■ RAM67 HIGH PERFORMANCE STATIC RAM

High speed (100ns) low power CMOS static RAM. 128K bytes, extended addressing . . . . . **PRICE \$995.00**

### ■ LDP72 FLOPPY DISK CONTROLLER

Single/double density, single/double sided disks, both 8" and 5¼" inch drives simultaneously . . . . . **PRICE \$275.00**

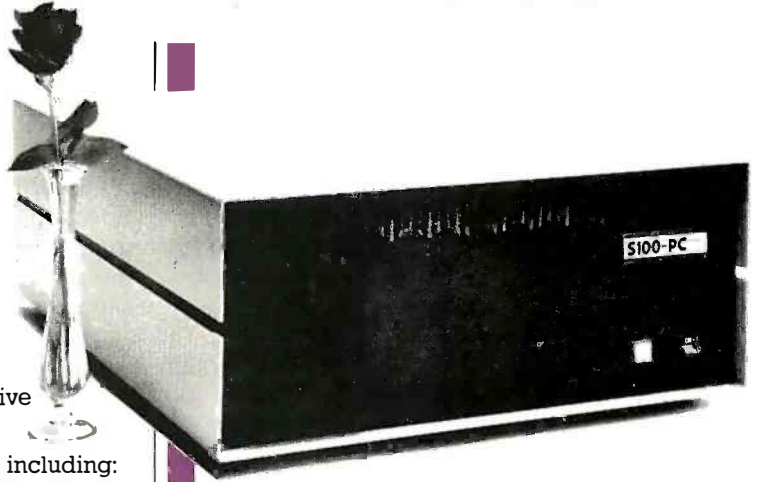
### ■ LIGHTNING 286—80286 CPU BOARD

Offers 4 times the performance of a 5MHZ 8086 CPU while maintaining software compatibility . . . . . **PRICE \$1395.00**

### ■ OCTAPORT 8 PORT SERIAL BOARD

0 to 19200 baud operation real time clock interrupt. Ideal for multi-user systems such as MP/M-86\* **PRICE \$395.00**

S100-PC-TM is a trademark of Lomas Data Products, Inc.  
\*CP/M-86, MP/M-86 and CONCURRENT CP/M-86 are trademarks of Digital Research. \*\*MS-DOS is trademark of Microsoft.  
\*\*\*Lightning One is trademark of Lomas Data Products, Inc.



**S100-PC-TM: The LDP Multi-user S100 Bus System offers high performance at a "low" price . . . plus, "our" system is expandable and upgradeable!**

PRICE  
An unbelievable

**\$6995<sup>00</sup>**

*Call today!*

# LDP

**LOMAS DATA PRODUCTS, INC.**  
66 Hopkinton road, Westboro, MA 01581  
Tel: (617) 366-6434  Telex: 4996272

Dealer inquiries invited.

For orders outside the U.S., contact our exclusive dealers:  **Australia** — LAMRON PTY. LTD., (02) 85-6228  
 **Malaysia** — EXA COMPUTER (M) SENDIRIAN BERHAD, 795284

cast of 128 ASCII characters. In extreme cases, a full range of 256 different characters or character signals may be necessary. Chances are, your microcomputer doesn't supply all of these from the keyboard. If it doesn't, your software had better do it for you. The best communications programs let you create a wide range of data signals from your keyboard. Be warned. You may have to memorize an extensive set of multiple key-presses.

Perhaps the most frustrating special signal is the physical break. Some communications software talks about a Break code. It turns out, however, that they are only talking about a Control-C (often used to terminate a program in operation). If your host requires a physical break, Control-C (or any of the ASCII characters you try to send) will have no effect whatsoever. What is needed is a momentary ces-

sation in the carrier signal. This means your software must have control over the electronics of your modem. That short break in the carrier is detected by the host and interpreted as a command to interrupt program execution.

The best communications programs will let you alter the length of the break. This is crucial. Too short an interruption will not be noticed by the host. Too long an interruption may cause it to hang up on you, on the assumption that telephone contact has been lost. You probably have already guessed that hosts that require a Break signal differ in their requirements for the ideal length of the break.


**DOWNLOADING—BECOMING THE PERFECT PARASITE**

All communications software will let you perform the functions we've talked about so far. That is, to qualify

as communications software, a program must let you contact and log on to a remote host system and let you use the host's programs. A program that does only this lets your micro emulate a "dumb" terminal.

The first additional feature a "smart" terminal-emulation program usually provides is "downloading." Downloading means that your micro can capture and store, temporarily or permanently, whatever is sent to it by the host.

The simplest and most widely used form of downloading is reserving some RAM as a buffer. Then you store all incoming characters in the buffer as they are shown on the screen. Later the contents of the download buffer are stored on a disk where they are accessible to utility programs for further reference and manipulation. Accessible, that is, if stored as a simple text file under your operating system.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Come visit us in our Long Island Showroom<br/>226 Sherwood Ave.<br/>Farmingdale, NY 11735</p>                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                        | <p>Se Habla Español</p>                                                                                                                                                                                                                                                         |
| <p>Cable: COMSYSTEC NEWYORK<br/>Telex: CSTNY 429418</p>                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                 |
| <p><b>OUR SPECIALTY: IBM COMPATIBLE PRODUCTS, GRAPHICS, DATABASE, 68000 UNIX, EXPORT</b></p>                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                 |
| <p><b>IBM PC &amp; COMPATIBLES</b></p>                                                                                                                                                                                                                                                                                                                                                                                                              | <p><b>ACCESSORIES</b></p>                                                                                                                                                                                                                                                                                                                                 | <p><b>Special Sale Items</b></p>                                                                                                                                                                                                                                                |
| <p>Fantastic busboard for expansion<br/><b>BASIC BUSBOARD, 0 RAM... \$169</b><br/>Can add up to 512K RAM+ unlimited number of modules listed below:<br/>Async I/O.....\$88<br/>Parallel I/O.....63<br/>Clock Calendar.....69<br/>Game I/O.....69<br/>Floppy controller.....160<br/>Monochrome adaptor.....190<br/>16 channel A/D.....110<br/>8-bit I/O module.....69<br/>64K RAM kit (9 chips).....45<br/><b>BUSBOARD with 512K RAM.....450</b></p> | <p>IBM PC 1 or 2 to XT upgrade ROM BIOS.....\$119<br/>TAVA 2.0 UPGRADE ROM BIOS.....85<br/>360K slimline floppy drive.....195<br/>5" floppy subsystem, 2 slimline disk drives, power supply, controller.....2,800<br/>10 MB hard disk w/controller.....810<br/>ROM for IBM PC (old version)<br/>allow boot from hard disk, speed up processing.....99</p> | <p><b>high quality diskettes...</b><br/>5¼" DSDD Soft Sector w/Hub Ring<br/>Bulk (min.20).....\$1.49 ea.<br/>DYSAN, 3M.....CALL<br/>Maxwell for IBM AT.....6.75 ea.<br/>3½" SS for APPLE etc.....4.50 ea.<br/>(* \$6 shipping minimum)<br/>reliable surge protector......89</p> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <p><b>NETWORK</b></p>                                                                                                                                                                                                                                                                                                                                     | <p><b>TELECOMMUNICATION</b></p>                                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <p>3Com Ethernet network.....CALL<br/>File Server w/513 MB Winchester hard disk, 160 MB streamer tape backup, latest technology<br/><i>Bring the mainframe power to PC!</i></p>                                                                                                                                                                           | <p><b>STUDENT BACK TO SCHOOL SPECIAL</b><br/><b>\$470</b><br/>ZENITH ZT1 terminal built in modem, auto dial your school computer</p>                                                                                                                                            |
| <p>Prices subject to change. American Express, Visa/Mastercard add 3%. F.O.B. point of shipment. 20% restocking fee for returned merchandise. Personal checks take 3 weeks to clear. COD on certified check only. N.Y. residents add sales tax. Manufacturers' warranty only. International customers, please confirm price before order. Accept P.O. from Fortune 500, schools and gov't.</p>                                                      | <p><b>SYSTEM CONFIGURATION</b></p>                                                                                                                                                                                                                                                                                                                        | <p><b>PORTABLE ON-THE-GO</b></p>                                                                                                                                                                                                                                                |
| <p><b>Computer Channel</b><br/>226 Sherwood Ave.<br/>Farmingdale, NY 11735<br/>For information CALL (516) 420-0142<br/>To order CALL 1-800-331-3341</p>                                                                                                                                                                                                                                                                                             | <p><b>TELEX: 429418 CSTNY</b></p>                                                                                                                                                                                                                                                                                                                         | <p>Columbia, Eagle, NEC PC 8021, ZENITH, TELEVIDEO</p>                                                                                                                                                                                                                          |
| <p><b>FORTUNE 1500 COMPANIES—LET US SOLVE YOUR SYSTEM NEEDS!</b></p>                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                 |

# PERFORMANCE CRITERIA

The captured information can even be printed.

Of course, if the reserved RAM area gets filled up, recording generally ceases. The rest of the information is lost. Even if your micro automatically saved the contents of a full buffer to disk, the time it took for that would lose information. The upshot is that the download buffer should be as large as possible, at least 30K bytes to store about 15 pages during a single downloading session. Since the download buffer memory will be larger the smaller your communications program (CP), another mark of a good CP is that it occupies a minimum amount of RAM.

One way to retain information during downloading is to set up a system of prearranged stop and start signals between the receiving micro and the host. Sometimes such a system is known as "handshaking" because the

two computers cooperate during data transfer. The result is that information is sent by the host in blocks, because after the microcomputer has had enough, it signals the host to stop sending until the data already sent has been stored to disk. Then the micro sends the go-ahead signal and the host sends until it receives the next stop signal. Unfortunately, different hosts recognize different stop/start signals. So your CP should have the option of choosing several different variations on this pattern.

There's an additional wrinkle to altering protocol. A few programs let you pause after you make the telephone connection and change your protocol in midstream. Those that don't can make your life difficult by making you lose data.

A different method of combatting the problem of potential data loss during downloading also provides a

solution to garbled data due to telephone-line noise. Noise is the presence of random electrical signals (you can even hear some of them as clicks or static) in the telephone company's transmission lines. Depending on how much is present, your data may be almost unreadable after transmission. Fortunately, some commercial communications software packages (and some in the public domain, too) incorporate an error-checking method of data transfer that allows only good (i.e., unaltered) data to be captured.

For these error-checking communications programs (Christensen, or XMODEM, and Kermit are two popular examples), both the host and the receiving micro have to use the same convention. Data is sent in bursts of 128 or 256 characters by the host. At the same time, the sum of the bytes in the packet is sent along with the

(continued)

Come visit us in our Long Island Showroom  
226 Sherwood Ave.  
Farmingdale, NY 11735

## Computer Channel

Se Habla Español  
Cable: COMSYSTEC NEWYORK  
Telex: CSTNY 429418

---

OUR SPECIALTY: IBM COMPATIBLE PRODUCTS, GRAPHICS, DATABASE, 68000 UNIX, EXPORT

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------------------------|-------------------------------|-------------------------------------------------|-----|----------------------------------|---------------|------------------------------------------|------------------------------------|----------------------|-----------------|------------------------------------|-----------------------------------|---------------------------|-------------------------------------|-----------------------------|-------------|--------------------------------------|-----------|-----------------|--------------------------|---------------------------|------------|----------------------------------|------------|----------------|----------------------|----------|--------------|------------------------|------|--|----------------------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------------------------|-----|--|-----------------------------|------|-----|----------------------------------------|-----|--|----------------------------------|-----|----------|------------------------------------|-----|--|--------------------------------|-----|-------------|-------------------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|----------|------|--|----------|-----|--------|---------------|-----|-------------|------------------|-----|----------|----------|-----|--|------------------|-----|--|------------|-------|-----------|--------------------|-----|--|----------------------|-----|--|---------------------|-------|---------|---------------------|-----|--|-----------------|-----|
| <p style="text-align: center; font-weight: bold;">IBM PC &amp; COMPATIBLES</p> <p>IBM PC/XT/AT, Columbia, Zenith, Sanyo, Leading Edge, Televideo</p> <p style="text-align: center; font-weight: bold;">OTHER POPULAR COMPUTERS</p> <p>Epson, Cromemco, NEC PC, Altos, North Star, Dual 68000, DEC PDP/VAX, APPLE Lisa/Mac</p> <p>We also have selected demonstration models for sale at special prices</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <p style="text-align: center; font-weight: bold;">AN AFFORDABLE CAD SYSTEM FOR ENGINEERS &amp; DESIGNERS</p> <div style="text-align: center;"> <pre> graph TD     A[COMPUTER ZENITH ZF151-82 320K RAM] --- B[SOFTWARE AUTOCAD]     A --- C[ZENITH ZVM 135]     A --- D[PRINTER EPSON FX-80]     A --- E[PLOTTER DMP-40]     A --- F[DIGITIZER DT-114]             </pre> </div> <p>AutoCAD* is a two-dimensional computer-aided drafting and design system suitable for many applications including drawings for architectural, mechanical, electrical, PCB layout, chemical, structural, and civil engineering.</p> <p>For the configuration as shown in the above flowchart,</p> <p style="text-align: center; font-weight: bold; font-size: 1.2em;">\$5,800.00</p> <p>Package with IBM PC/XT also available</p> <p>***** CALL FOR DETAILS *****</p> <p>smARTWORK for PCB layout.....845</p> | <p style="text-align: center; font-weight: bold;">PRINTERS</p> <p style="text-align: center; font-weight: bold;">EPSON, OKIDATA full line</p> <p style="text-align: right; font-weight: bold;">Call</p> <p style="text-align: center; font-weight: bold;">Holiday sale on EPSON!!!</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">EPSON LQ1500</td> <td style="width: 50%;">24 wire, excellent</td> </tr> <tr> <td>Hewlett Packard</td> <td>ThinkJet.....\$450</td> </tr> <tr> <td></td> <td>LaserJet.....3,300</td> </tr> <tr> <td>Toshiba P1340</td> <td>80 col., 160 cps.....799</td> </tr> <tr> <td>Dataproduct</td> <td>8010 180 cps.....545</td> </tr> </table> <p style="text-align: center; font-weight: bold;">***Letter Quality***</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Star Power Type</td> <td style="width: 50%;">18 cps parallel/serial.....375</td> </tr> <tr> <td>NEC 2050</td> <td>20 cps for IBM PC.....760</td> </tr> <tr> <td>3550</td> <td>35 cps for IBM PC.....1,520</td> </tr> <tr> <td>C.Itoh F-10</td> <td>50 cps.....1,350</td> </tr> <tr> <td>Juki 6100</td> <td>18 cps.....459</td> </tr> <tr> <td>Qume 11/40</td> <td>w/IBM interface.....1,420</td> </tr> <tr> <td>Diablo 630</td> <td>ECS/IBM ext. char. set.....2,100</td> </tr> <tr> <td>Dynax HR35</td> <td>33 cps.....910</td> </tr> <tr> <td>Comrex Comwriter III</td> <td>.....740</td> </tr> <tr> <td>Transtar 315</td> <td>graphic, color.....479</td> </tr> </table> | EPSON LQ1500 | 24 wire, excellent         | Hewlett Packard               | ThinkJet.....\$450                              |     | LaserJet.....3,300               | Toshiba P1340 | 80 col., 160 cps.....799                 | Dataproduct                        | 8010 180 cps.....545 | Star Power Type | 18 cps parallel/serial.....375     | NEC 2050                          | 20 cps for IBM PC.....760 | 3550                                | 35 cps for IBM PC.....1,520 | C.Itoh F-10 | 50 cps.....1,350                     | Juki 6100 | 18 cps.....459  | Qume 11/40               | w/IBM interface.....1,420 | Diablo 630 | ECS/IBM ext. char. set.....2,100 | Dynax HR35 | 33 cps.....910 | Comrex Comwriter III | .....740 | Transtar 315 | graphic, color.....479 |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| EPSON LQ1500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 24 wire, excellent                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| Hewlett Packard                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | ThinkJet.....\$450                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | LaserJet.....3,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| Toshiba P1340                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 80 col., 160 cps.....799                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| Dataproduct                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 8010 180 cps.....545                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| Star Power Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 18 cps parallel/serial.....375                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| NEC 2050                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 20 cps for IBM PC.....760                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| 3550                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 35 cps for IBM PC.....1,520                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| C.Itoh F-10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 50 cps.....1,350                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| Juki 6100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 18 cps.....459                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| Qume 11/40                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | w/IBM interface.....1,420                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| Diablo 630                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | ECS/IBM ext. char. set.....2,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| Dynax HR35                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 33 cps.....910                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| Comrex Comwriter III                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | .....740                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| Transtar 315                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | graphic, color.....479                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| <p style="text-align: center; font-weight: bold;">PLOTTERS/DIGITIZERS</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">Amdek</td> <td style="width: 40%;">6-pen X-Y Plotter.....</td> <td style="width: 30%; text-align: right;">\$895</td> </tr> <tr> <td>Houston Instrument</td> <td>DMP-29 8-pen X-Y Plotter.....</td> <td>1,795</td> </tr> <tr> <td></td> <td>DMP-40 1 pen plotter.....</td> <td>795</td> </tr> <tr> <td></td> <td>DMP-41, DMP-42 22x34", 24x36".....</td> <td>CALL</td> </tr> <tr> <td></td> <td>DMP-51, DMP-52 22x34", 24x36".....</td> <td>CALL</td> </tr> <tr> <td></td> <td>HIPAD DT-11AA Digitizer.....</td> <td>725</td> </tr> <tr> <td></td> <td>HIPAD DT-114 4-button digitizer.....</td> <td>CALL</td> </tr> <tr> <td>Hewlett Packard</td> <td>7470A 2-pen plotter.....</td> <td>940</td> </tr> <tr> <td></td> <td>7475A 6-pen plotter.....</td> <td>1,640</td> </tr> <tr> <td>Calcomp M84</td> <td>8-pen plotter.....</td> <td>1,650</td> </tr> <tr> <td></td> <td>945A/PCI 24x48".....</td> <td>CALL</td> </tr> <tr> <td></td> <td>965A/PCI 34x59".....</td> <td>CALL</td> </tr> </table> | Amdek                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 6-pen X-Y Plotter.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | \$895        | Houston Instrument         | DMP-29 8-pen X-Y Plotter..... | 1,795                                           |     | DMP-40 1 pen plotter.....        | 795           |                                          | DMP-41, DMP-42 22x34", 24x36"..... | CALL                 |                 | DMP-51, DMP-52 22x34", 24x36"..... | CALL                              |                           | HIPAD DT-11AA Digitizer.....        | 725                         |             | HIPAD DT-114 4-button digitizer..... | CALL      | Hewlett Packard | 7470A 2-pen plotter..... | 940                       |            | 7475A 6-pen plotter.....         | 1,640      | Calcomp M84    | 8-pen plotter.....   | 1,650    |              | 945A/PCI 24x48".....   | CALL |  | 965A/PCI 34x59"..... | CALL | <p style="text-align: center; font-weight: bold;">MODEMS</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">HAYES</td> <td style="width: 40%;">Smartmodem 300/1200 bps.....</td> <td style="width: 30%; text-align: right;">475</td> </tr> <tr> <td></td> <td>1200B modem for IBM PC.....</td> <td>CALL</td> </tr> <tr> <td>USR</td> <td>300/1200 bps w/64K, parallel port.....</td> <td>550</td> </tr> <tr> <td></td> <td>Password 300/1200 bps modem.....</td> <td>350</td> </tr> <tr> <td>NOVATION</td> <td>Smartmodem 300/1200 bps modem.....</td> <td>415</td> </tr> <tr> <td></td> <td>PC Cat 300/1200 bps modem.....</td> <td>450</td> </tr> <tr> <td>Racal-Vadic</td> <td>MAXWELL 1200.....</td> <td>450</td> </tr> </table> | HAYES | Smartmodem 300/1200 bps..... | 475 |  | 1200B modem for IBM PC..... | CALL | USR | 300/1200 bps w/64K, parallel port..... | 550 |  | Password 300/1200 bps modem..... | 350 | NOVATION | Smartmodem 300/1200 bps modem..... | 415 |  | PC Cat 300/1200 bps modem..... | 450 | Racal-Vadic | MAXWELL 1200..... | 450 | <p style="text-align: center; font-weight: bold;">TERMINALS</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Zenith</td> <td style="width: 50%;">Z29.....</td> <td style="width: 50%; text-align: right;">CALL</td> </tr> <tr> <td></td> <td>Z49.....</td> <td>880</td> </tr> <tr> <td>ESPRIT</td> <td>6310 14".....</td> <td>580</td> </tr> <tr> <td>EXEC 10/102</td> <td>emul. VT102.....</td> <td>850</td> </tr> <tr> <td>QUME 102</td> <td>14".....</td> <td>499</td> </tr> <tr> <td></td> <td>emul. VT100.....</td> <td>875</td> </tr> <tr> <td></td> <td>211GX.....</td> <td>1,050</td> </tr> <tr> <td>VISUAL 55</td> <td>emul. TEK4010.....</td> <td>760</td> </tr> <tr> <td></td> <td>14" emul. VT102.....</td> <td>920</td> </tr> <tr> <td></td> <td>emul. TEK 4010.....</td> <td>2,050</td> </tr> <tr> <td>WYSE 50</td> <td>14" 80/132 col.....</td> <td>559</td> </tr> <tr> <td></td> <td>ANSI X3.64.....</td> <td>625</td> </tr> </table> | Zenith | Z29..... | CALL |  | Z49..... | 880 | ESPRIT | 6310 14"..... | 580 | EXEC 10/102 | emul. VT102..... | 850 | QUME 102 | 14"..... | 499 |  | emul. VT100..... | 875 |  | 211GX..... | 1,050 | VISUAL 55 | emul. TEK4010..... | 760 |  | 14" emul. VT102..... | 920 |  | emul. TEK 4010..... | 2,050 | WYSE 50 | 14" 80/132 col..... | 559 |  | ANSI X3.64..... | 625 |
| Amdek                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 6-pen X-Y Plotter.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | \$895                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| Houston Instrument                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | DMP-29 8-pen X-Y Plotter.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1,795                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | DMP-40 1 pen plotter.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 795                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | DMP-41, DMP-42 22x34", 24x36".....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | CALL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | DMP-51, DMP-52 22x34", 24x36".....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | CALL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | HIPAD DT-11AA Digitizer.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 725                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | HIPAD DT-114 4-button digitizer.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | CALL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| Hewlett Packard                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 7470A 2-pen plotter.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 940                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 7475A 6-pen plotter.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1,640                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| Calcomp M84                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 8-pen plotter.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1,650                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 945A/PCI 24x48".....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | CALL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 965A/PCI 34x59".....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | CALL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| HAYES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Smartmodem 300/1200 bps.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 475                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1200B modem for IBM PC.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | CALL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| USR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 300/1200 bps w/64K, parallel port.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 550                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Password 300/1200 bps modem.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 350                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| NOVATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Smartmodem 300/1200 bps modem.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 415                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | PC Cat 300/1200 bps modem.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 450                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| Racal-Vadic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | MAXWELL 1200.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 450                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| Zenith                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Z29.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | CALL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Z49.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 880                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| ESPRIT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 6310 14".....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 580                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| EXEC 10/102                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | emul. VT102.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 850                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| QUME 102                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 14".....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 499                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | emul. VT100.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 875                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 211GX.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1,050                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| VISUAL 55                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | emul. TEK4010.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 760                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 14" emul. VT102.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 920                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | emul. TEK 4010.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2,050                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| WYSE 50                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 14" 80/132 col.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 559                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | ANSI X3.64.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 625                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| <p style="text-align: center; font-weight: bold;">POWERFUL ADD-ON BOARDS</p> <p>from AST, PERSYST, PLANTRONIC, TECMAR, QUADRAM, HERCULES, TITAN, DTC AQUIX, MAYNARD, WESTERN DIGITAL</p> <p style="text-align: center; font-weight: bold;">MORE FOR YOUR IBM PC</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p style="text-align: center; font-weight: bold;">MONITORS</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Panasonic amber super.....</td> <td style="width: 50%; text-align: right;">199</td> </tr> <tr> <td>Comrex CR6800 14" RGB.....</td> <td>489</td> </tr> <tr> <td>NEC JC1216 RGB monitor, 640x300 resolution.....</td> <td>435</td> </tr> <tr> <td>Amdek 300 12" green monitor.....</td> <td>155</td> </tr> <tr> <td>Pricentron Graphic HX12 RGB monitor.....</td> <td>490</td> </tr> <tr> <td></td> <td>SR12 RGB.....</td> <td>630</td> </tr> <tr> <td>Zenith ZVM 123 Green Monitor.....</td> <td>87</td> </tr> <tr> <td>ZVM 135 RGB monitor for IBM PC.....</td> <td>475</td> </tr> </table>                                                                                                                                                | Panasonic amber super.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 199          | Comrex CR6800 14" RGB..... | 489                           | NEC JC1216 RGB monitor, 640x300 resolution..... | 435 | Amdek 300 12" green monitor..... | 155           | Pricentron Graphic HX12 RGB monitor..... | 490                                |                      | SR12 RGB.....   | 630                                | Zenith ZVM 123 Green Monitor..... | 87                        | ZVM 135 RGB monitor for IBM PC..... | 475                         |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| Panasonic amber super.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 199                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| Comrex CR6800 14" RGB.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 489                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| NEC JC1216 RGB monitor, 640x300 resolution.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 435                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| Amdek 300 12" green monitor.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 155                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| Pricentron Graphic HX12 RGB monitor.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 490                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | SR12 RGB.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 630                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| Zenith ZVM 123 Green Monitor.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 87                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |
| ZVM 135 RGB monitor for IBM PC.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 475                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |                            |                               |                                                 |     |                                  |               |                                          |                                    |                      |                 |                                    |                                   |                           |                                     |                             |             |                                      |           |                 |                          |                           |            |                                  |            |                |                      |          |              |                        |      |  |                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                              |     |  |                             |      |     |                                        |     |  |                                  |     |          |                                    |     |  |                                |     |             |                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |          |      |  |          |     |        |               |     |             |                  |     |          |          |     |  |                  |     |  |            |       |           |                    |     |  |                      |     |  |                     |       |         |                     |     |  |                 |     |

Circle 76 on inquiry card.

DECEMBER 1984 • BYTE 205

# magnum p.c.

## 800-544-4354



GA Residents  
(404) 441-3112



4056 WETHERBURN WAY, SUITE 205, ATLANTA, GA 30092

### COMPUTERS

IBM PC YOU CONFIGURE.....CALL  
SANYO MBC & SUPER.....NEW LOW PRICES

### BOARDS

AST SIX PAC PLUS & MONOGRAPH.....CALL  
CSS SUPERVISION.....NEW  
EVEREX GRAPHICS EDGE.....CALL  
FORTE DATA PC3278 EMULATOR.....NEW  
HERCULES GRAPHICS CARD.....335  
IRMA 3278 EMULATOR.....BEST PRICE  
MICROLOG BABY BLUE (CPM CARD).....NEW  
ORCHID PC BLOSSOM & TURBO.....CALL  
PCjr MEMORY EXPANSION (UP TO 512K).....CALL  
PERSYST BOARDS & CARDS.....SAVE  
QUADRAM ALL PRODUCTS.....CALL  
STB GRAPHIX PLUS II.....CALL  
TECMAR ALL PRODUCTS.....CALL  
TITAN ACCELERATORS FOR IBM OR APPLE.....CALL  
TSENG LABS ULTRA PAK.....NEW

### DISK DRIVES

FULL HEIGHTS (FOR IBM).....FROM 110  
HALF HEIGHTS (FOR IBM).....FROM 125  
ALPHA OMEGA TURBO 10.....CALL  
EVEREX 10 MEG INTERNAL HARD DISK.....950  
IOMEGA BERNOLLI BOX (20 MEG).....2895  
MICRO SCI (FOR APPLE).....CALL  
PCjr 2ND DISK DRIVE OR HARD DISK.....CALL  
PEACHTREE PERIPHERALS.....CALL  
QUADDISK 6 MEG REMOVABLE.....CALL  
QUENTIN (FOR APPLE & IBM).....SAVE  
TALLGRASS HARD DISK WITH BACKUP.....CALL  
TANON TM100-2..199 TM65 1/2 HEIGHT..175  
10 MEG HARD.....CALL  
TEAC 1/2 HT STREAMERS & HARD DISK.....NEW  
TECMAR 5 MEG REMOVABLE.....CALL

### PRINTERS

ANADEX.....CALL  
C. ITOH LETTER QUALITY.....CALL  
EPSON FX, MX, RX.....SAVE  
NEC SPINWRITER, P2 & P3.....CALL  
OKIDATA ALL MODELS.....BEST PRICES  
RITEMAN NEW 3" HIGH MODELS.....SAVE  
STAR MICRONICS GEMINI 10X/15X.....279/399  
TOSHIBA P1350 & P1340.....CALL

### MONITORS

AMDEK.....CALL  
PRINCETON GRAPHICS.....SAVE  
QUADRAM QUADCHROME.....CALL  
TAXAN ALL MODELS.....CALL

### SOFTWARE

COPY II PC.....SAVE D-BASE III.....399  
FRAMEWORK.....399 JANUS/ADA.....SAVE  
LOTUS 1-2-3.....SAVE MULTIMATE.....279  
SYMPHONY.....475 10 BASE.....CALL

### MODEMS

HAYES SMART MODEM 300/1200.....212/499  
NOVATION SMART CAT PLUS W/MITE.....399  
PENRIL.....SAVE VEN-TEL.....CALL

### ACCESSORIES

BUFFERS/SPOOLERS.....CALL  
CHIPS 64K - SET OF 9.....49  
COMPUSERVE STARTER KIT.....32  
2 & 4 WAY SWITCH BOXES PAR. & SERIAL.....SAVE

### DISKETTES

|                  | CASE 100 | BOX 10 |
|------------------|----------|--------|
| BASF 5 1/4 SS/DD | 145      | 17     |
| 5 1/4 DS/DD      | 170      | 20     |

AVAILABILITY AND PRICES SUBJECT TO CHANGE

APPROVED CORPORATE ACCOUNTS WELCOMED

## PERFORMANCE CRITERIA

packet. The program in the receiving micro captures the data and also sums the packet's bytes. Only if the micro-generated sum is the same as that sent by the host is the data accepted. If it differs, the program assumes that an error has occurred, i.e., that line noise has altered the data in some way. That packet is then discarded, and the host sends the last set of characters again.

Notice that with error-checking protocol, the host sends only one packet of information at a time. It never sends more until you tell it to do so. This means that only a small download buffer is needed. The communications software pauses and dumps the buffer onto a disk before advising the host that it is ready for the next packet. Downloading by one of these error-checking methods is more accurate than using a simple download buffer. The process can go on all day without losing information, and watching two machines perform flawlessly in tandem is a kind of high-tech poetry. But remember, whenever time is at a premium, error-checking transmission is much slower than simple downloading, and it can get very slow indeed if there is much noise on the line.

A software filter is another of those things that may seem like a luxury but isn't. When downloading information to a remote microcomputer, different hosts will mix in a variety of special characters (often control characters) with the transmission. Most frequently found are the carriage return (Control-M) and the linefeed (Control-J). Depending on your final use for the data, these special characters can be annoying. Furthermore, unwanted control characters can cause functional changes in your microcomputer if they correspond to codes used by your software. The only solution to this kind of problem is to have the communications software filter the incoming transmission. It must either discard certain characters you don't want or replace them with acceptable alternatives. Filtering is often accomplished by a translation table. Such a table allows you to specify before-

hand exactly how each incoming character is treated and changed before it is stored.

One common downloading feature that doesn't seem too important to us is the ability to turn on the printer and transmit characters to it during the course of direct downloading from the host. This, of course, gets around the problem of lost information, but it can slow you down so much that it hardly seems worth the trouble. Besides, once you use paper you can't erase it like a disk file. You run the risk of wasting a lot of paper on useless information. And if you now believe that unwanted control characters can screw up a disk file, you should see what they can do to a printer. There, control codes are routinely used to set such functions as paper advance, font size, etc. As a general rule, it's probably most efficient to download directly to a disk file and print anything that looks interesting at a later time.

The only real use we've found for the printer while we're communicating is to record the menus of a new host system. When logging on for the first time, it is convenient to print out the menus and sign-on messages immediately so you can continue to explore the system. Otherwise, you may waste a lot of time re-calling those menus for reference. You can't afford too much delay while you try to remember what to do next. Many host systems are set up with "timed out" capabilities. In other words, if you haven't sent a command by the time the host thinks you should, the system will automatically log you off and disconnect.

### UPLOADING—I CAN'T BELIEVE IT ATE THE WHOLE THING

The other side of "intelligent" terminal operation is sending stored files from your microcomputer to a host computer—what's known to the cognoscenti as "uploading."

Why would anyone want to upload? The reasons differ widely and are pretty specific to the individual. Perhaps the most common reason is

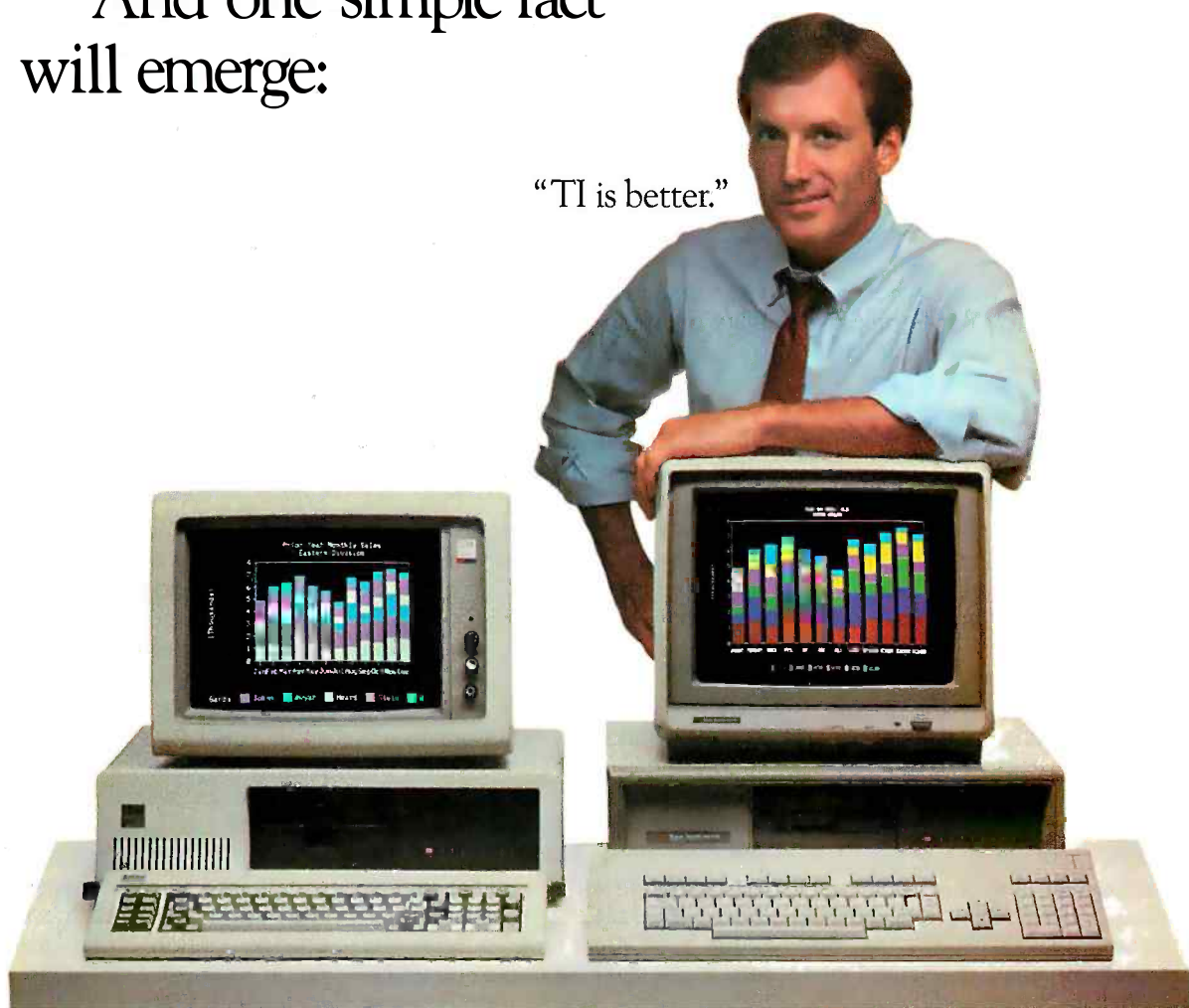
(continued)

**Dare to Compare.** Come in. Sit down.  
Run both PCs. IBM vs. TI. Side by side.  
Compare how they run powerful software.  
Like 1-2-3™ from Lotus. Or BPS Business  
Graphics.™ Or MultiMate.™

Compare speed. Keyboards. Graphics.  
Service and support. Compare everything  
a PC can do for you.

And one simple fact  
will emerge:

“TI is better.”



IBM Personal Computer  
(1-2-3 from Lotus)

Texas Instruments Professional Computer  
(1-2-3 from Lotus)

Take TI's "Dare to Compare" challenge today. Selected dealers want you to see for yourself how the TI Professional makes the best software perform even better. You'll also learn how TI backs you with outstanding service and support, including an optional 24-hour customer support line and extended 1- or 5-year warranties. Call us toll-free at 1-800-527-3500 for your nearest TI dealers.

IBM is a trademark of International Business Machines, Inc. Lotus and 1-2-3 are trademarks of Lotus Development Corporation. BPS Business Graphics is a trademark of Business & Professional Software, Incorporated. MultiMate is a trademark of SoftWorld Systems. Copyright © 1984, Texas Instruments Incorporated.

  
**TEXAS  
INSTRUMENTS**  
Creating useful products and services for you.

2764-48

*The only thing trickier than getting onto a system without pain is getting away with a clean and satisfying attitude.*

that the host computer is being used for electronic mail (EMAIL)—sending a message to be read by another user of the system. Often the EMAIL editor programs are rather primitive. You may prefer to use the word-processing software on your microcomputer to prepare and edit messages before sending them to the host for processing.

Maybe you're a writer who composes with a portable microcomputer on the road and you need to store text files for your magnum opus. You send them to a mainframe host for safekeeping. When you get home again, you download the lot for further editing and printing. Maybe you use your micro as a "glass keypunch." Programs and data files prepared on your own system are later sent to a mainframe to run big number-crunching jobs.

Whatever your reason for uploading files to a host computer, the potential problems are many. All the details of protocol are just as important as in downloading. In addition, there is wide variation in the ability of host computers to consume your transmission. Some can absorb a seemingly endless quantity of characters without a complaint. Others require that the data stream be neatly packaged into individual lines, separated by carriage returns, sometimes accompanied by linefeeds.

If you are to use these varied systems automatically, your CP must not only be able to read a disk file and send it out over your modem, but must also be able to send it in the fashion required by the host. If it can't, the result will be error messages, confusion, and usually a breakdown in

communications with the attendant waste of time, and maybe money, too.

#### **MACHINE ACCESS—STOP THE WORLD, I WANT TO GET OFF**

When you're telecommunicating with another computer, you might still want complete access to your own machine. (Most CPs don't allow this.) At the very least, you are sure to want to check your file list (and also to change data disks during the session). Maybe you'll need to review a disk file before uploading or after downloading. It should be fairly easy to find those capabilities, but some programs don't allow them.

It's still harder to find a CP that will let you run one of your own programs while you're connected to the host, so that you can send your program output directly over the phone line. This can sometimes be a very useful capability, as in the job one of us had, to transfer over a thousand sequentially numbered, short disk files over the phone line to a minicomputer for statistical processing. We didn't have a CP that was up to doing the job automatically, so the primitive programmability built into the modem had to be utilized. A jury-rigged CP was improvised in BASIC, to minimize the agony.

#### **SIGNING OFF—SAY GOODNIGHT, GRACIE**

Sooner or later you will want to terminate the current conversation between your microcomputer and the host and move on to something else. The only thing trickier than getting onto a system without pain is getting away with a clean and satisfying attitude. First you'll have to figure out how to get the host to give up gracefully. It seems they all have different requirements for saying good-bye.

If you have a direct-connect modem, you'll also want your CP to be smart enough to tell it how to hang up the phone. Some communications software is tailored only to work with specific communications hardware—fine and convenient if you happen to have all the parts that work together. We think it's a little better to have the

flexibility to define macros so that new hang-up commands can be sent to a new modem when you need it. Of course, you can always just "pull the plug." But that's so inelegant (to say nothing of kludgy), you run the risk of endangering your health through sheer mortification.

#### **GENERAL FEATURES**

In addition to the necessary functions mentioned above, there are a host of other factors to take into account. Some, while not crucial, are vexatious to do without. We know of one package, for instance, which, in its first commercially available version, didn't allow files to be read from or written to any disk drive other than the one from which the program disk had been booted. That program disk had to be removed from the drive before any intelligent terminal operation was possible—a constant source of annoyance. Fortunately, the second version of the program had the necessary option to redirect input and output from/to a second disk. Ideally you should look for a program that can address any of several disk drives you may have now or might add in the future. (This will be especially important if you add a hard disk at some point.)

Not all special features are so critical, and some may be regarded as largely a matter of personal preference. One CP has an extensive set of menus to guide you through such intricacies as selecting block-transfer protocol, baud rate, and disk drives. Another presents you with a blank screen and relies on memorization of the control codes necessary to change options. Changes can be made, however, without first switching to a special menu.

The first program is easier to use for the first month or two. In addition to being hand-held through the necessary steps, it is always clear which on-screen messages are coming from the host and which are coming from the communications software. For the experienced user, however, the second program is preferable. It isn't

*(continued)*



You're traveling through 140° terrain  
at 300 rpm.

**While some disks lose their way in the torrid zone of drive heat,  
Maxell guarantees safe passage.**

A lifetime warranty. And manufacturing standards that make it almost unnecessary.

Consider this: Every time you take your disk for a little spin, you expose it to drive heat that can sidetrack data. Worse, take it to the point of no return. Maxell's Gold Standard jacket construction defies heat of 140°F. And keeps your information on track.

And Maxell runs clean. A unique process impregnates lubricants throughout the oxide layer. Extending media and head life. How good is Gold?

Maxell's the disk that many drive manufacturers trust to put new equipment through its paces. It's that bug-free.

So you can drive a bargain. But in accelerated tests, Maxell was an industry leader in error-free performance and durability. Proving that if you can't stand the heat you don't stand a chance.



**maxell**®  
IT'S WORTH IT.

Maxell Corporation of America, 60 Oxford Drive, Moonachie, N.J. 07074 201-440-8020

necessary to call up an annoying series of menus to initiate each simple operation.

Clearly, which kind of program you look for depends a lot on your personal preference. We think the ideal solution is a program with extensive menu guidance for the uninitiated, but with the option to skip all menus

for the experienced user.

Another feature you might not think you need until you have wasted 40 minutes and 1000 keystrokes is the ability to automatically redial a number and sound a warning that connection with that busy host system has finally been made. Anyone who frequently has to use telecommunica-

tions will quickly place this in the "must have" category. You'll be able to continue other activities, secure in the knowledge that a clear and recognizable signal will be sounded when the link is ready.

Finally, some CPs come with a batch of utility programs that may be run before or after the on-line session with the host. These are usually related to processing disk files so they can be transmitted more easily, or interpreted or printed readily after downloading. It is possible, for instance, to translate a binary file into ASCII form for transmission with a utility program. But wouldn't it be better to simply build the facility for transmitting binary files into the CP in the first place? The same might be said of utilities that allow transfer of disk files between each of several operating systems you may run.

Generally, the question of special-purpose utilities accompanying the CP seems to us a minor one. The most important utilities should obviously be built into the program. The less important ones are better handled by a utility like a word processor.

At this point, perhaps the last and most useful guideline we can suggest is to remember that like almost every other product that is subject to technical and design limitations, the "best" CP is going to mean different things to different people. Since the more features you have, the more memory you use up (or the more time-wasting disk access you require), you can't have everything in a single program. Judging communications software should be a matter of evaluating the trade-offs. In other words, excellence becomes a matter of how many features the author of the package was able to include without sacrificing compactness and efficiency.

Whatever you are looking for in CPs, you're sure to find a considerable variety to choose from. And when at last you find the program that does almost everything you want, we can guarantee that you're in for a fascinating experience in telecommunica-  
tion. ■

# Better BASIC

## Programmer's Quiz

BetterBASIC is \_\_\_\_\_.

- a. Interactive
- b. Structured
- c. Compiled
- d. Modular
- e. Extensible
- f. Supports 640k
- g. All of the above

**Ans. g. all of the above.**

Ask your dealer for **BetterBASIC** or  
call Summit Software at **617-235-0729**

**BetterBASIC 199.00** 8087 MathModule **99.00**  
Runtime System **250.00** Sample Disk **10.00**



Summit Software Technology, Inc.

P.O. Box 99, Babson Park, Wellesley, MA 02157





# A New Age Dawns for Microcomputer Programming

**Meet PROMAL™. The First Fast Structured Language That Lets You Program The Way You Always Wanted To. And For Only \$49.95.**

**PROMAL™ is innovative.** PROMAL (PROgrammer's Micro Application Language) was designed to achieve maximum performance from small computers...performance previously impossible except with machine language. And it was developed, specifically, to meet the need for a development system for limited memory environments.

**PROMAL is complete.** It's a fast, structured programming language. It's also a true development system, complete with its own command-oriented operating system executive; fast one-pass compiler; and full-screen cursor-driven editor. In short, PROMAL is the complete set of tools that microcomputer programmers have been waiting for.

**PROMAL is fast.**

| Commodore 64 Benchmark<br>(Sieve of Eratosthenes) | PROMAL | BASIC | COMAL | FORTH | PASCAL |
|---------------------------------------------------|--------|-------|-------|-------|--------|
| Execution Time (secs.)                            | 30     | 630   | 490   | 51    | 55     |
| Object Code Size (bytes)                          | 128    | 255   | 329   | 181   | 415    |
| Program Load Time (secs.)                         | 3.2    | 3.8   | 6.3   | 11.2  | 23.5   |
| Compile Time (secs.)                              | 8.5    | —     | —     | 3.9   | 108    |

As the benchmark results in the table show, PROMAL is much faster than any language tested. From 70% to 2000% faster! And it generates the most compact object code. The PROMAL compiler is so fast that it can compile a 100-line source program in 10 seconds or less. And, not only is it fast in compile and run time, it also reduces programming development time.

**PROMAL is easy.** It's easier to learn than Pascal or C or FORTH. It makes use of powerful structured statements, like IF-ELSE, WHILE, REPEAT, FOR, and CHOOSE. Indentation of statements is part of the language's syntax, so all programs are neatly and logically written. There are no line numbers to complicate your programming. And comments don't take up memory space, so you can document programs completely. And with the full-screen editor, you can speed through program development

with saves to memory and compilation from memory workspace.

**PROMAL is elegant.** PROMAL overcomes the performance limitations inherent in all small systems. It gives you access to the power of the machine. But it doesn't require the complexity of machine language programming. With PROMAL, you can have performance the easy way...since it was developed from the very beginning to work on small systems...elegantly.

**PROMAL may be the answer to your programming needs.** Finally, there's an answer to the need for a complete environment for simple and rapid program development. Finally, a new age has begun for microcomputer programmers. Finally, there's PROMAL.

**PROMAL is available for the Commodore 64 now. PROMAL is scheduled for release on the Apple IIe in December, 1984 and on the IBM PC in 1st Quarter, 1985.**

## PROMAL FEATURES

**COMPILED LANGUAGE**  
Structured procedural language with indentation  
Fast, 1-pass compiler  
Simplified syntax requirements  
No line numbering required  
Long variable names  
Global, Local, & Arg variables  
Byte, Word, Integer & Realties  
Dec or Hex number types  
Functions w/passed arguments  
Procedures w/passed arguments  
Built in I/O library  
Arrays, strings, pointers  
Control Statements: IF-ELSE, IF, WHILE, FOR, CHOOSE, BREAK, REPEAT, INCLUDE, NEXT, ESCAPE, REFUGE  
Compiler I/O from/to disk or memory

**EXECUTIVE**  
Command oriented, w/line editing  
Memory resident  
Allows multiple user programs in memory at once  
Function key definitions  
Program abort and pause  
22 Resident system commands, 8 user-defined resident commands, no limit on disk commands  
Prior command recall  
I/O Re-direction to disk or printer  
Batch jobs

**EDITOR**  
Full-screen, cursor driven  
Function key controlled  
Line insert, delete, search  
String search and replace  
Block copy, move, delete & write to/read from file  
Auto indent, undent support

**LIBRARY**  
43 Machine-language commands  
Memory resident  
Call by name with arguments  
I/O, Edit, String, Cursor control and much more  
  
PROMAL runs on Commodore 64s with disk drive.

### HOW TO ORDER

- Please send me my copy of PROMAL for the Commodore 64 at \$49.95 plus \$5.00 for shipping and handling at a total cost of \$54.95. Satisfaction guaranteed.
- Please send me a PROMAL demo diskette for the Commodore 64 at \$10 for the diskette plus \$2.50 for postage and handling for a total cost of \$12.50. (Non-refundable.)
- My check is enclosed.  Please charge my purchase to my...  Visa  MasterCard

Card Number \_\_\_\_\_ Expiration Date \_\_\_\_\_

Signature \_\_\_\_\_

Name \_\_\_\_\_

Address \_\_\_\_\_

City, State, Zip \_\_\_\_\_ North Carolina residents add 4 1/2% sales tax.

For quicker response on credit card orders, call...  
**Toll Free 1-800-762-7874 (In North Carolina 919-787-7703)**  
**Our Guarantee**

Try your copy of PROMAL for 15 days. If you are not completely satisfied, return it to us undamaged and we'll refund your money. No questions asked. Dealer inquiries invited.

**SYSTEMS MANAGEMENT ASSOCIATES**  
3700 Computer Drive, Dept. PB-1  
Raleigh, North Carolina 27609

## INTRODUCING Interface Technologies' Modula-2 Software Development System

The computer press is hailing Modula-2 as "the next standard in programming languages." Modula-2 combines the strengths of its popular predecessor—Pascal—with the features that made the C language appealing, like independent compilation and direct hardware control.

But until today, no company offered a Modula-2 system that made software development fast, easy and efficient.

### The fast, powerful tool for programmers

Now that breakthrough is here: Interface Technologies' Modula-2 Software Development System for the IBM® PC, XT, AT and compatible computers gives programmers the same quantum leap in productivity that spreadsheets and word processors gave to end-users. It can reduce monotonous wait time, dramatically increase speed, help eliminate thoughtless mistakes, and free you to become more creative in all your programming efforts.

### How to speed input and eliminate 30% of errors

Thirty percent of programming mistakes are syntax errors and simple typos in the program structure. Our "syntax-directed" Modula-2 editor does away with these time-consuming headaches forever.



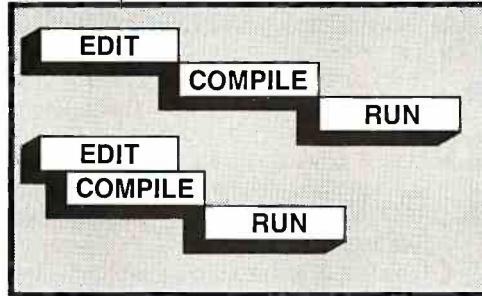
Enter complete statements  
with one keystroke.

It also speeds input by reducing manual typing as much as 90%, letting you enter statements with a single keystroke. For example, if you type a capital "I" at the beginning of a line, the editor completes the logical "IF THEN" statement automatically, so you can concentrate on what you want to program, rather than your typing.

The editor locks out errors, finishing each statement and procedure in perfect accord with the standardized rules of Modula-2. It also indents and formats your text automatically, making programs easy to read and maintain, an important feature on big projects.

And if you leave an undefined variable or data type, the editor detects the mistake and gives you the option of on-line "help" to correct it. No other programming text editor offers you this much innovation.

### How to turn "wait time" into "work time"



The Interface Technologies Modula-2  
Software Development System saves  
time by compiling while you edit.

Most of a programmer's time is spent waiting, and the biggest culprit is usually the compiler. Our compiler

# THE ANATOMY OF A

turns this wait time into work time, with a technical innovation we call "background" compilation.

With background compilation, every moment you spend writing or editing a Modula-2 program, it's automatically being compiled into object code, line by line as you work!

When you're finished editing, all that's left for the compiler to do is a quick mopping up that generates optimized native code in a single pass.

How quick is "quick"?

Thanks to background compilation and the fact that the compiler itself is so fast, Interface Technologies' compiler can turn 100 lines of typical Modula-2 program text into optimized machine code in less than five seconds.

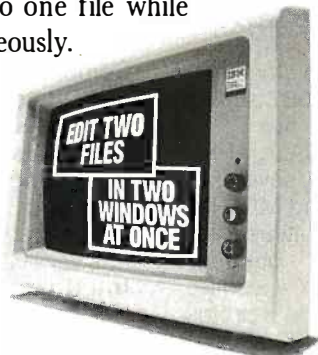
And the Interface Technologies Modula-2 Software Development System compiler produces compact code that has execution speed superior to that produced by any other Modula-2 compiler presently available to individuals and firms involved in software development.

### How to do two things at once

Along with the syntax-directed editor and background compilation, Interface Technologies' Software

Development System gives your screen multiple windows so you can refer to one file while you edit another—simultaneously.

Concurrent editing of multiple files is particularly useful when you're doing programming work intended for separate compilation, and Interface Technologies has the only Modula-2 development system on the market that provides you this helpful benefit.



*Work with multiple files faster, easier in windows.*

## How preprogrammed modules speed development

One of the advantages of Modula-2 is that it lets you build large, reliable programs quickly, by linking smaller "building-block" modules.

The development system's toolkit of precompiled program modules includes the standard Modula-2 library, and adds exclusive link-and-run modules for color graphics support, sound, and direct calls to the

You can use it on any IBM® PC, XT, AT or compatible with two DSDD floppy drives and 320K RAM.

You get a thoroughly indexed, comprehensive user's manual and free telephone support from Interface Technologies.

But the most important thing you get is the future, and the programming language of the future is Modula-2.

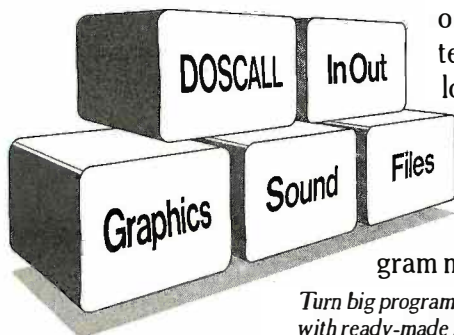
For more information, or to order the Modula-2 Software Development System, call 1-800-922-9049 today. In Texas, call (713) 523-8422.

To order by mail, or to request further information, fill out and mail the coupon below.



IBM is a registered trademark of International Business Machines Corporation.

# BREAKTHROUGH



operating system. Plus you get low-cost updates from Interface Technologies' growing library of program modules.

*Turn big programs into smaller projects with ready-made modules.*

## Increase productivity for \$249

Interface Technologies' Software Development System is fast, powerful and unlimited. It works so well that it's the same tool Interface Technologies is using to write business and consumer applications in Modula-2.

For \$249, you get the syntax-directed editor and compiler, linker, module library and tutorial that will have even modestly experienced programmers writing in Modula-2 in days. And you have full rights to your work; there's no license fee for programs you develop with our system.

NAME \_\_\_\_\_ PHONE \_\_\_\_\_

COMPANY or SCHOOL \_\_\_\_\_

MAILING ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_

PLEASE SEND ME \_\_\_\_\_ copies @ \$249 each.

### MAIL REQUESTS TO:

INTERFACE TECHNOLOGIES CORPORATION

3336 Richmond, Houston, Texas 77098

ITC will accept personal checks, money orders or the following credit cards:

Visa/American Express/MasterCard

Credit Card # \_\_\_\_\_ Exp. Date \_\_\_\_\_

Interbank number {MasterCard}: \_\_\_\_\_

Your Signature \_\_\_\_\_

Texas residents, add 6.125% Sales Tax.

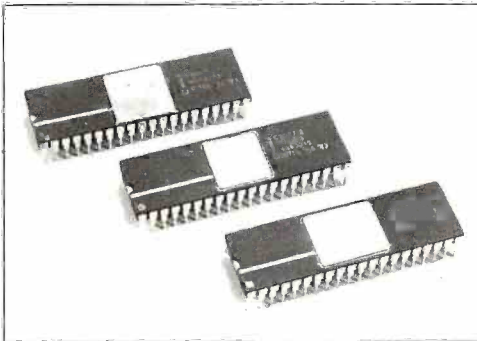
## INTERFACE TECHNOLOGIES



## MODULA-2 SOFTWARE DEVELOPMENT SYSTEM

# THE 8087 AND 80287 ARE IN STOCK!

MicroWay\* is the world's leading retailer of 8087s. We also have the most accurate statistics on chip reliability. They are: .01% infant mortality, .00% adult mortality and .02% 8088 incompatibility. As for ease of installation, we have never had a customer return a chip because of bent pins. We are so confident that you will be able to successfully install and use the chip that we offer a 180-day warranty with every chip we sell. That's 90 days more than anyone else!



To support the 8087 we stock the largest selection of 8087 software anywhere. This includes: five FORTRANs, three PASCALS, APL, Intel's ASM86, PL/M-86, several Cs, 87BASIC, 87MACRO and MATRIXPAK. For real time or multi-user applications we offer RTOS™ - our implementation of Intel's iRMX executive. Our new products include a professional debugger with 8087 support, an interface library which enables MS Fortran users to call the IBM Basic

Compiler Library, and a translator that converts object modules into readable assembly language files. If you have a question about which computer, language, compiler, operating system or application package is best suited to your problem, we can answer it. Just call:  
**Information and Orders—**  
**617-746-7341**  
**University, Corporate and Government Buyers—**  
**617-746-7364**

## MicroWay™ 8087 Support

For the IBM PC, PC XT, PC AT and Compatibles.

**MWS-286™** Configured to your specifications, our computer runs RTOS-286 or XENIX. Includes one Intel compiler, seven slot multibus chassis, hard disk, streaming tape backup and Intel Service Contract. Six to twenty times faster than your PC ..... **CALL**

**REAL TIME MULTI-TASKING/MULTI-USER EXECUTIVE - RTOS**  
 RTOS is a MicroWay configured version of iRMX-86. Includes ASM-86, LINK-86, LOC-86, LIB-86, and the ROM Hex Loader..... **\$600**

**87FORTRAN/RTOS™** - our adaptation of the Intel Fortran-86 Compiler generates in line 8087 code using all 8087 data types including 80-bit reals and 64-bit integers. The compiler uses the Intel large memory model, allowing code/data structures of a full megabyte, and supports overlays. Includes RTOS and support for one year ..... **\$1350**

**87PASCAL/RTOS™** is Intel's ISO-Standard Pascal with 8087-8088 exceptions. These make it possible to use all the 8087 data types directly, while generating modules in one of the three Intel Memory Models. Includes RTOS and support for one year ..... **\$1350**

**RTOS DEVELOPMENT PACKAGE**  
 includes 87FORTRAN, 87PASCAL, PL/M-86, Utilities, TX Screen Editor and RTOS..... **\$2500**

**OBJ→ASM™** - a multipass object module translator and disassembler. Produces assembly language listings which include public symbols, external symbols, and labels commented with cross references. Ideal for understanding and patching object modules and libraries for which source is not available ..... **\$200**

**FFT87** an FFT package for the 8087. Performs Forward and Inverse Transforms on complex data. Callable from SSS or MS Fortran..... **\$150**

**MATRIXPAK™** manages a MEGABYTE! Written in assembly language, our runtime package accurately manipulates large matrices at very fast speeds. Includes matrix inversion and the solution of simultaneous linear equations. Callable from MS Fortran 3.2, 87MACRO, 87BASIC, and RTOS..... each **\$150**

**87BASIC™** includes patches to the IBM Basic Compiler and both runtime libraries for USER TRANSPARENT and COMPLETE 8087 support. Provides super fast performance for all numeric operations including trigonometrics, transcendentals, addition, subtraction, multiplication, and division ..... **\$150**

**87BASIC/INLINE™** generates inline 8087 code! Converts the IBM Basic Compiler output into an assembly language source listing which allows the user to make additional refinements to his program. Real expression evaluations run seven times faster than in 87BASIC..... **\$200**

**87MACRO™** - our complete 8087 software development package. It contains a "Pre-processor," source code for a set of 8087 macros, and an object library of numeric functions including transcendentals, trigonometrics, hyperbolics, encoding, decoding and conversions ..... **\$150**

**87DEBUG™** - a professional debugger with 8087 support, a sophisticated screen-oriented macro command processor, and trace features which include the ability to skip tracing through branches to calls and software and hardware interrupts. Breakpoints can be set in code or on guarded addresses in RAM..... **\$150**

**FOR→BAS™** - a library of interface routines which allow MS Fortran programs to call the IBM Basic Compiler library and access features such as the RANDOM NUMBER GENERATOR, SOUND, PLAY, DRAW and SCREEN commands..... **\$150**

**8087-3 CHIP..... \$149**  
 including DIAGNOSTICS and 180-day warranty

**8087 8mhz..... \$375**

**80287 CHIP..... \$350**

**64K RAM Set..... \$35**

**256K RAM Set..... \$250**

**PC AT 30 MEGABYTE WINCHESTER DRIVE..... \$2000**

**MICROSOFT FORTRAN 3.2.... \$239**

**MICROSOFT PASCAL 3.2..... \$209**  
 These IEEE compatible compilers support double precision and the 8087.

**DIGITAL RESEARCH FORTRAN..... \$279**

**MICROSOFT C COMPILER..... \$329**

**LATTICE C with 8087 support..... \$329**

FLOAT87 for MS C..... **125**

IBM Basic Compiler..... **CALL**

SuperSoft Fortran 66..... **329**

STSC APL★PLUS/PC..... **500**

TURBO PASCAL or SIDEKICK..... **45**

TOOLBOX..... **45**

TURBO PASCAL with 8087 Support..... **85**

HALO GRAPHICS..... **CALL**

GRAPHMATIC..... **125**

ENERGRAPHICS..... **295**

Professional BASIC..... **295**

COSMOS REVELATION..... **850**

MAYNARD WS1 HARD DISK..... **950**

MAYNARD WS2 or WS3 HARD DISK..... **1109**

JRAM-2..... **CALL**

smARTWORK by WINTEK..... **895**

SPSS/PC..... **695**

Alpha Software ESP..... **595**

SuperCalc III with 8087 support..... **CALL**

Phoenix PLINK86..... **295**

**NO CHARGE FOR CREDIT CARDS ALL ITEMS IN STOCK**

\*Formerly MicroWare, Inc. - not affiliated or connected with MicroWare Systems Corporation of Des Moines, Iowa.

**MicroWay**

P.O. Box 79  
 Kingston, Mass.  
 02364 USA  
 (617) 746-7341

**You Can Talk To Us!**

# THE ON-LINE SEARCH

BY SUZANA LISANTI

---

## *Accessing the world's electronic brain*

UNTIL RECENTLY, only librarians and specialists with extensive training and a prime-time, prime-rate budget found searching for information from the world's "data banks" an easy task. Now, anyone with a terminal, a modem, and a password can access any of 344 of these data repositories, offering over 2400 database files—with a minimal amount of fuss.

Pricing policies for access to, and use of, these on-line services vary greatly. About 35 percent of the databases require some type of subscription payment, ranging from a \$35 sign-up fee to several thousand dollars per year. However, the cost of on-line searches has begun to come down.

The following three developments have helped to lower costs. First, some information services have introduced low-cost subscriptions to their most popular databases, offering evening and weekend access. Dialog's "Knowledge Index" currently makes 24 databases available, and BRS's "After Dark" service provides access to 36 databases. A typical search on these services can be done for \$5 or less. Other reduced-rate services offer a group of subject-specific databases

(for instance, in business or medicine) to professionals for a flat fee, like \$100 per month, allowing unlimited prime-time access.

Second, new *front-end* search software packages for microcomputers, such as In-Search, Sci-Mate, Search Helper, and Search Master, let you enter your search terms off line. By striking a single key, you are connected to a major on-line service. The software then performs your search automatically, downloads the results, and logs off. This can provide you with an easier interface to the database services, increase your productivity on line, and reduce your connect charges.

Third, new *gateway systems* are being offered by companies to get you into the database services. EasyNet offers a toll-free number you can call using your terminal, and upon approval of your credit-card number, you can use EasyNet's menu-driven system to search the Dialog databases. Neither a subscription to Dialog nor previous

.....  
*Suzana Lisanti is president of Lisanti Associates, an information and research company. She can be reached at POB 105, Irvington, NY 10533.*

searching experience are necessary to use the system effectively. A typical EasyNet search costs \$10 for 10 references.

The reduced rate services and new search software packages are revolutionizing the way we access information. Data banks are now available to everyone. Every home with a student, or a professional with continuing educational activity, has a potential on-line searcher. Every office where decisions must be made based on technical, legal, industrial, or market factors, or where parallels can be drawn with other cases, cannot afford to ignore the information available on line.

### USER SEARCH SERVICES

BRS/After Dark and Dialog's Knowledge Index both became available for the first time in 1983. They offer non-prime-time service at reduced rates and give you a simplified way to search a select group of databases. With both After Dark and Knowledge Index, no previous training is required.

When you first log on to BRS/After Dark, you are given a choice of subject libraries. After a library is

*(continued)*

selected, the system responds by giving you a list of available databases within that library. You can then either read a description of each database or begin your search immediately. Either way, you proceed by choosing menu screens and replying to the prompts. The number of BRS/After Dark databases has increased four-fold in the past two years, and new

databases are added every month. As of last October, there were 42 databases: 16 in sciences and medicine, 5 in business, 6 in reference, 7 in education, and 8 in the social sciences and humanities.

Most search features used in the prime-time BRS system also are available in After Dark. These include the AND, OR, NOT operators, truncations,

specification of fields such as author, title, publication year, and descriptor terms. Once you become familiar with the menu-prompted searching, you can stack commands to bypass many menu screens, descriptions, and prompts. Prices for After Dark range from \$6 to \$20 an hour, depending on the database. You can run a complete search and print 40 references on line for about \$5.

BRS is also developing a self-service option for libraries based on a plastic charge card that the patrons will sign out at the desk, as though it were a book. Possession of the card allows the user to activate the library's microcomputer and perform a search, within preset financial limits.

Dialog's Knowledge Index offers 24 databases divided into seven subject areas: Agriculture; Computers/Electronics and Engineering; News; Business Information; Magazines and Books; Medicine and Psychology, Legal; and Education and Government Publications. The amount of information offered on Knowledge Index increases regularly, with new files introduced quarterly.

Knowledge Index is command-driven, rather than menu-driven and, as such, allows for a more complex search strategy than After Dark. The documentation provided with a subscription is very good, and there are on-line help functions for each command. Most commands can be used in their abbreviated one-letter form. Documents can be ordered on line for an average of \$8-\$10 per article. (See table 1 for a comparison of Knowledge Index and After Dark.)

**MICROCOMPUTER FRONT-END SOFTWARE**

Front-end search software packages let you prepare and input your search strategy in advance. Then they automatically log on to the database service, perform the search, download the results, and log off. These packages offer simplified search protocols and, in some cases, help you choose the database you want to search. Because the actual search is done automatical-

(continued)

Table 1: Both After Dark and Knowledge Index are reduced-rate services that require no previous experience or professional help to operate. Since Knowledge Index is command-driven instead of menu-driven, it lets you create a more complex search strategy.

|                                                                      | After Dark                                                                                                   | Knowledge Index                                                                                              |
|----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| Type of system                                                       | Menu-driven                                                                                                  | Command-driven                                                                                               |
| Hours available (beginning hour = local time; closing hour = E.S.T.) | Mon-Fri: 6 P.M.-4 A.M.<br>Fri: 6 P.M.-midnight<br>Sat: 6 A.M.-4 A.M.<br>Sun: 6 A.M.-4 A.M.,<br>7 P.M.-4 A.M. | Mon-Thur: 6 P.M.-5 A.M.<br><br>Sat: 8 A.M.-midnight<br>Sun: 3 P.M.-5 A.M.                                    |
| Toll-free help line hours (E.S.T.)                                   | Mon-Fri: 6 P.M.-1 A.M.<br>Sat: 8 A.M.-5 P.M.<br>Sun: 8 A.M.-2 P.M.                                           | Daily: 7 P.M.-11 P.M.                                                                                        |
| Number of databases on line                                          | 36                                                                                                           | 24                                                                                                           |
| Start-up fee                                                         | \$75                                                                                                         | \$35 (first two hours free)                                                                                  |
| Connect prices per database                                          | \$6-\$20                                                                                                     | \$24                                                                                                         |
| Monthly minimum usage                                                | 2 hours                                                                                                      | None                                                                                                         |
| Search features:                                                     |                                                                                                              |                                                                                                              |
| Boolean operators                                                    | AND, OR, NOT                                                                                                 | AND, OR, NOT                                                                                                 |
| Free text searching                                                  | Yes                                                                                                          | Yes                                                                                                          |
| Descriptor searching                                                 | Yes                                                                                                          | Yes                                                                                                          |
| Truncation                                                           | Yes                                                                                                          | Yes                                                                                                          |
| Limit by AU, TI, PY                                                  | Yes                                                                                                          | Yes                                                                                                          |
| Display COST on line                                                 | No                                                                                                           | Yes                                                                                                          |
| Help commands                                                        | No (menu-driven)                                                                                             | Yes                                                                                                          |
| Print formats                                                        | S,M,L                                                                                                        | S,M,L                                                                                                        |
| Order documents on line                                              | No                                                                                                           | Yes                                                                                                          |
| Electronic mail service                                              | Yes (MCI)                                                                                                    | No                                                                                                           |
| Contact                                                              | BRS-Bibliographic Retrieval Services<br>1200 Route 7<br>Latham, NY 12110<br>(800) 553-5566<br>(518) 783-1161 | Dialog Information Services<br>3460 Hillview Ave.<br>Palo Alto, CA 94304<br>(800) 227-5510<br>(415) 858-3996 |

# Prescription: SemiDisk™

... just what the doctor ordered!

## Fast-acting.

If you've been "patient" with slow disk drives for too long, SemiDisk will relieve your suffering.

The SemiDisk, a super-fast disk emulator, stores and retrieves data much faster than either a floppy or hard disk. This is especially useful with programs such as editors, assemblers, compilers, spelling checkers, and large capacity data base managers.

## Easy to apply.

Installation is as easy as plugging the SemiDisk into an empty slot of your computer, booting up normally, and running the installation software provided. No assembly language programming is required.

## Comes in regular and extra-strength.

SemiDisk I is the standard model for S-100, for use with CP/M® 2.2. SemiDisk II is just as easy to use,

and offers extra speed and flexibility for custom S-100 applications. There are also SemiDisks for TRS-80 Model II, IBM PC, and Epson QX10.

## Contains gentle buffers.

CP/M®80 installation software includes SemiSpool, which temporarily stores print data in the SemiDisk, and continuously feeds the printer as it becomes ready for data. This buffering action allows the computer to be ready for other uses immediately after issuing a print command, while the printer is printing.

## No blackouts: A cure for emulator amnesia.

The optional Battery Backup Unit (BBU) plugs into the SemiDisk, and supplies power even when the computer is off. It contains a battery which keeps the data alive during prolonged power outages of four hours or more.

## Stops head-aches.

Unlike a hard disk, which can 'crash' its head on the rapidly rotating disk surface, and a floppy, which grinds the disk constantly, the SemiDisk has no moving parts to break or wear out. No buzzing, clicking, grinding, or other noise. Just ultra-fast, silent data transfer.

## Won't bruise your wallet.

And now the really good news! SemiDisk's price won't raise your blood pressure.

|                      | 512K   | 1Mbyte |
|----------------------|--------|--------|
| SemiDisk I, S-100    | \$995  | \$1795 |
| SemiDisk II, S-100   | \$1245 | \$2095 |
| SemiDisk, TRS-80 II  | \$995  | \$1795 |
| SemiDisk, IBM PC     | \$945  | \$1795 |
| SemiDisk, Epson QX10 | \$995  |        |

# SEMIDISK

SemiDisk Systems, Inc.  
P.O. Box GG, Beaverton, Oregon 97075  
503-642-3100

ly, you spend both less time and less money with the on-line service.

**IN-SEARCH**

The In-Search search software package, from Menlo Corporation, is a front-end package that facilitates searching the Dialog databases and uses windows to create the illusion of library catalog cards. You can browse through these "cards" until you find a database you want to search. With In-Search, you first choose one of four main categories. You use the cursor-movement keys to place the cursor bar over the appropriate category in the screen's upper left-hand window: 1) Arts, Education, and Social Sciences; 2) Biology and Medicine; 3) Business, Government, and News; and 4) Engineering, Mathematics, and Physical Sciences. The next choice will indicate the possible 30-40 subject terms within each category displayed

in the second window. These subject terms may be topical, such as electronics, or refer to the form of the source document, such as dissertations or conferences. You can then examine the system-selected database descriptions on center screen, like browsing through library catalog cards, to choose the database you want to search. At any point, you can move from the selection level you're on back to an earlier one, change categories, and browse freely. If you want more information on any specific database, you can call up the disks' data sheets and get further file descriptions, subject coverage, information on how the database is organized and indexed, the source documents, the address of the database producer, the name of a contact person, and his or her telephone number, among other items. This is the equivalent of Dialog's "blue sheets," the

hard-copy reference source used by professional searchers. Menlo Corporation says it updates the database information on the In-Search disks once a month and ships the disks out to customers for free. They say they will make their updates on line in the near future, allowing users to download directly to Dialog.

After you select the appropriate database, you enter search words and phrases off line, to be processed by In-Search and Dialog automatically, once you are logged on to the system. The great advantage of any system that will let you input your search parameters off line is that you can edit those parameters without incurring on-line costs. Search lines may contain a single keyword (ARTIFICIAL), a phrase (ARTIFICIAL INTELLIGENCE), or an expression (s1 and s2) that makes use of Boolean operators and refers to previously entered set numbers. In-Search will automatically insert the adjacency operator W between words on a search line.

You can do more refined searches by specifying the field in which you want the search to take place. Before connecting to Dialog, for instance in the middle of inputting your search parameters, you can select the Index command and a window will appear with the list of the indexed fields for the specific database you have chosen. The author, title of article or book, and journal name are usually indexed fields.

When you are ready to search, a single function key will cause In-Search to dial up and log you on to the host system. The search is automatically performed. In-Search will let you edit a search line while on line. The retrieved data can either be stored on disk or sent to a printer. You might want to review the records in short format while on line, mark the records electronically with In-Search, and then retrieve only the marked records (which In-Search keeps track of for you) in medium or long format. To log off, press the Return key and In-Search provides Dialog with the appropriate disconnect protocols.

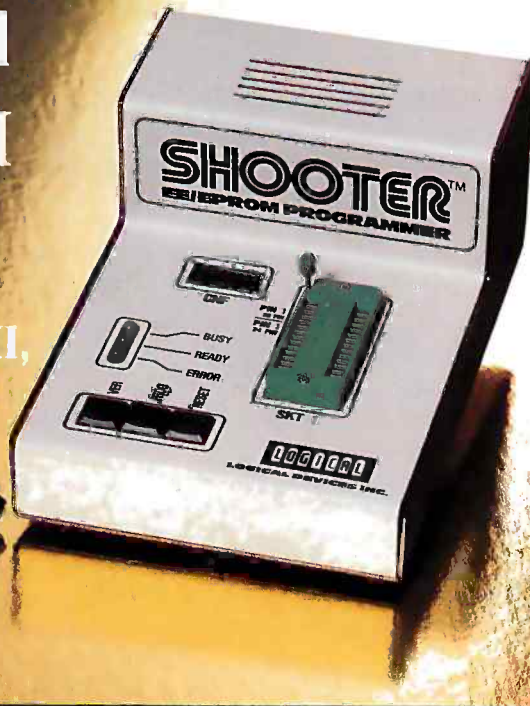
At any point during this entire pro-

# The Personal EE/EPROM Programmer

FOR YOUR  
**IBM P.C., APPLE II,  
COMMODORE 64  
OR ANY OTHER PC**

**\$395.00**  
PLUS POSTAGE  
& HANDLING

*With Shooter  
You Aim Low  
in Price and High  
in Quality!*



- RS-232 Port. Works with any computer or terminal.
- Stand-Alone. Copies & verifies.
- 32K/128K RAM Buffer.
- Upload / Download in Intel or Motorola Hex format.
- 90 Day Warranty



**LOGICAL DEVICES, INC.**

1-800-EE1-PROM (331-7766)  
FLA. (305) 974-0967 • TELEX: 383142 LOGICALTX  
1321 E. N.W. 65th PLACE, FT. LAUDERDALE, FL 33309



## THE ON-LINE SEARCH

cess, the Help key will get you assistance. On top of that, I've always found the user's manual to be very clear on the basics of search strategies and in explaining the software. The search strategy can be saved, edited further, and reloaded in another search session.

In-Search runs on the IBM Personal Computer (PC) and compatibles that use MS-DOS 2.0 or later revisions, and the Texas Instruments Professional Computer. It requires a minimum of 192K bytes of memory and costs \$399. For more information, contact Menlo Corporation at 4633 Old Ironsides, Suite 400, Santa Clara, CA 95050, (408) 986-0200.

### SCI-MATE

Sci-Mate, from the Institute for Scientific Information (ISI), the producers of SCISEARCH and SOCIAL SCISEARCH databases, is a menu-driven microcomputer software package composed of two integrated systems: the Universal Online Searcher and the Personal Data Manager. Whereas In-Search assumes that novices will be its users, Sci-Mate's target is the science and technology researcher or information specialist, who will need to perform cross-system searches. The Universal Online Searcher lets you query major on-line systems using Sci-Mate's own "universal" menu-driven language that translates the search query to the various protocols appropriate to ISI's own databases, Dialog, BRS, NLM (National Library of Medicine), and SDC. Alternately, you can search any other database with the Universal Online Searcher through the database system's native index.

The Sci-Mate Universal Online Searcher will let you preformulate your strategy before going on line, and it will automatically dial up a remote system, perform log-on protocols, and perform your search, saving you on-line connect costs. Sci-Mate supports Boolean operators and it also lets you limit your search to specific fields and the browsing or scanning of the database index(es) while on line. When you are browsing, you can create search statements, and

Sci-Mate will set aside groups of records containing the words you selected.

The companion package from ISI, the Personal Data Manager, is an off-line enhanced database-management system that lets you manipulate the downloaded data, reformat it for bibliographies and reports, add your own library references, search the records, and flag articles that have been ordered or are part of your collection. Though they were designed to be used together, both packages also work independently.

Sci-Mate runs on the IBM PC; Vector 3 or 4; Apple II, II+, and IIe; TRS-80 Model II or 12, and Kaypro 2 or 10. It requires a minimum of 64K bytes of memory. The Sci-Mate Universal Online Searcher lists for \$440, and the Personal Data Manager for \$540. The combined price for both is \$880. For more information contact ISI at 3501 Market St., University City Science Center, Philadelphia, PA 19104, (800) 523-4092.

### SEARCH HELPER

Search Helper, from Information Access Company (IAC), a division of Ziff-Davis Publishing Company, is a "novice-friendly" communications software package for accessing six of the IAC databases available through Dialog: Magazine Index, National Newspaper Index, Trade and Industry Index, Legal Resources Index, Newsearch, and Management Contents. This microcomputer system consists of software and a search contract to use the IAC files at a guaranteed cost of \$2.50 per search (with a maximum number of 20 on-line prints). The system is primarily designed for inexperienced end users who would like to perform on-line searches by themselves at low cost. The target market for Search Helper is public, academic, and special libraries willing to pay \$1750 a year for 700 searches and, in turn, offer these low-cost fixed-rate searches to their patrons.

Search Helper is fully menu-driven. You first select the database you want (a help screen describes the contents

(continued)

FANTASTIC LOW PRICES ON

# BASF

## QUALIMETRIC DISKETTES!



BASF QUALIMETRIC DISKETTES have a lifetime warranty and are packed in plastic storage cases. TYVEK sleeves, reinforced hubs, user identification labels and write-protect tabs included.

**\$139**<sup>ea.</sup> 5 1/4" SSDD Qty. 20  
**\$159**<sup>ea.</sup> 5 1/4" DSDD Qty. 20

### SOFT SECTOR ONLY! 3M HEADCLEANING KITS

Stop swearing and start cleaning. This non-abrasive cleaning kit has everything you need for 30 applications. **\$18.00** Shpng.

### AMARAY MEDIA-MATE 50: A REVOLUTION IN DISKETTE STORAGE



Every once in a while, someone takes the simple and makes it elegant. This unit holds 50 5 1/4" diskettes, has grooves for easy stacking, nipples to keep diskettes from slipping and several other features. We like it.

**\$10.95** + \$2.00 ea. Shpng.



### DISKETTE 70 STORAGE: STILL A GREAT BUY

Dust-free storage for 70 5 1/4" diskettes. Six dividers included. An excellent value.

**\$11.95** + \$3.00 Shpng.



### DISK CADDIES

The original flip-up holder for 10 5 1/4" diskettes. Beige or grey only.

**\$1.65** + 20¢ ea. Shpng.

### PRINTER RIBBONS AT BARGAIN PRICES!

Brand new ribbons produced to manufacturer's specs.  
Epson MX-70/80 ..... **\$3.58** ea. + .25 Shpng.  
Epson MX-100 ..... **\$6.99** ea. + .25 Shpng.  
Okidata Micro 83 ..... **\$1.48** ea. + .25 Shpng.  
Okidata Micro 84 ..... **\$3.66** ea. + .25 Shpng.

Shipping: 5 1/4" DISKETTES—Add \$3.00 per 100 or fewer diskettes. Other Items: Add shipping charges as shown in addition to diskette shipping charges. Payment: VISA and MASTERCARD accepted. COD orders only, add \$3.00 handling charge. Taxes: Illinois residents only, add 8% sales tax.

MINIMUM ORDER: \$35.00

FOR ORDERS ONLY:  
**1-800-621-6827**  
(In Illinois: 1-312-944-2788)

INFORMATION & INQUIRIES:  
**1-312-944-2788 only!**

HOURS: 9AM - 5PM Central Time,  
Monday - Friday

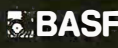
WE WILL BEAT ANY NATIONALLY ADVERTISED PRICE  
ON THE SAME PRODUCTS AND QUANTITIES!

**DISK WORLD!, Inc.**

Suite 4806 • 30 East Huron Street • Chicago, Illinois 60611

**DISK  
WORLD!**

Authorized Reseller  
Information Processing  
Media



# UNIX\*

OPERATING SYSTEM

- Advanced Full-Screen Editor
- PC DOS File Transfer
- 8087 Co-Processor Support
- Queuing System
- IBM Support

Now you can have a complete UNIX System III implementation on most models of the IBM PC.

The IBM Personal Computer Interactive Executive<sup>†</sup> (PC/IX) offers you tools like the C language, programmer's workbench, communication facilities, a text processing system and much more. It's also a multitasking system that offers you the same facilities found on larger UNIX operating systems.

And PC/IX incorporates many significant enhancements. For example, a new full-screen editor helps you program more effectively. It offers such advanced features as windowing, function-key editing, the ability to

execute commands from the editor, and automatic file backup. Beginning users of the editor can rely on a variety of "help" screens.

If you've been using PC DOS, you'll be glad to hear that it can co-reside with PC/IX. And that you can transfer files between the two systems.

PC/IX is specifically designed to take full advantage of the architecture of the IBM PC.

It transparently supports the 8087 Math Co-Processor. And PC/IX automates the management of input/output streams through a multipurpose queuing and spooling system.

IBM has other software for PC/IX

# IBM'S PC/IX

available, too, including INfort (a FORTRAN compiler with programming tools) and INmail/INnet/FTP (an electronic mail and file transfer facility)†

And because PC/IX is from IBM, you get IBM's quality documentation, as well as IBM service and support.

PC/IX requires 256KB of memory on an IBM PC with fixed disk or an IBM PC XT, PC XT/370 or PC AT.

You'll find PC/IX at your nearest IBM Product Center or your Authorized IBM Personal Computer Dealer. To order, or for more information and the latest list of PC/IX application software, call IBM toll free at 1 800 IBM-2468, and ask for the PC Software Department,

Ext. 587. Or call your IBM marketing representative.



IBM Direct PC/IX  
PC Software Dept. 3E/587  
1 Culver Road, Dayton, NJ 08810

Please send me more information on PC/IX.

Name \_\_\_\_\_

Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Phone \_\_\_\_\_

\*UNIX is a trademark of AT&T Bell Laboratories. PC/IX is based on UNIX System III, which is licensed to IBM by AT&T Technologies, Inc.  
†Developed for IBM by INTERACTIVE Systems Corp.

of each database); indicate whether you're interested in a person or a subject; enter the person's name or describe the subject in one to three words; optionally refine your search with an additional word or phrase; and review and edit your strategy, if necessary. Search Helper will insert the appropriate adjacency protocols and mask them from you. If the name Ronald Reagan is entered, Search Helper will insert the (f) field operator to limit the occurrence of both words in one field. If you select a subject search and type in the three subject words Computer, Assisted, and Instruction, one on each search line, Search Helper will insert the Boolean AND between the words. Records will be retrieved where these words occur in any order, anywhere in the record. Alternately, if you type in the search phrase Computer Assisted Instruction, Search Helper will automatically

insert the Dialog protocol (2w) between words. It will then search this phrase as a string in which the word order must be maintained with, at most, one additional word between each specified term. At present, the only Boolean operator supported by Search Helper is the AND (the most often used operator). IAC is investigating adding the OR operator as well.

After you have input the search terms, Search Helper's automatic function takes over. It makes the telecommunications connection, performs your search, downloads the 20 most recent citations to your microcomputer, and logs off. There is no user interaction from the time you initiate the search until the download menu appears on your screen, when the information resides in your microcomputer's memory, and no further on-line costs are incurred. At the download screen, you can print selec-

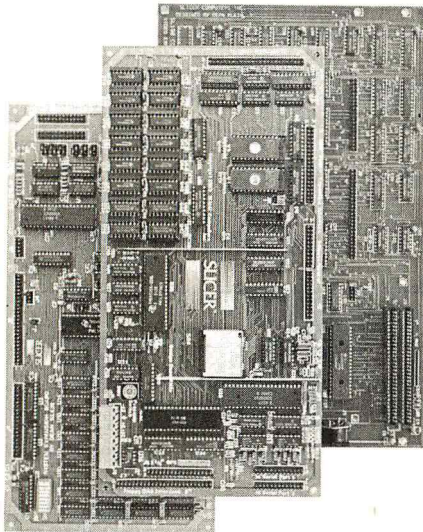
tively or print all citations.

Due to the coverage in the IAC databases and the guaranteed low price per search, this is an appropriate option for many libraries and information centers. Magazine Index covers more than five major U.S. newspapers from 1979; Newsearch offers cover-to-cover indexing of five national newspapers within 24 hours of their publication. Search Helper can be used very effectively by the end user who needs the most recent citations on a topic of interest for a low cost.

Search Helper runs on the IBM PC, Eagle, and Apple II, II+, and IIe. It requires a minimum of 128K bytes of memory on the IBM PC and 48K bytes on the Apple. Search Helper's pricing includes the software and 700 searches on IAC databases for \$1750 a year (\$2.50 per search). For more information, contact IAC-Information

(continued)

# SLICER—THE SYSTEM THAT GROWS TO FIT YOUR NEEDS



## THE SLICER Real 16 Bit Power on a Single Board— Featuring the Intel 80188

- Complete 8 MHz 16-bit microprocessor on a 6" x 12" board
- 256K RAM, plus up to 64K EPROM
- SASI port for hard disk controller
- Two full function RS232C serial ports with individually programmed transmission rates—50 to 38.4K baud
- Software compatibility with the 8086 and 8088.
- 8K of EPROM contains drivers for peripherals, commands for hardware checkout and software testing
- Software supports most types and sizes of disk drives
- Source for monitor included on disk
- Bios supports Xebec 1410 and Western Digital WD 1002 SHD controller for hard disks

Fully assembled and tested only \$995  
Also available in several kit forms

## THE SLICER SYSTEM EXPANSION BOARD For expanded memory, additional ports, and real time clock

- Up to 256K additional dynamic RAM
- 2 RS232C asynchronous ports with baud rates to 38.4K for serial communication

- 2 additional serial ports for asynchronous RS232C or synchronous communication (Zilog 8530 SCC)
  - Real Time Clock with battery backup for continuous timekeeping
  - Centronics type parallel printer port
- Fully assembled and tested only \$800  
Available in several kit forms also

## THE SLICER PC EXPANSION BOARD Gives your Slicer high performance video capability

- IBM compatible monochrome video
  - Video memory provides 8 pages of text or special graphics capability
  - 2 IBM type card slots for color video, I/O expansion, etc.
  - IBM type keyboard port
- Fully assembled and tested only \$600  
Available in several kit forms also

**Also available:** The Slicer 80188 system. 5 1/4" form factor. Call or write for more information.

Operating systems are CP/M 86 by Digital Research, Inc. (\$85), and MS DOS by Microsoft Corporation (\$175).

MasterCard, Visa, Check, Money Order, or C.O.D. Allow four weeks for delivery. Prices subject to change without notice.



**Slicer Computers, Inc.**  
2543 Marshall St. N.E., Minneapolis, MN 55418  
612/788-9481 • Telex 501357 SLICER UD

# PC vs JC



Most Choose PC,  
but  
Most Need JC.

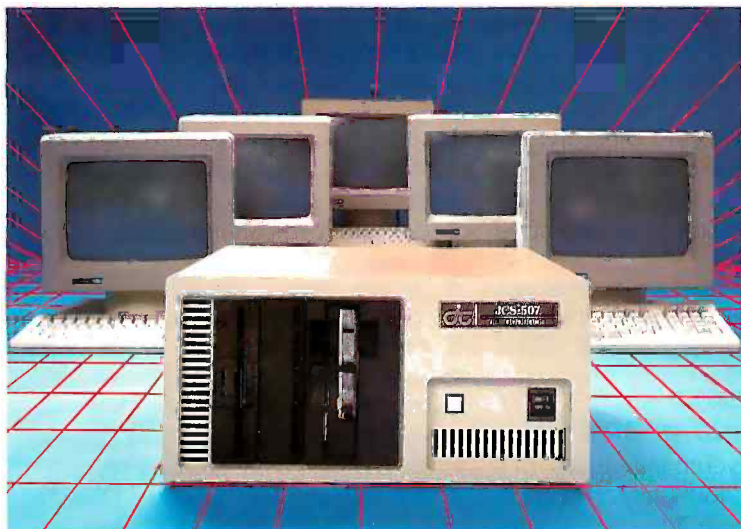
PC, personal computer has become a commodity product. It is just like a personal car. It has limitations and problems. People expect PC to do more than it can do.

JC is a growing computer. The superb architecture can offer you painless expansion for your organization. If your computer must be able to grow as you grow, JC is your only choice.

JC computers have been available thru our world-wide dealer network since 1979. The installed base of computers is now reaching 10,000 units. Our latest addition features a **multi-user, multi-processor system**, based on our 80186 master/slave processor modules. It runs under TurboDos\* 1.4 operating system with PC/DOS emulation.

JC users agree that our computers truly offer **expandability, low cost, and high performance.**

If you want to know more, contact us. Let one of our professional dealers help you. They will hold your hand until you get solutions, not problems.



**JC SYSTEMS**

HIGH PERFORMANCE COMPANY

JC INFORMATION SYSTEMS, INC.

469 Valley Way  
Milpitas, CA 95035  
(408) 945-0318  
TWX 910-381-7041

\*TurboDos is a trademark of Software 2000, Inc.

\*PC/DOS is a trademark of IBM Corporation.

## *EasyNet lets you access the Dialog databases on a pay-as-you-go basis.*

Access Corporation, 11 Davis Dr., Belmont, CA 94002, (800) 277-8431.

### SEARCH MASTER

Search Master, from SDC Information Services, is different from the other microcomputer packages in that it is designed for the information specialist in the corporate environment. It is unique in that it allows the information specialist to design search "scripts" for recurrent searches, where different search terms can be inserted according to need. The user, who may be a scientist, patent attorney, or subject specialist who does not have previous experience in on-line searching, fills in the script's blank spots.

Search Master offers one-time entry of log-on information for many database services, such as SDC's own ORBIT, BRS, Dialog, and NLM. The search strategy is entered off line through a menu-driven system. Search Master will automatically log on to the database system, perform the search, let you interact manually with the database system, store your results, and log off. The search strategy can be saved and used again in different databases. The package will also perform an unattended search and search only the records in the databases that have been added since the last update, thus providing you with a current awareness service.

Search Master runs on the IBM PC and the Burroughs B20. It requires a minimum of 64K bytes of memory, and the list price is approximately \$300. For more information, contact SDC Information Services, 2500 Colorado Ave., Santa Monica, CA 90406, (800) 352-6689.

### GATEWAY SYSTEM: EASYNET

The latest entry into the database-search market is EasyNet, an inter-

mediary computer, or "gateway system," that lets you access the Dialog databases on a pay-as-you-go basis. The only two requirements for you to use EasyNet are a communicating terminal and a credit card. By dialing 1-800-EASYNET anytime during Dialog's functioning hours, you can perform a search. EasyNet will ask you for your name, credit-card number, and credit-card expiration date, which it will verify immediately. Upon approval of the credit card, menu screens will prompt you as to what you want to search; each choice will offer you a screen with further refinements of the topic.

You input the key search terms, and EasyNet will select the most appropriate database to search. If you have a database in mind, you can also indicate your preference. While you wait, EasyNet will connect with Dialog and perform the search automatically. The 10 most recent references retrieved will be downloaded in bibliographic format (not including abstracts), or, in the case of directory databases, EasyNet will give you the first 500 lines of text. Additional references or lines can be requested for a surcharge. If you want to order the full records including abstracts, or the original article or text, you can indicate your wishes while connected to EasyNet. Your order will be sent by facsimile, overnight or by regular mail. When you call EasyNet, your transmission rate (300 or 1200 bps) will automatically be detected, and screens are 16 lines at most to be compatible with most lap-size portables.

EasyNet has been officially endorsed by the National Federation of Abstracting and Indexing Services (NFAIS). The version I just described is still in Beta test. For more information, contact Richard Kollin, Telebase Systems Inc., 134 North Narberth Ave., Narberth, PA 19072, (215) 664-6168.

### WHERE TO FIND IT ON LINE

Having read everything up to this point, you're undoubtedly anxious to get right out there and start access-

ing all kinds of useful information. The problem is, what's out there and who has it? The following section is an alphabetical sampling of the kinds of topics that may have some interest for you. To use it, call up the database (in parentheses) by referring to the telephone numbers in the text box at the end of the article. After you have become a subscriber (and the requirements for subscription vary) you can get information by requesting a specific service. For example, to find out about agriculture, you first subscribe to BRS or Dialog, then you request access to the AGRICOLA information service at the National Agricultural Library. Once you're connected to AGRICOLA, you can ask a specific question such as the one provided as an example.

**AGRICULTURE:** Have poultry raisers improved egg production using microcomputers? AGRICOLA (BRS, Dialog). Books and journals catalog of the National Agricultural Library, 1970 to present, 1,920,000 records.

**ARTIFICIAL INTELLIGENCE:** Who has been investigating applications in Europe? ELCOM (SDC). British and international coverage. Language: French.

**BIOMEDICAL:** What kinds of computers are used for applications such as hospital intensive-care monitoring systems? AAMSI Communications Network (CompuServe, The Source). Citations to articles in medical and computing journals, including listings of vendors of computerized medical information systems.

**BOOKS:** I need a book on BASIC programming. BOOKS IN PRINT (BRS, Dialog). Lists books produced by 12,000 U.S. publishers, including scientific, technical, medical, paperbacks, and forthcoming books (up to six months in advance of publication). LC MARK. The catalog of the Library of Congress, 1900 to date, almost 2,000,000 records.

**BUSINESS:** How much growth can I expect in the robotics industry over the next six months? PTS FORECASTS (BRS, Dialog). Over 800,000 records and forecasts, 1971 to date.

*(continued)*



© 1984 Cosmos Inc.

## Revelation.<sup>®</sup> Because the object is to win.

Winning isn't easy when you have to work harder than your PC because your relational database falls short.

That's why experienced users power their PC's with the Revelation<sup>®</sup> "Applications Environment" from Cosmos.

More than a relational database. Revelation gives you the tools and flexibility you need to prototype and develop even the most exotic micro-computer applications with relative ease and efficiency. Revelation uses plain English to create files, fields,

entry screens and menus, process information, make simple inquiries or generate complex reports.

Revelation's R/DESIGN applications generator does the work for you, or you can switch to Rev's structured R/BASIC language for precise program customization. You can make changes in programs, screens or data structures in a matter of seconds without having to start from scratch.

Revelation works with MS/DOS<sup>™</sup> so you can take advantage of all your favorite microcomputer software packages,

and Rev's "Open Environment" communications concept allows interactive access to many mainframe and mini-computer systems. Networking and runtime versions are also available.

When you need more than a simple database, Rev up your PC with Revelation, the "Applications Environment" from Cosmos.

Contact us by phone or write and we'll arrange an unforgettable demonstration for you with a Cosmos representative in your area.

*MS/DOS<sup>™</sup> of Microsoft Corp.*

Circle 97 on inquiry card.

Cosmos Inc. 19530 Pacific Highway S.

# COSMOS<sup>™</sup>

Seattle, WA 98188, (206) 824-9942

**CHEMICALS:** Where can I buy par-chloro-aminoanisole hydrochloride? ACS JOURNALS ONLINE (BRS). Full text (25,000 articles) or 18 journals from the American Chemical Society. **PHARMACEUTICAL NEWS INDEX** (Dialog). 114,000 records. 1975 to date.

**CITATIONS:** Has this article been cited

by other authors? **SCISEARCH** (Dialog). Indexes 90 percent of the world's scientific and technical literature. Provides for retrieval of other relevant papers by searching for later references to a known work.

**COLD WEATHER:** How will this equipment perform in cold weather? **COLD** (SDC). Produced by the Cold Regions

Research and Engineering Laboratory of the U.S. Army Corps of Engineers. Covers all disciplines dealing with Antarctica, and behavior of materials and equipment in low temperatures.

**COMPUTER-ASSISTED INSTRUCTION:** What is written on computer-assisted instruction in literacy programs? **NTIS** (BRS, Dialog). Government-sponsored research and analyses prepared by federal agencies, their contractors, or grantees. **ERIC** (BRS, Dialog). Research reports, articles, and projects in education.

**CONFERENCES:** What engineering societies held conferences in Hawaii in the past two years? **MEETING** (Questel). Forthcoming conferences, meetings, workshops, exhibitions, and fairs. Covers scientific, technical, and social science fields.

**DEFENSE CONTRACTS:** Anything on defense electronics and military contracts? **DEFENSE ELECTRONICS MAGAZINE** (Aerospace Daily Online). Full text of monthly magazine covering U.S. and international military electronics. **PTS DEFENSE MARKETS AND TECHNOLOGY** (Dialog). Thorough abstracting of more than 100 key defense journals, selective abstracting of 1500 additional journals and newspapers, including DOD contract awards.

**EDUCATION:** What materials are there for handicapped children? **ECER** (Exceptional Child Education Resources) (BRS, Dialog). References (print and nonprint) for gifted, disturbed, or handicapped children.

**ELECTRONIC PUBLISHING:** Anything on electronic publishing? **EPA** (Electronic Publishing Abstracts) (Pergamon-Infoline). Contains more than 4000 references to literature on electronic publishing. Covers North America, Europe, and Japan, from 1975 to present.

**ENGINEERING:** What effects has very-large-scale integration (VLSI) had on telecommunications systems? **COMPENDEX** (BRS, Dialog, SDC). Synopses of worldwide engineering publications and articles covering the entire engineering field.

**ENVIRONMENT:** In planning for a new

(continued)

# INTRODUCING VOLKSMODEM 12. PORSCHE PERFORMANCE, VOLKSMODEM PRICE.



Who says basic transportation for data can't boast sports car performance? Compatible with virtually every personal computer on the market today, our VOLKSMODEM 12 is loaded with today's most desired performance features, and no sticker shock! Auto dial/auto answer. Hayes command structure. 300/1200 baud data rates. And more. With the Volksmodem

12 and one of seven adapter cables you are instantly in touch with the world of data communications.

How can we offer all this at a sticker price that makes the competition cringe? Because we're Anchor Automation, one of the world's leading independent modem makers.

Visit your local computer store, today! Kick the tires. Look under the hood. Compare what you pay with what you get. You'll find the VOLKSMODEM 12 runs away from the pack.

Anchor Automation, Inc., 6913 Valjean Ave., Van Nuys, CA 91406. (818) 997-6493.

**ANCHOR AUTOMATION**  
A Leader in Modem Technology

© 1984 Anchor Automation, Inc. **SEE US AT CES**

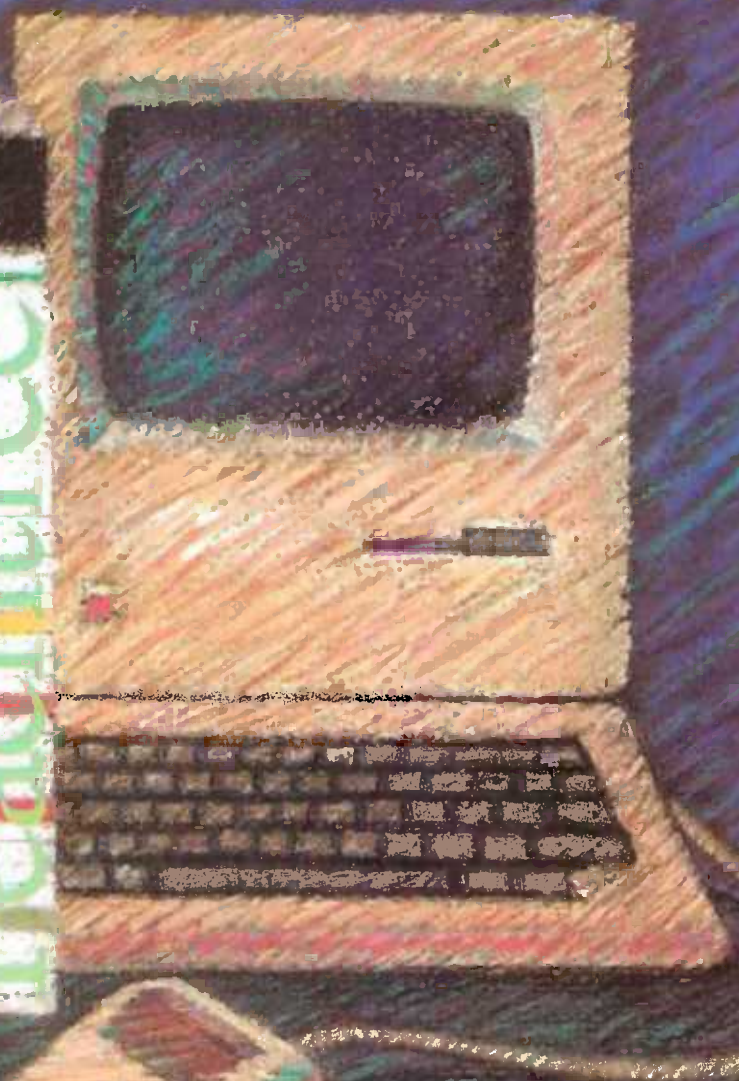
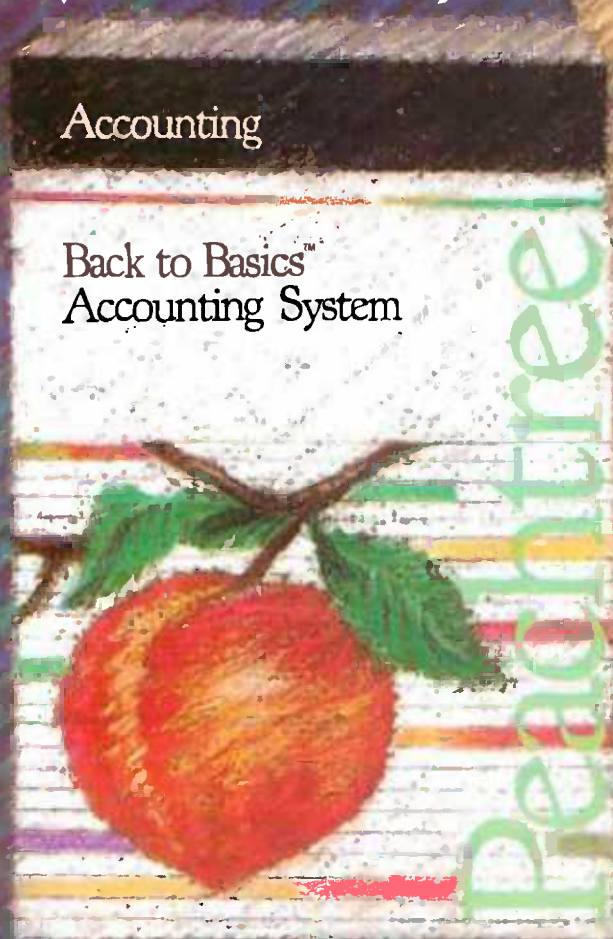


Circle 26 on inquiry card.

Circle 304 on inquiry card. →



# Introducing Accounting For Those With A Mouse In The House. (Or Office)



**Back to Basics Accounting System by Peachtree Software® is now available for the Macintosh.™**

It's named Back to Basics because it is an uncomplicated, easy-to-learn accounting system for small businesses.

You don't need any accounting experience and barely need any computing experience. The straightforward manual teaches both accounting and computing at the same time.

But make no mistake. This is a full-featured series of interactive products including General Ledger, Accounts Payable and Accounts Receivable.

The first business accounting system for the Macintosh, Back to Basics has been enjoyed by owners of Apple® II+,

IIe and IIc all along. In fact, you've probably seen it featured in Apple Macintosh advertisements.

Uncomplicated—easy-to-learn—yet full featured. That's Back to Basics.

For more information, contact your local dealer or Peachtree Software, 1-800-554-8900.

**America's Software grows on the Peachtree.™**

**Peachtree Software**

Apple is a registered trademark licensed to Apple Computer, Inc. Macintosh is a trademark licensed to Apple Computer, Inc. Peachtree and Peachtree Software are registered trademarks of Peachtree Software Incorporated, an MSA Company.



electric power generating plant, what environmental factors, licenses, permits, and safety considerations should I be aware of? EPIA (Electric Power Industry Abstracts) (SDC). 20,000 citations, 1975 to date. ENERGYLINE (EIC/Intelligence). 30,000 records, 1971 to date.

**FIBER OPTICS:** How are fiber optics being used in machine vision systems for process control in manufacturing? INSPEC (BRS, Dialog). One of the largest English-language databases in the fields of physics, electrical engineering, electronics, computers and control engineering, and information technology. THE ALTERTEXT REPORT (Newsnet). Full text of newsletter by the same name, includes all fields of telecommunications. 1983 to date. FIBER OPTICS AND COMMUNICATIONS (Newsnet). Full text of newsletter covering industry news, new technology, market trends. 1982 to date.

**FOREIGN COMPUTER SCIENCE:** What foreign databases can I access for computer information? ZDE (Dokumentation Elektrotechnik). Communications, electrical and electronics engineering. 575,000 citations to worldwide literature. Titles and search terms in English and German, 40 percent abstracts in English, 60 percent in German. SBI (Questel). References and abstracts to the literature of electronics, automation, and robotization. 18,000 records, 1978 to date. Languages: 70 percent French, 20 percent English, 10 percent other. REDOSI (Questel). French and European computer science and public issues. 1974 to present. Languages: 67 percent French, 30 percent English, 3 percent other. TELEDOD (Questel). Telecommunications and electronics. 1972 to present. Languages: 85 percent French and English, 15 percent other. INFOTEL

(Sarin). 100,000 citations to worldwide literature on telecommunications and related fields. 1970 to present. Primarily English.

**GRAPHICS:** What companies are putting computer graphics to profitable use? The S. KLEIN NEWSLETTER ON COMPUTER GRAPHICS (Newsnet). Full text newsletter covering all aspects of computer graphics.

**HARDWARE:** Who makes teleprinters will a split platen for under \$2500? SPECS Service (DRI). Information on more than 12,000 computer and peripheral product models including price, specifications, and performance characteristics. DATAPRO/ONLINE (DRI). Hardware, software, vendor profiles, and other aspects of the computer market. Approximately 10,000 records. TERMINALS Guide (ECHO). Descriptions of more than 350 terminals.

**MARKET INTELLIGENCE:** Where can I

## Subscription Problems?

**We want to help!**

*If you have a problem with your **BYTE** subscription, write us with the details. We'll do our best to set it right. But we **must** have the name, address, and zip of the subscription (new and old address, if it's a change of address). If the problem involves a payment, be sure to include copies of the credit card statement, or front and back of cancelled checks. Include a "business hours" phone number if possible.*



**BYTE**

Subscriber Service  
P.O. Box 328  
Hancock, NH 03458



find market intelligence on the computer industry? **COMPUTER INDUSTRY MARKET INTELLIGENCE SYSTEM** (Computer Intelligence Corporation). Information on computer systems installed at more than 67,000 business locations. Data available per location, industry group, computer system, peripheral devices, software packages. Data collected from user surveys in the U.S. and Canada. 1972 to present. **DATAPRO/ONLINE** (DRI). Raw data from user surveys on computers, communications equipment, terminals, software, etc. 1983 to date. **NUCLEAR**: What computer programs will let me check out the detonator circuit on that nuclear torpedo I'm hiding in the basement? **OECD NUCLEAR ENERGY AGENCY DATA BANK** (U.S. DOE). Descriptions of approximately 545 computer programs in the field of nuclear energy (available only to staff and contractors of

the U.S. Department of Energy.) **OFFICE AUTOMATION**: What effects does office automation have on employees? **MANAGEMENT CONTENTS** (BRS, Dialog, SDC). Business and management topics from over 700 business journals, proceedings, transactions, etc. **ABI/INFORM** (BRS, Dialog, SDC). Business practice and trends from over 600 top business and management journals. **PATENTS**: What Japanese patents on computer clocks have been registered in Europe but not in the United States? **COMPUTERPAT** (Pergamon-Infoline). Records for all U.S. digital data-processing patent documents as classified by the U.S. Patent and Trademark office. **JAPANESE AWARENESS SERVICE** (Engineering Information Inc.). English translations of more than 1000 publications each year from Japanese industrial, research, and development organizations.

**PERIODICALS**: How many journals deal specifically with robotics? **ULRICH'S INTERNATIONAL PERIODICALS DIRECTORY** (BRS, Dialog). Worldwide publications, includes full buying and ordering information. **PHYSICS**: What is the function of Zener diodes? **INSPEC** (Information Services in Physics, Electrotechnology, Computers, and Control) (BRS, Dialog, SDC). 1969 to present, almost 2 million records. **PRICE FORECASTS**: What price changes can I expect in digital integrated circuits over the next few years? **ELECTRONIC COMPONENTS PRICE FORECAST** (DRI). Quarterly and annual forecasts of invoice prices for active and passive electronic components, and percent price change over a five-year period. **PUBLIC POLICY**: What is the public policy on computer crime? **PAIS IN-**  
*(continued)*

# BYTE back issues for sale

|       | 1976   | 1977   | 1978   | 1979   | 1980   | 1981   | 1982   | 1983   | 1984   |
|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Jan.  |        |        |        | \$2.75 | \$3.25 | \$3.25 |        | \$3.70 | \$4.25 |
| Feb.  |        |        | \$2.75 | \$2.75 | \$3.25 | \$3.25 |        | \$3.70 | \$4.25 |
| March |        |        | \$2.75 |        | \$3.25 |        | \$3.70 | \$3.70 | \$4.25 |
| April |        |        | \$2.75 | \$2.75 | \$3.25 | \$3.25 | \$3.70 | \$3.70 | \$4.25 |
| May   |        | \$2.00 | \$2.75 | \$2.75 | \$3.25 |        | \$3.70 | \$3.70 | \$4.25 |
| June  |        | \$2.00 | \$2.75 | \$2.75 | \$3.25 |        | \$3.70 | \$3.70 | \$4.25 |
| July  | \$2.00 | \$2.00 | \$2.75 | \$2.75 | \$3.25 |        | \$3.70 | \$4.25 | \$4.25 |
| Aug.  |        | \$2.00 | \$2.75 | \$2.75 |        | \$3.25 | \$3.70 | \$4.25 | \$4.25 |
| Sept. |        | \$2.75 | \$2.75 | \$2.75 | \$3.25 |        | \$3.70 | \$4.25 | \$4.25 |
| Oct.  |        |        | \$2.75 | \$2.75 | \$3.25 | \$3.25 | \$3.70 | \$4.25 | \$4.25 |
| Nov.  |        |        |        | \$3.25 |        | \$3.25 | \$3.70 | \$4.25 | \$4.25 |
| Dec.  |        | \$2.75 | \$2.75 | \$3.25 | \$3.25 | \$3.25 | \$3.70 | \$4.25 |        |

Special BYTE Guide to IBM PC's — \$4.75

Prices include postage in the US. Please add \$.50 per copy for Canada and Mexico; and \$2.00 per copy to foreign countries (surface delivery).

Check enclosed

Payments from foreign countries must be made in US funds payable at a US bank.

VISA

Master Card

Card # \_\_\_\_\_

Exp. \_\_\_\_\_

Signature \_\_\_\_\_

Please allow 4 weeks for domestic delivery and 12 weeks for foreign delivery.

**NAME** \_\_\_\_\_

**ADDRESS** \_\_\_\_\_

**CITY** \_\_\_\_\_

**STATE** \_\_\_\_\_ **ZIP** \_\_\_\_\_

Circle and send requests with payments to:  
**BYTE Back Issues**  
**P.O. Box 328**  
**Hancock, NH 03449**

## WHO'S ON CALL

The following 18 information services/database vendors were mentioned in this article. With some of the tips mentioned here, and possible those you will discover on your own, the "world's electronic brain" can be made to serve your information needs with minimum fuss, as well as minimum cost.

### BRS

1200 Route 7  
Latham, NY 12110  
(518) 783-1161  
(800) 833-4707  
(800) 553-5566 (NY only)

### CHEMICAL ABSTRACTS SERVICE

POB 3012  
Columbus, OH 43210  
(614) 421-3600  
(800) 848-6533

### COMPUSERVE INC.

5000 Arlington Centre Blvd.  
Columbus, OH 43220  
(614) 457-8600  
(800) 848-8990

### COMPUTER INTELLIGENCE CORPORATION

3344 North Torrey Pines Court  
Suite 210  
La Jolla, CA 92037  
(619) 450-1667

### DATA RESOURCES INC. (DRI)

24 Hartwell Ave.  
Lexington, MA 02173  
(617) 861-0165

### DIALOG INFORMATION SERVICES INC.

3460 Hillview Ave.  
Palo Alto, CA 94304  
(415) 858-3785  
(800) 227-1927

### ECHO SERVICE

15, avenue de la Faiencerie  
L-1510 Luxembourg  
(352) 20764

### EIC/INTELLIGENCE

48 West 38th St.  
New York, NY 10018  
(212) 944-8500  
(800) 223-6275

### ENGINEERING INFORMATION INC.

345 East 47th St.  
New York, NY 10017  
(212) 705-7615  
(800) 221-1044

### INTERNATIONAL

RESEARCH & EVALUATION  
21098 IRE Control Center  
Eagan, MN 55121  
(612) 888-9635

### NATIONAL LIBRARY OF MEDICINE

MEDLARS Management Section  
8600 Rockville Pike  
Bethesda, MD 20209  
(301) 486-6193

### NEWSNET INC.

945 Haverford Rd.  
Bryn Mawr, PA 19010  
(215) 527-8030  
(800) 345-1301

### PERGAMON INTERNATIONAL INFORMATION CORPORATION (INFOLINE)

1340 Old Chain Bridge Rd.  
McLean, VA 22101  
(703) 442-0900

### SARIN S.P.A.

Via Bergamini 50  
00159 Rome, Italy  
06-4363

### SDC INFORMATION SERVICES

2500 Colorado Ave.  
Santa Monica, CA 90406  
(213) 453-6194  
(800) 421-7229  
(800) 352-6689 (CA only)

### SOURCE TELECOMPUTING CORPORATION

1616 Anderson Rd.  
McLean, VA 22102  
(703) 734-7500 x546  
(800) 336-3366

### SWEDISH CENTER FOR TECHNICAL TERMINOLOGY (TNC)

Box 2303  
S-103 17 Stockholm, Sweden  
(08) 24-9290

### TELESYSTEMES-QUESTEL

1625 Eye Street NW, Suite 818  
Washington, DC 20006  
(202) 296-1604  
(800) 424-9600

INTERNATIONAL (BRS, Dialog). Current policy issues including public administration from over 9000 information sources each year.

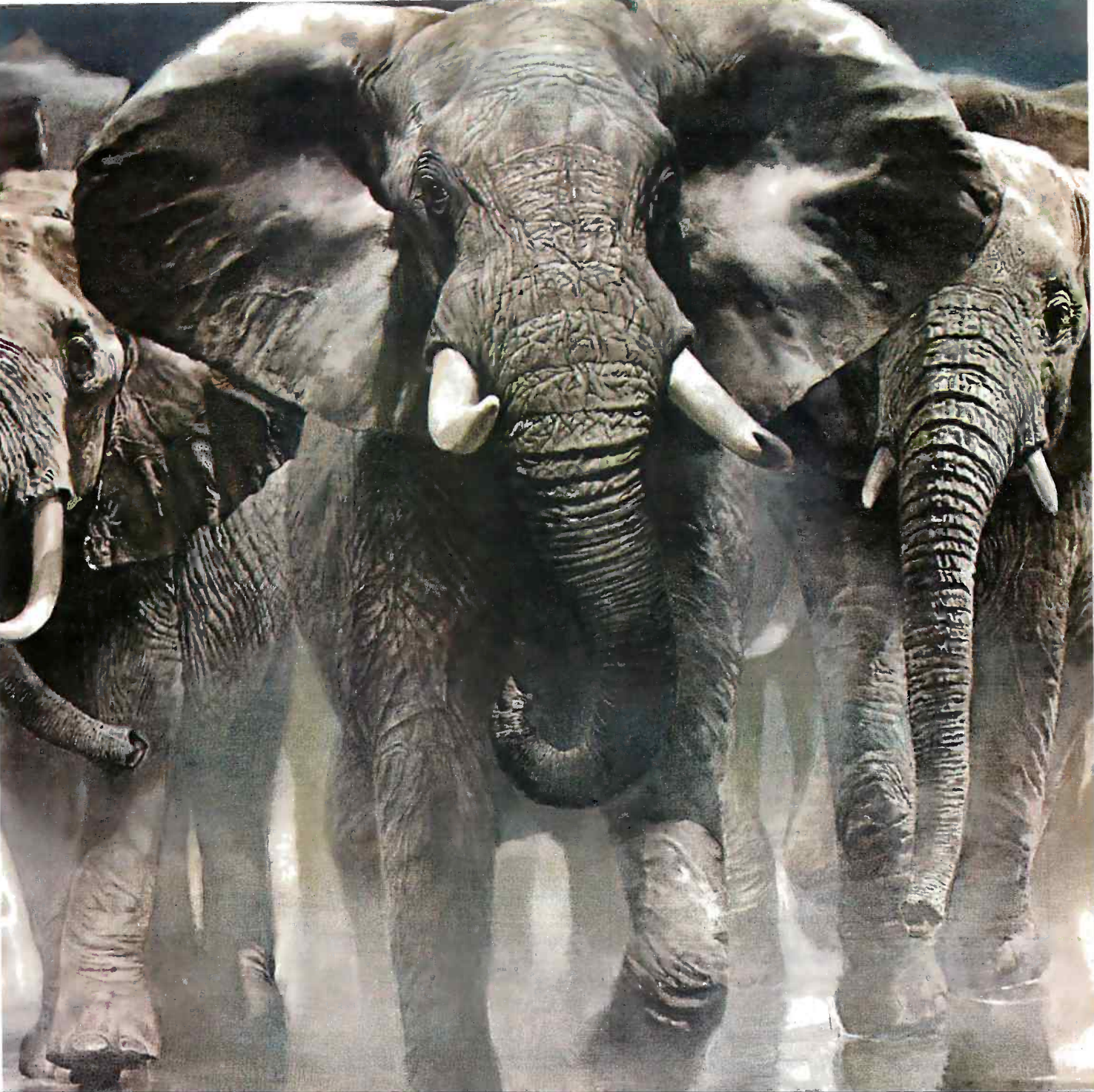
**SCIENTIFIC LEADERS:** We need a prominent lecturer for our yearly meeting...? AMERICAN MEN AND WOMEN OF SCIENCE (BRS, Dialog). Over 130,000 biographical citations on scientists in the physical, biological, and computer sciences, including contact information.

**SOFTWARE:** I need information on a microcomputer software package...? MICROSEARCH (The Source). Article abstracts from more than 100 leading industry publications. DISC (BRS). Table of contents and citations to journal literature specializing in microcomputer field. MENU (BRS). Listings of more than 50,000 software packages for micro- and minicomputers, requirements, and prices. MICRO-COMPUTER INDEX (Dialog). Citations and abstracts on use and applications of microcomputers. PERIODICAL GUIDE FOR COMPUTERISTS (CompuServe). Citations of articles in over 35 popular computer magazines.

**TECHNOLOGY TRANSFER:** What's going on in technology transfer? TRANSIN (Questel). Lists offers and requests for industrial techniques and new products. In French and English. INFORMATION AND TECHNOLOGY TRANSFER DATABASE (International Research and Evaluation). Over 3 million citations on science and technology and criminal justice on a variety of subjects. TRADE OPPORTUNITIES (Dialog). Leads to export opportunities for U.S. businesses; supplied by the U.S. Department of Commerce.

**TESTING:** How are micros used in test administration and data analysis? PSYCHINFO (BRS, Dialog, SDC). Published research in psychology and behavioral science, including case studies.

**TRANSLATION:** I need translations for these technical terms in five languages...? TERMDOK (Swedish Center for Technical Terminology). Contains translations and definitions of over 18,000 technical terms in up to 10 languages. Updates about 1500 terms a month. ■



# INTRODUCING A NEW BREED OF ELEPHANT.™



The Elephant  
Organizer™

Introducing Elephant Premium Floppy Disks. They're specially designed for the more demanding needs of business, and because they are, we test them at a higher standard. In fact, 150% of the industry standard. And then, they're certified 100% error-free at that more critical level.

So we can say with confidence that Elephant Premium will protect your data when other disks won't.

Plus, Elephant Premium is the only floppy disk that features The Elephant Organizer™—the easiest way ever to store, reference and protect your disks.

For the Elephant dealer nearest you, call 1-800-343-8413. In Massachusetts, call collect 617-769-8150.

**ELEPHANT NEVER FORGETS.™**

**Dennison**

Serving business for over 140 years.



# COMPLETE IBM™ PC SYSTEMS

## IBM PC STARTER SYSTEM

IBM PC w/64K (256K capacity) **\$1,642.00\*** (35.47)

- Floppy Drive Controller
- 1 Double Sided Double Density 320/360 Disk Drive
- Hercules Color Card w/Parallel Port
- Zenith 2VM-123 Display Monitor

CALL FOR  
LATEST IBM  
PRICING

The NETWORK has the perfect starter system for you! The combination of double sided drive, color card and printer part allows you to run most any program and grow without need for replacing any component you buy now.

## IBM PC BASE SYSTEM

IBM PC w/256K **\$1,625.15\*** (35.10)

- Floppy Drive Controller
- 2 Double Sided Double Density 320/360K Disk Drives

The Base System is your lowest cost starting point for configuring the exact system of your choice. Combine it with any of the monitors, video cards, multifunction cards and accessories listed in this ad, and prove The NETWORK can't be beat as your system source.

## IBM PC PROFESSIONAL HARD DISK SYSTEM (XT)

IBM PC w/256K **\$2,195.15\*** (48.60)

- Floppy Drive Controller
- 1 Double Sided Double Density 320/360K Disk Drive
- w/MMI new technology 3" 10MB Hard Disk.

CUSTOM  
CONFIGURATIONS  
WELCOME

- Uses less power than a floppy.
- Shock mounted 1/2 height installation leaves room for tape drive in pc.
- Automatic Hard Disk Boot Feature.

This system increases productivity in any business or professional situation. The 10MB hard disk eliminates cumbersome floppy disk changes, simplifies operations and dramatically speeds program execution time. The NETWORK's buying power provides you with better than XT performance at a price lower than you'd expect to pay for a standard PC.

\*PC Network Members pay just 8% above this wholesale price plus shipping. These prices have been prepared in September, 1984 and may have been changed with new product announcements. Call for latest prices.

## LATEST ISSUE REDUCTIONS!

64K MEMORY EXPANSION KITS . . . \$ 35.55\*

Set of 9 chips Guaranteed for Life.

LOTUS 1-2-3 . . . \$270.00\*

New Best Price!

TANDON 10MB INTERNAL HARD DISK . . . 675.00\*

Low Power Automatic Boot

PANASONIC SHUGART . . . per pair 225.00\*

1/2 Height DSDD Disk Drives with Mounting Kit

STAR MICRONICS GEMINI 10X . . . 225.00\*

120 CPS Epson IBM Graphics Compatible w/Tractor

TANDON TM100-2 DRIVES . . . 153.00\*

ORCHID BLOSSOM/64K installed . . . 205.00\*

New Price! Full Six-Pack Features with networking capability!

### AMDEK MONITORS

V300G Composite Green . . . 110.00\*

V300A Composite Amber . . . 120.00\*

V310A IBM Amber . . . 130.00\*

HERCULES MONOCHROME CARD . . . 298.00\*

HAYES 1200B with new Smartcom II . . . 366.90\*

NEC SPINWRITER 2050 . . . 625.00\*

20 CPS-Letter Quality Printer

BRAND NAME DISKETTES . . . 16.00\*

DS/DD Box of 10 Guaranteed for Life Not Generic

\*NETWORK members pay just 8% above these wholesale prices plus shipping

CALL TOLL FREE 1-800-621-S-A-V-E (orders and memberships only)

In Illinois call (312) 280-0002 validation code B3C1

# PC NETWORK

## ... WITH THESE 15 UNIQUE BENEFITS

**1 COST + 8% PRICING** — The NETWORK purchases millions of dollars in merchandise each month. You benefit in receiving the lowest price available and all at just 8% above published dealer wholesale price.

**2 OUR 500 PAGE WHOLESALE CATALOG** — Members receive our 500 page wholesale catalog containing over 20,000 hardware and software products for the IBM PC, APPLE and over 50 other popular computer systems. THE NETWORK'S CATALOG IS THE LARGEST SINGLE COMPILATION OF PERSONAL COMPUTER PRODUCTS AVAILABLE TODAY.

**3 IN-STOCK INSURED FAST HOME DELIVERY** — The NETWORK maintains a giant multi-million dollar inventory of most popular products, allowing us to ship many orders from stock. Non-stock items are typically maintained in local warehouses just days away from The NETWORK and YOU. We pay all insurance expenses on your shipment. **EMERGENCY OVERNIGHT SERVICE IS AVAILABLE ON REQUEST.**

**4 10 DAY RETURN POLICY** — If you are not satisfied, for any reason with any hardware component purchased from The NETWORK within 10 days of receipt, we will refund your entire purchase (less shipping) with no questions asked.

**5 MEMBERSHIP SATISFACTION GUARANTEE** — If for any reason you are not satisfied with your membership within 30 days, we will refund your dues IN FULL.

**6 EXPERIENCED CONSULTANTS** — The NETWORK hires consultants, not order takers, to aid you in product selection. Our consulting staff possesses in excess of 150 man years of personal computer product experience. **We back our consultants with our money back guarantee: IF ANY PRODUCT RECOMMENDED BY OUR CONSULTING STAFF FAILS TO PERFORM AS PROMISED — OR IS INCOMPATIBLE WITH YOUR SYSTEM — WE WILL TAKE IT BACK AT OUR EXPENSE FOR A 100% REFUND.**

**7 FREE TECHNICAL SUPPORT** — The NETWORK supports every product it sells. Our qualified TECH-SUPPORT staff will help you assemble your system, interpret vendor documentation and get your software and hardware to work. **WE WILL GIVE YOU ALL THE HELP YOU NEED, WHEN YOU NEED IT — FREE!**

**8 OPTIONAL BUSINESS RENTAL LIBRARY** — All members can join our BUSINESS RENTAL LIBRARY featuring over 1000 available titles for just \$25 PER YEAR above the base membership fee. This entitles you to rent business software AT JUST 20% of the DISCOUNTED PRICE FOR A 14 DAY PERIOD. If you decide to keep the software, the entire rental fee is deducted from the purchase price. **VIP MEMBERS GET A FULL 28 DAYS** for just \$30 above the V.I.P. base fee. This also includes the game library privileges for a \$5 combination savings.

**9 OPTIONAL GAME SOFTWARE RENTAL LIBRARY** — The Game Rental library is available to members for just \$10 PER YEAR and permits evaluation (or just enjoyment) of any game or educational software product as above.

**10 SPECIAL SAVINGS BULLETINS — THE PRINTOUT** — The NETWORK seeks every opportunity to save money for its members. We buy excess dealer inventories, and store bankruptcy closeouts regularly. We then turn around and make this merchandise (only top quality name brand products) available to our members at fantastic savings via THE PRINTOUT, our newsletter and savings bulletins.

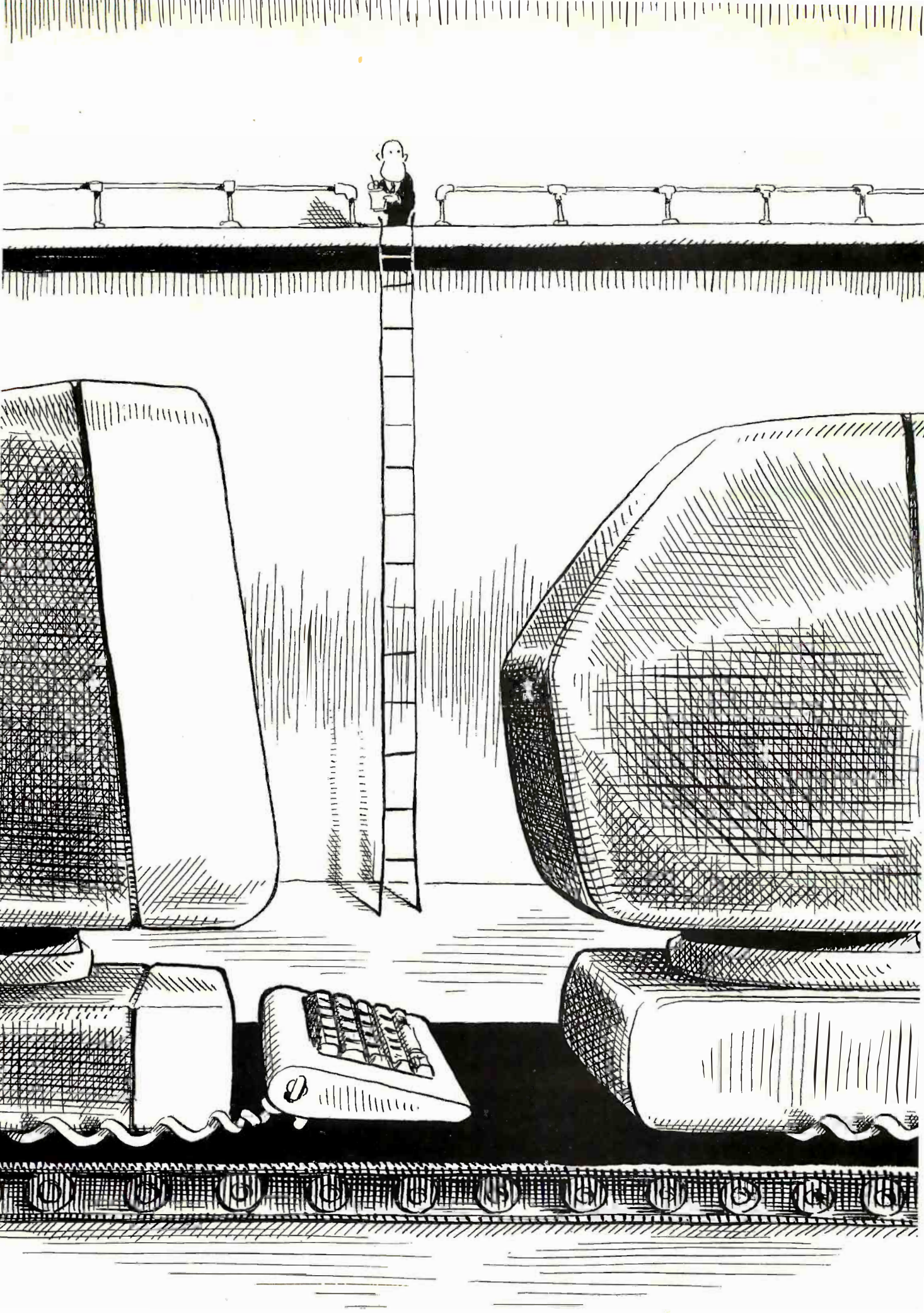
**11 DISCOUNT BOOK LIBRARY** — Working with numerous publishers and distributors, The NETWORK has assembled a library of over 1000 computer related books and manuals at savings of up to 75% from the normal store price.

**12 MEMBERSHIP REFERRAL BONUS** — Our most valuable source of new members is you! To date almost 40% of our members have been referred by word of mouth from other satisfied members. For those of you who refer new members, THE NETWORK will credit a cash bonus to your account applicable to any future purchase.

**13 CORPORATE ACCOUNT PROGRAM** — Almost 50% of The NETWORK'S members are corporate buyers and users (see opposite page left). The NETWORK can establish open account status and assign designated account managers to expedite orders, and coordinate multiple location shipments.

**14 QUANTITY DISCOUNTS** — For large corporations, clubs and repeat or quantity buyers The NETWORK can extend additional single order discounts, when available to us from our manufacturers and distributors.

**15 PRICE PROTECTION** — The PC Industry is crazy!! Prices change not yearly or monthly or even weekly but often day by day! These changes are sometimes up but are mostly down!! **THE NETWORK GUARANTEES THAT IN THE EVENT OF A PRODUCT PRICE REDUCTION, BETWEEN THE TIME YOU PLACE YOUR ORDER AND THE TIME THE PRODUCT SHIPS YOU WILL ONLY PAY THE LOWER AMOUNT!!**





# SAVE 50% \*



- United States  One Year \$21  2 Years \$38  3 Years \$55  
Canada/Mexico  One Year U.S. \$23  2 Years U.S. \$42  3 Years U.S. \$61  
Europe  \$53 (air delivery), U.S. Funds enclosed  
Elsewhere  \$37 (surface mail), U.S. Funds enclosed

BILL ME. If I'm not completely satisfied with my first copy, I'll simply write "cancel" across your invoice, mail it back, and my subscription will be cancelled.

Check Enclosed  Bill VISA  Bill Mastercard

Please allow 6-8 weeks for processing your subscription.

Name \_\_\_\_\_ 42C4

Address \_\_\_\_\_

City/State/Zip \_\_\_\_\_

Card # \_\_\_\_\_ Expires \_\_\_\_\_

Signature \_\_\_\_\_

\* off newsstand price of \$42.00



# SAVE 50% \*



- United States  One Year \$21  2 Years \$38  3 Years \$55  
Canada/Mexico  One Year U.S. \$23  2 Years U.S. \$42  3 Years U.S. \$61  
Europe  \$53 (air delivery), U.S. Funds enclosed  
Elsewhere  \$37 (surface mail), U.S. Funds enclosed

BILL ME. If I'm not completely satisfied with my first copy, I'll simply write "cancel" across your invoice, mail it back, and my subscription will be cancelled.

Check Enclosed  Bill VISA  Bill Mastercard

Please allow 6-8 weeks for processing your subscription.

Name \_\_\_\_\_ 42C4

Address \_\_\_\_\_

City/State/Zip \_\_\_\_\_

Card # \_\_\_\_\_ Expires \_\_\_\_\_

Signature \_\_\_\_\_

\* off newsstand price of \$42.00





NO POSTAGE  
NECESSARY  
IF MAILED  
IN THE  
UNITED STATES

**BUSINESS REPLY CARD**

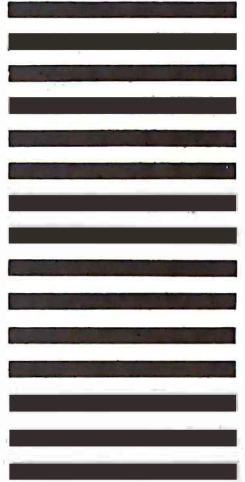
FIRST CLASS PERMIT NO. 39 MARTINSVILLE, NJ

POSTAGE WILL BE PAID BY ADDRESSEE



the small systems journal

Subscription Dept.  
P.O. Box 590  
Martinsville, NJ 08836



NO POSTAGE  
NECESSARY  
IF MAILED  
IN THE  
UNITED STATES

**BUSINESS REPLY CARD**

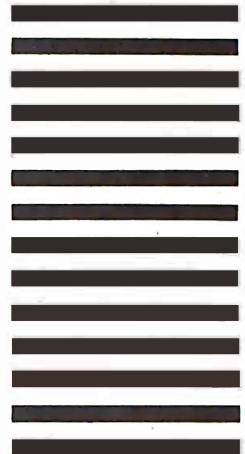
FIRST CLASS PERMIT NO. 39 MARTINSVILLE, NJ

POSTAGE WILL BE PAID BY ADDRESSEE



the small systems journal

Subscription Dept.  
P.O. Box 590  
Martinsville, NJ 08836



# Reviews

---

|                                      |            |
|--------------------------------------|------------|
| <b>REVIEWER'S NOTEBOOK</b>           |            |
| <i>by Rich Malloy</i> . . . . .      | <b>237</b> |
| <b>THE TANDY MODEL 2000</b>          |            |
| <i>by Mark S. Jennings</i> . . . . . | <b>239</b> |
| <b>THE ZENITH Z-150 PC</b>           |            |
| <i>by Wayne Rash Jr.</i> . . . . .   | <b>252</b> |
| <b>TK!SOLVER</b>                     |            |
| <i>by Alan R. Miller</i> . . . . .   | <b>263</b> |
| <b>WORDPERFECT</b>                   |            |
| <i>by Ricardo Birmele</i> . . . . .  | <b>277</b> |
| <b>THE EPSON LQ-1500</b>             |            |
| <i>by Ken Sheldon</i> . . . . .      | <b>293</b> |
| <b>REVIEW FEEDBACK</b> . . . . .     | <b>301</b> |

---

ONE OF THE MOST SIGNIFICANT products announced last year was the Tandy TRS-80 Model 2000. It was one of the first 80186-based computers, and it was the first MS-DOS computer from Radio Shack. Compared with the ubiquitous IBM PC, the Tandy 2000 has a faster processor, better graphics, larger disk drives, and a better keyboard. The only problem has been shortages—a shortage of machines and a real shortage of software—caused by the 2000's incompatibility with the IBM.

Now that there is software for the 2000, and now that the machine is available, the question arises: Just how good a buy is it? Read Mark Jennings's detailed report on this interesting machine for the answer.

Zenith's first MS-DOS machine, the Z-100, was much like Tandy's. In many ways it was a much better machine than the IBM PC. It, too, had better graphics, and it could use expansion boards designed for the S-100 bus. It even had a Z80 coprocessor. But, like the Tandy 2000, it was not completely compatible with the software for the machine from Big Blue.

Zenith, realizing which way the software winds were blowing, went back to the drawing board and produced yet one more IBM clone—the Zenith Z-150—and again seemed to improve on the PC. What were these improvements? How does this machine compare with the IBM PC? And is it really completely compatible? Check the answers to these questions in Wayne Rash's review.

In the old days, a businessperson who wanted to perform some complex financial analysis would have to write, or get someone else to write, a small computer program. Then, a few years ago, the spreadsheet calculator program appeared, and suddenly businesspeople who didn't know the difference between a GOTO and a GOSUB were doing some incredibly complex calculations.

Similarly, most scientists usually approach a computationally difficult problem by writing a program. But a year or so ago, scientists gained a new tool: Software Arts, the people who literally invented spreadsheets, came out with TK!Solver. This product can be loosely described as a spreadsheet for scientists. Alan Miller, a scientist himself, describes this program and examines just how valuable it might be.

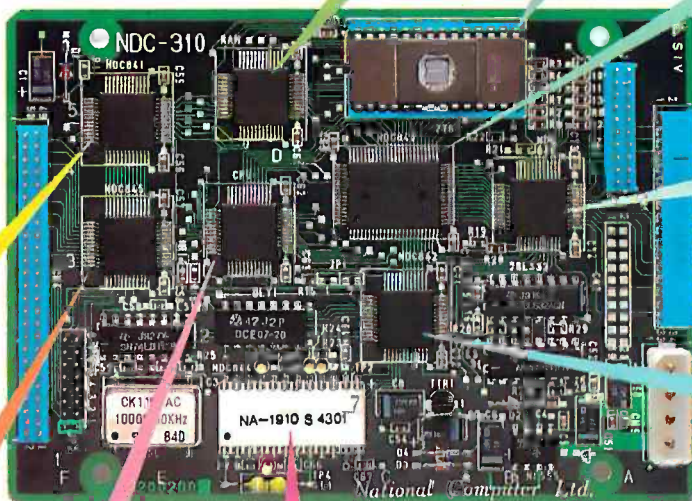
In the microcomputer industry, the relative market shares of Apple, Commodore, Kaypro, Radio Shack, and IBM seem to change almost monthly. Who the leader is depends on how you define the term. But when it comes to dot-matrix printers, the leader is, and has been for a very long time, Epson. Epson's latest printer, the LQ-1500, offers very high resolution, very high-quality characters, and high print speeds—but a high price also. Is it worth it? Check the views of Ken Sheldon, one of our Peterborough pundits, in his review of this interesting printer.

And what would an issue be without a word-processor review? This month Ricardo Birmele looks at WordPerfect, a relatively new word processor for the IBM PC. Ricardo puts this program through its paces and attempts to answer the obvious question: Is this package indeed true to its name?

—Rich Malloy, Senior Technical Editor

---

# 3.5" HDC



RAM  
2KB

ROM  
8KB

HDC  
FORMATTER  
ECC  
S/P-P/S CONVERTOR  
COMPARATOR  
DMA

DISK  
(DRIVER /  
RECEIVER)

ENCODER /  
DECODER

SASI I/F

HOST  
(DRIVER /  
RECEIVER)

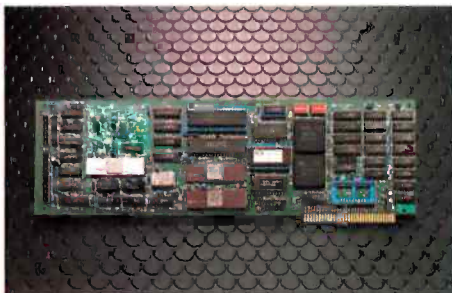
MPU  
Z80

VC O

HOST I/F: SASI  
Sector Length: 256B/512B  
Data Buffer: Full-sector dual buffer  
Data Transfer Rate: 1MB/S (DMA MAX)  
Voltage Source: +5.0V(800mA), +12.0V(100mA)  
Size: 5.75" wide, 4.02" deep  
Disk I/F: ST506 disk drive compatible

# 5.25" HDC SERIES

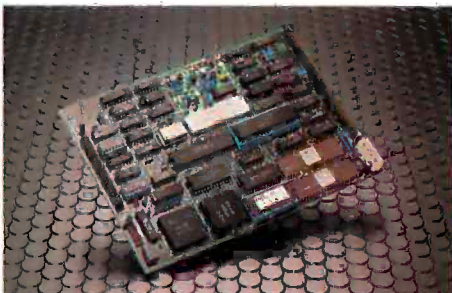
NDC-100  
IBM



HOST I/F: IBM P.C plug compatible  
Sector Length: 512B  
Data Buffer: Full-sector buffer  
Data Transfer Rate: 500KB/S (DMA MAX)  
Voltage Source: +5.0V, 2.0A  
Size: 13.20" wide, 4.02" deep  
Disk I/F: ST506 disk drive compatible

● IBM is a registered trademark of International Business Machines Corp.

NDC-100  
SASI



HOST I/F: SASI  
Sector Length: 128B/256B/512B  
Data Buffer: Full-sector buffer  
Data Transfer Rate: 500KB/S (DMA MAX)  
Voltage Source: +5.0V, 2.0A  
Size: 7.80" wide, 5.60" deep  
Disk I/F: ST506 disk drive compatible

*National Computer Ltd.*

UASON OFFICE IN CALIFORNIA PHONE:(408)734-1006 FAX:(408)744-0709

AKEBONO BLDG. 2-6-12 IWAMOTO-CHO CHIYODA-KU, TOKYO, JAPAN PHONE:(03)863-6705 TLX:J27542 FAX:(03)864-4581

# R·E·V·I·E·W·E·R'S N·O·T·E·B·O·O·K

---

**F**or most of this century a very successful entity existed: the phone company. A few years ago, the phone company decided that breaking itself up would let it offer less service for more money and sell computer equipment. Ever since then, we have been waiting to see its computers.

Recently, AT&T Information Systems (Morristown, New Jersey) consented to send one of its more expensive microcomputers to our computer room. The 3B2/300 is approximately the lowest-priced member of AT&T's 3B2 and 3B5 family.

I say approximately because I am not sure about the prices of the bigger machines. When companies start talking about really big computers, they seem to stop talking about prices. Their attitude is like J. P. Morgan's opinion of yachts: If you have to ask, you can't afford one. Since I'm not Mr. Morgan, there seems to be no limit to the items I cannot afford, but I still want to know how much they cost. In fact, that is usually my first question about any product.

Getting back to the 3B2/300, I can definitely say that its price is about \$10,000. It runs on a proprietary AT&T 32-bit microprocessor, and it comes with a 10-megabyte hard disk, a 720K-byte floppy-disk drive, and 512K bytes of memory (using 256K-bit chips). It also comes with UNIX System 5, the most current version of that much-praised operating system.

AT&T has done a fair job of aiming for the microcomputer marketplace. They sent us UNIX versions of Multiplan and dBASE II. Multiplan on the 3B2 ran 2½ times faster than Multiplan on the IBM PC, and just a shade slower than the IBM PC AT.

Despite all the hoopla about UNIX, it is still a rather unfriendly environment in which to work. It has great power, but it is very hard to use.

Sometimes, to shut off the machine you have to enter SHUTDOWN-GO-S1-Y. Not exactly intuitive. Imagine all the less friendly features of MS-DOS 2.0 compounded 10 times over. We've heard so much about UNIX's ability to support friendly "shells" that separate us from its encrypted innards, but if AT&T has one, I have yet to find it.

Despite the present unfriendliness of UNIX and AT&T's rather questionable and untested marketing ability, the 3B2/300 should have a rosy future. UNIX has thousands of devotees, and this is the only multi-user UNIX microcomputer with the AT&T "deathstar" emblem on its front panel. Watch for a review in BYTE.

**B**uying computer equipment can be a real adventure. Sometimes, no matter how many precautions you take, no matter how many reviews you read, no matter how many friends you ask, you end up with a product that doesn't perform as you would like. On rare occasions the product does not perform at all. Then begins a close relationship with your dealer. With most dealers, you will eventually get a working product, but you still have lost quite a bit of time.

At BYTE we are not immune to this problem. We receive dozens of products on short-term loan, but for evaluation only. The products we actually use to put together BYTE are all purchased by us. We buy them without taking advantage of any editorial discount—usually from one of several local dealers.

Yet with all our experience and the parade of products that passes through our computer room, sometimes we get unpleasantly surprised by the products we purchase.

For example, in our Guide to the IBM Personal Computers (page 238),

we published a review of the Popcom modem from Prentice (Sunnyvale, California). This is a pretty impressive 300/1200-bps modem at a good price (\$475). We bought a small batch of them, but of the seven I looked at, five were dead on arrival.

It turns out that the Popcoms we received were part of a batch that had been assembled with one faulty chip, which would eventually fail over time. All the modems passed the factory quality-control test and failed later. I have heard that these were the same faulty chips that were in the IBM computer in the space shuttle. (Next time I'm late for work, I'm going to claim that these chips were in my clock radio.) But thanks to our dealer and Prentice, things turned out all right. We returned the modems and quickly received models that have worked perfectly ever since.

**I**n February we ran a review of ProDOS (page 252), Apple Computer's new operating system for the Apple IIe. This operating system offers improved performance over the previous Apple DOS 3.3. But, since most of our readers were still using DOS 3.3, we have been using the older operating system in our benchmark tests. Starting this month, however, we will be using ProDOS as the standard operating system.

We were somewhat surprised at our results with ProDOS. Most of the benchmarks were faster, but two of them (the Format/Disk Copy and File Copy) were slower. Also, we found out that a ProDOS version of Multiplan wouldn't be available until the first quarter of next year. For obvious reasons, the Multiplan tests are still done with DOS 3.3. As soon as a ProDOS version of it becomes available, we will use it.

—Rich Malloy, Product-Review Editor

# WE CUT 'EM.



## Our prices on IBM, IBM-compatible and Apple II, Apple IIe, and Apple II+ HARD DISK SYSTEMS.

We've sold thousands of these super-reliable hard disks in the last 12 months.

However, if you haven't bought your **Mercury MegaBank** hard disk yet, you're in luck.

### Now, the price is right.

#### The MegaBank Archive:

a complete **10-megabyte** hard disk for use in the second floppy bay of your PC

ONLY:  
**\$795**

#### The MegaBank 10:

a complete **10-megabyte** single bay hard disk system

ONLY:  
**\$995**

#### The MegaBank 20:

a complete **20-megabyte** single bay hard disk system

ONLY:  
**\$1,495**

#### The MegaBank 40:

a complete **40-megabyte** single bay hard disk system

ONLY:  
**\$1,995**

#### The MegaBank Streamer:

a solid-cartridge **tape unit** that plugs into your PC to back up your MegaBank 10, 20 or 40. Copies up to 20 megabytes, in approximately seven minutes, & no extra slot is required.

ONLY:  
**\$995**

You'll be up and running in minutes. With MegaBank, you simply add the included adapter board to your PC chassis, plug in the hard disk unit, and turn it on. Everything you need is included, so don't worry about tricky installation or "extras".

And every MegaBank product is fully supported by our "no-risk" customer service network. We're standing by with a User's 800 Line to provide answers to technical questions or to give you helpful hints.

Every MegaBank component is warranted for a full 90 days.

Finally, if you aren't satisfied — for any reason — just return your order to us within 30 days. On the day we receive it, a full refund check will be on its way to you. When we say "no-risk," we mean it.

### TO ORDER OR FOR MORE INFORMATION, CALL 800-551-7666.

In Illinois, 312-951-0616.

We accept Visa, Mastercard and American Express, and we'll ship within 48 hours of receiving your credit card order or check.

There is an additional charge of \$33 per item ordered for shipping, handling, and insurance.

#### Specifications:

All Megabank drives are 9 $\frac{3}{8}$ " wide by 5 $\frac{5}{8}$ " high by 14 $\frac{1}{2}$ " deep.

Runs on your IBM compatible with DOS 2.0, 2.1, or CP/M 86. Apple compatibles: DOS 3.3, ProDOS, 1.01, CPM and Pascal.

Average access time 93M Sec. with a 5.0 Bits/Sec. transfer rate.

**IBM**® and  compatible

Mercury MegaBank Corporation  
311 West Superior Street Dept. 416  
Chicago, IL 60610

IBM and Apple are registered trademarks of International Business Machines, Inc. and Apple Computers, Inc.

10 meg shown.



## The Tandy Model 2000

A  
compromise  
between  
IBM PC  
compatibility  
and high  
performance

BY MARK S. JENNINGS

**A**fter six months of intensively using the Tandy 2000 alongside an IBM PC, I can say without reservation that the 2000 is the superior computer. It is noticeably faster and has better display options, a superior keyboard, higher disk-storage capacity, and more room for expansion. You should choose between the two computers based on whether you are willing to accept the limited availability of software and hardware in order to gain much higher performance.

### SYSTEM OVERVIEW

The Tandy 2000 is a low-profile unit with a thin, detachable keyboard. You can set either a monochrome or RGB (red-green-blue) monitor on top of the system unit, or Tandy will sell you a stand to mount the system unit vertically on the floor.

Tandy used plastic as the main construction material; RF (radio frequency) shielding is accomplished with foil lining and metal access covers. I'm not big on plastic, but it makes the 2000 lighter than the IBM PC. The color is an attractive eggshell white.

A small but important feature of the 2000 is a front-panel reset button. Some people complain that hardware reset buttons cause accidents; however, the 2000's reset button is deeply recessed on the unit's front panel to prevent problems. A hardware reset button ensures that you can always reboot the system, even after a serious software crash. You can also use the IBM PC's Control-Alternate-Delete combination to boot the 2000.

The basic 2000 system includes 128K bytes of RAM (random-access read/write memory), dual 5¼-inch floppy-disk drives, a monochrome display adapter, a parallel port, and a serial port. Adding Tandy's VM-I monochrome monitor produces a working system for about \$3000 list. You can substitute a 10-megabyte hard-disk drive for one of the floppies; this system (with monochrome monitor) lists for approximately \$4500. Monochrome graphics requires an expansion board, and if you want

color graphics you'll need a memory-chip upgrade kit and Tandy's CM-1 RGB monitor. All told, a two-floppy, color graphics system runs about \$4200.

### INTERNAL LAYOUT

A large main circuit board lies horizontally at the base of the 2000's system unit. Cables interconnect the main board to the power supply and disk drives. While the 2000 has slots for expansion boards, these boards do not connect directly to the main board. Instead, a small expansion bus board rises vertically from a connector on the left side of the main board (see photo on "At a Glance" page). Expansion boards slide in horizontally from the back and connect to the expansion bus board. Four expansion board slots are provided.

This method of plugging in expansion boards has several advantages. First, you do not need to open the computer's case to plug in a board—just pop two plastic clips on the back panel of the computer, slide the board in until it seats, and re-pop the clips. You don't even need a screwdriver. Second, the entire rear edge of the expansion board can have I/O (input/output) connectors. This alleviates the "connector space squeeze" that afflicts IBM PCs with multifunction expansion boards. Third, keeping the expansion connectors on a separate board allows plenty of space for big connectors. The 2000 uses a 96-pin three-tiered Euroconnector rather than the usual card-edge connector. The relatively large number of pins provides designers of expansion boards with more flexibility.

A disadvantage of the 2000's arrangement is that you need two connectors instead of one to connect each expansion board to the main board, perhaps degrading reliability a bit.

### PROCESSOR

The 2000 uses the Intel 80186, an improved descendant of the 8086/8088 micropro-

(continued)

Mark S. Jennings (POB 3203, Durham, NC 27705) is the founder and president of Digital Kinetics, a software-development firm. He received his B.S. from Purdue University and his M.S. from Stanford University; both degrees are in civil engineering.

processors used by the IBM PC and most other MS-DOS computers. Compared to the 8088 as used in the IBM PC, the 80186 has a faster clock speed (8 MHz versus 4.77 MHz), uses a full 16-bit data bus, and includes a number of functions for which the 8088 requires extra support chips. All these improvements do not compromise software compatibility; the 80186 can execute the full 8086/8088 instruction set and has a few new instructions of its own. The 80186 has one drawback: limited availability. Intel can't produce enough to meet demand.

Do these features translate into improved performance? Yes and no. Operations that are "processor-intensive" (such as recalculating a spreadsheet) run about two to three times faster on the 2000 than on the IBM PC. This peeps up certain programs. The "At a Glance" benchmarks indicate the performance improvement you can expect in this area.

Unfortunately, the effective operating speed of many programs is limited by disk I/O speed rather than processor speed. There is little significant difference in disk I/O speed between the 2000 and the IBM PC as shown in the benchmark graphs. This means that programs that read and write disk files extensively (most compilers) will

not show as much of a performance increase when run on the 2000.

The key to fast execution of a program that does extensive disk I/O is to use a hard disk or, better yet, a RAM disk. The 2000 has a hard-disk option but doesn't yet have RAM-disk software. Tandy has contracted for the development of a RAM-disk package and it might be available by the time you read this. Until a 2000 RAM disk is available, an IBM PC with a RAM disk can outpace a 2000 when running programs with heavy disk I/O.

If your program requires floating-point arithmetic operations, a numeric coprocessor (such as the Intel 8087) can be the key to fast execution. The 80186 can use the 8087 but it needs the 82188 controller chip to coordinate. Unfortunately, the 82188 is in short supply and Tandy doesn't expect to release a coprocessor option until early 1985. It won't require any expansion slots; the coprocessor option will be a small board that plugs, piggyback style, onto the main board. With this option, the 2000 should be among the fastest number crunchers available short of a VAX.

## MEMORY

The basic 2000 comes with 128K bytes of RAM chips mounted on a small piggyback board that connects

to the main board (see photo 1). You add the next 128K with another small piggyback board. After this, you add memory with expansion boards that use the expansion bus; each board comes with 128K bytes and sockets for another 128K. Two expansion boards give a total maximum memory size of 768K bytes, as compared to the IBM PC's maximum memory limit of 640K.

Another interesting feature of the 2000 is its RAM-based character fonts. While the IBM PC stores the pixel maps defining each character font in ROM (read-only memory), the 2000 stores the maps in dedicated static RAM on the main board. This simplifies redefinition of character fonts. (But don't expect to see proportional spacing on the 2000's display like that of Apple's Macintosh and Lisa; the 2000's display system is still basically character-oriented.)

In general, the 2000 avoids the use of ROM, using only 16K bytes for boot-up. The 2000 loads the BIOS (basic input/output system) to RAM from disk rather than using ROM as the IBM PC does. This lets Tandy make frequent changes to the BIOS; however, this flexibility might lead to software problems unless Tandy makes sure that each new version of the BIOS is completely compatible with previous versions. The problem has already surfaced in Tandy's version of SuperCalc3, which uses a BIOS that is incompatible with earlier versions. You have to reboot the system before and after running SuperCalc3 in order to run other programs. Tandy has acknowledged the problem and claims to be working on a solution.

Another area where the 2000 uses RAM rather than ROM is in its GW-BASIC interpreter. The 2000 loads the entire interpreter into RAM from disk, whereas the IBM PC includes the core of its BASIC interpreter in ROM.

The 2000's heavy use of RAM for the operating system tends to eat into the RAM available for programs. Equipped with only the basic 128K bytes of RAM, a 2000 has only about 75K bytes of RAM left after loading

(continued)

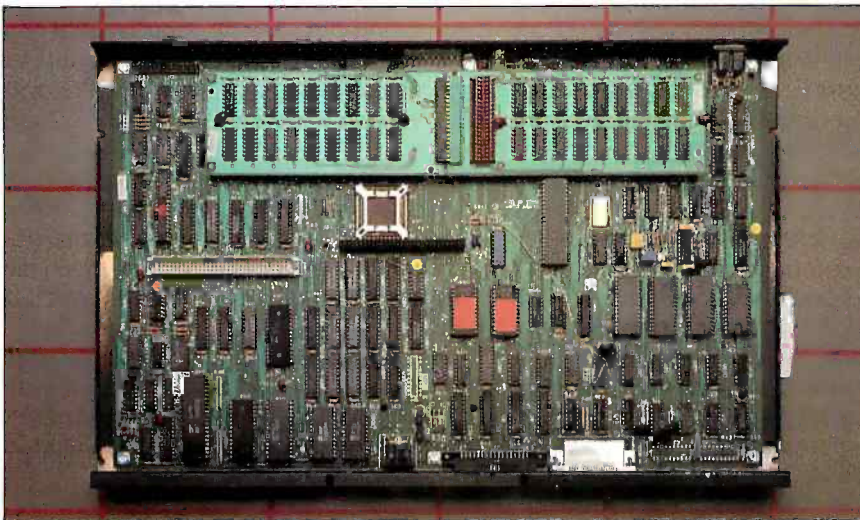


Photo 1: The 2000's main circuit board with standard and optional piggyback boards installed, each with 128K bytes of RAM. The large white connector on the left is for the expansion bus board.



# AT A GLANCE

## Name

Tandy Model 2000

## Manufacturer

Tandy Corporation  
1500 One Tandy Center  
Fort Worth, TX 76102  
(817) 338-2390

## Components

Size: 19 by 6 by 16 inches  
(system unit), 16.3 by 1.2 by  
7.9 inches (keyboard)

Weight: 23 pounds (system  
unit), 2.8 pounds (keyboard)

Processor: Intel 80186

Memory: 128K bytes  
standard, up to 768K bytes  
optional

Display: 12-inch green  
phosphor or 14-inch RGB,  
nonstandard input

Keyboard: Detachable with 90  
keys, standard layout, 12  
function keys, separate cursor  
control and numeric keypad

Mass storage: Two 5¼-inch,  
720K-byte, floppy-disk drives

Expansion: Four slots,  
nonstandard

I/O interfaces: RS-232C serial  
port, parallel printer port

## Software

MS-DOS 2.02, GW-BASIC  
interpreter

## Optional Hardware

Monochrome graphics \$449

Color-graphics chip kit \$199

Mouse \$100

Mouse/clock controller \$120

Monochrome monitor \$249

Color monitor \$799

128K RAM expansion kit \$299

External 256K expansion \$499  
board (with 128K)

Internal 10-Mb hard disk \$1699

## Documentation

*Introduction to the Model  
2000*: 69 pages

*MS-DOS Manual*: 291 pages

*BASIC Manual*: 366 pages

*Reference Guide to the Model  
2000*: 51 pages

## Prices

Base system price \$2750

Monochrome system \$3946

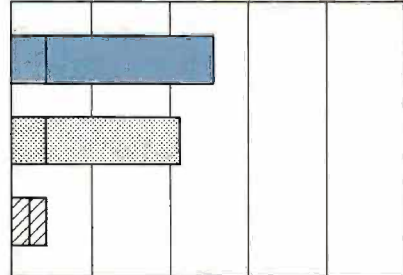
with 256K, color/graphics  
capability

Color system with 256K \$4496



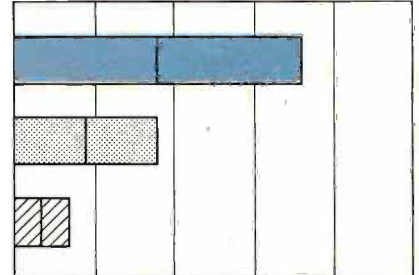
MEMORY SIZE (K BYTES)

0 300 600 900 1200 1500



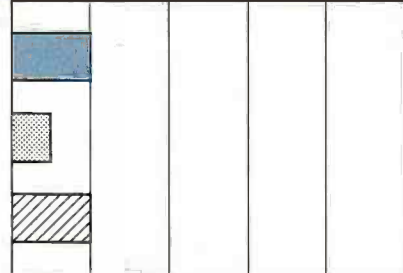
DISK STORAGE (K BYTES)

0 400 800 1200 1600 2000



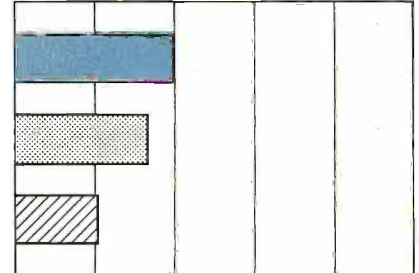
BUNDLED SOFTWARE PACKAGES

0 2 4 6 8 10



PRICE (\$ 1000)

0 2 4 6 8 10



TANDY 2000

IBM PC

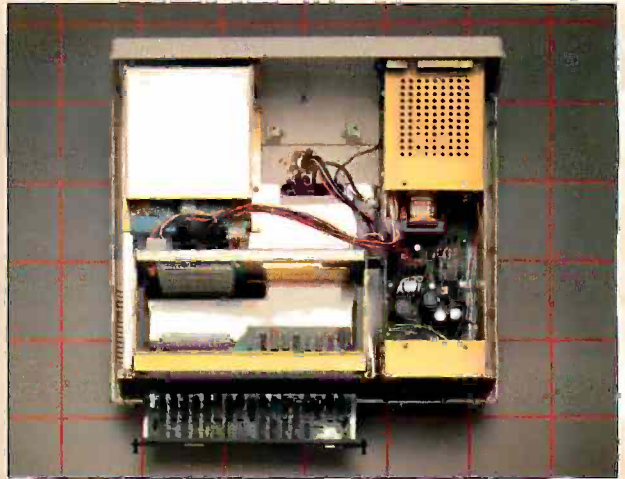
APPLE IIe

The Memory Size graph shows the standard and optional memory available for the computers under comparison. The Disk Storage graph shows the highest capacity of one and two floppy-disk drives for each system. The Bundled Software graph shows the number of software packages included with each system.

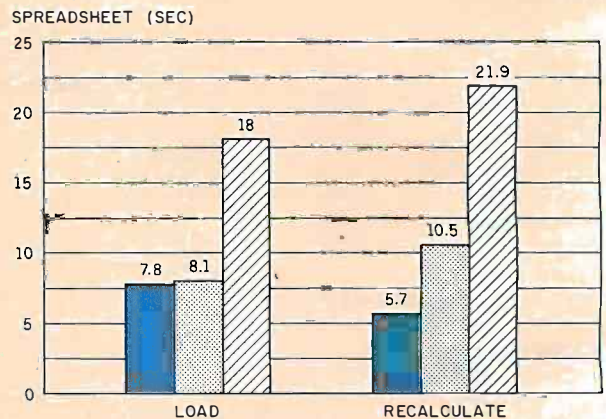
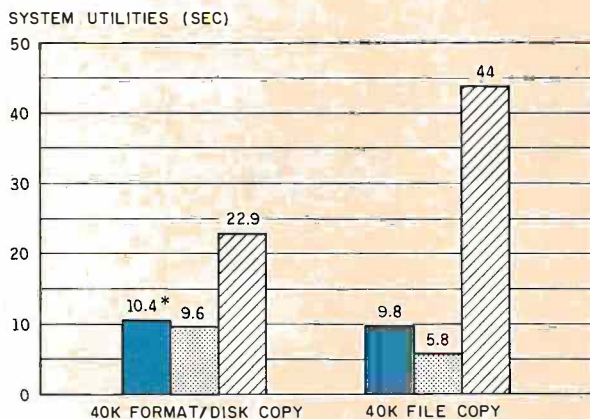
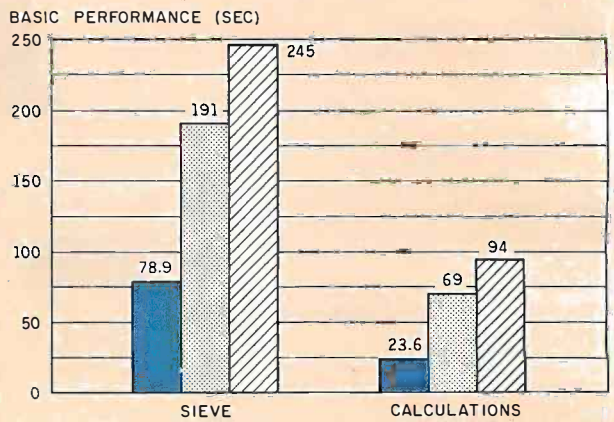
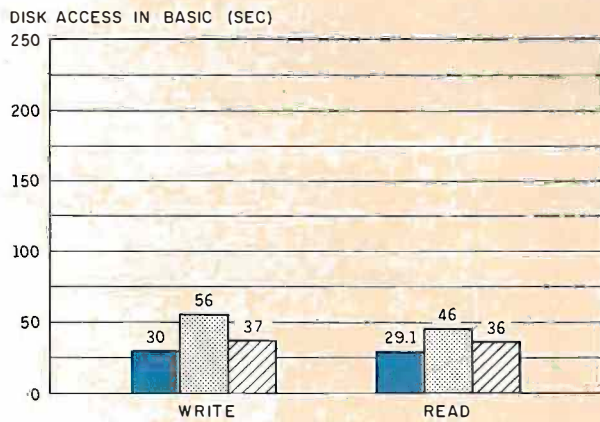
The Price graph shows the list price of a system with two high-capacity floppy-disk drives, a monochrome monitor, graphics and color-display capability, a printer port and a serial port, 256K bytes of memory (64K for 8-bit systems), the standard operating systems for the computers, and their standard BASIC interpreters.



The back panel of the Tandy 2000. The serial and parallel ports are along the bottom.



Removing the 2000's top reveals the disk drives (top left), power supply (right), and expansion bus (bottom left).



■ TANDY 2000    ▨ IBM PC    ▩ APPLE IIe

In the Disk Access in BASIC graph, a 64K-byte sequential text file was written to a blank floppy disk, then read. (For the program listings see June BYTE, page 327, and October, page 33.) The Sieve column shows how long it takes to run one iteration of the Sieve of Eratosthenes. The Calculations column shows how long it takes to do 10,000 multiplication and division operations using single-precision numbers. The System Utilities graph shows how long it takes to format and copy a disk (adjusted time for 40K bytes of disk data) and

to transfer a 40K-byte file using the system utilities. The Spreadsheet graph shows how long the computers took to load and recalculate a 25- by 25-cell spreadsheet where each cell equals 1.001 times the cell to its left. The spreadsheet program used was Microsoft Multiplan. The tests for the Apple IIe were done with the ProDOS operating system (except for the spreadsheet test, which was done with DOS 3.3). The IBM PC was tested with PC-DOS 2.0. \*Note: Format and Disk Copy are separate operations on the Tandy 2000.

the operating system. This is insufficient for most programs; most users will want to upgrade their 2000s to at least 256K.

## DISPLAY

The Tandy 2000 offers a number of options for different combinations of text, monochrome graphics, and color graphics. A text system requires only the VM-1 green monitor—no expansion board. This is a superb system for word processing. Characters are crisply formed with an 8- by 16-pixel matrix against a dark background. This display is slightly superior to the IBM PC's excellent monochrome display.

By adding a graphics expansion board, you can display 640- by 400-pixel monochrome graphics on the VM-1. For color, you need a memory-chip upgrade for this board, as well as the CM-1 RGB monitor. This provides for 640 by 400 graphics in 8 colors (selected from 16 possible colors). This color system looks spectacular—easily producing the most attractive color displays I have seen on a mass-market microcomputer. The resolution, focus, and color rendition (particularly yellow) are excellent.

Unfortunately, the 2000's color graphics are seriously flawed. When operating in the graphics mode, the computer displays text at a snail's pace, more than nullifying its speed advantage over other systems. An odd hardware configuration is to blame. With a text-only system or when using the monochrome-graphics option, the 2000 uses a high-speed 9007 CRT controller chip that scrolls text very quickly. But when the color-graphics chips are added, the 9007 can no longer be used to generate text in the graphics mode. Instead, text must be laboriously generated in software.

The text display in color-graphics mode is very slow. I wrote a short BASIC program that displays the words "Hello, BYTE" on the screen 100 times. It ran in less than 2 seconds on a text-only 2000 but took over 30 seconds on a color-graphics

system. I obtained similar results when I performed the test in Pascal.

With programs that switch back and forth between text and color-graphics modes, such as Lotus 1-2-3, this performance penalty will go largely unnoticed. But programs that stay in the graphics mode continuously, such as the BASIC interpreter, will be severely hampered when run with the color-graphics system.

If you know that you will not be using any graphics, you can reconfigure the 2000 as a text-only system. The manual tells you to tap the F12 key when the disk drive flashes during the boot-up procedure, and if this doesn't work, to "repeat the procedure, tapping the key as quickly as possible." I tried and could reconfigure my system (some of the time) by furiously hitting the F12 key for several seconds during the boot-up process. It turns out that the manual is wrong—you're supposed to hit the F12 key when the Caps and Num Lock indicators on the keyboard flash. This reconfigures the system and provides normal text display speed, but it limits you to text display until you reboot the system. Even when you know how to do it, this is an inconvenient way to reconfigure the system.

One aspect of the 2000 that I like is that it doesn't require a separate monitor if you want both high-quality

text and graphics. The graphics systems (monochrome or color) display text with the same resolution offered by the text-only system. And the 2000's RGB monitor is acceptable for text display (although definitely not as good as the monochrome monitor).

Another drawback: both the VM-1 and CM-1 monitors are specifically designed to work with the 2000 and won't work with any other computer system. Conversely, no other monitors will work with the 2000.

## KEYBOARD

The 2000's keyboard (photo 2) is a strong point. The layout is conventional; Tandy wisely avoided IBM's controversial placement of an extra key near the left shift key. The cursor controls are arranged separately from the numeric keypad in an upside-down "T" arrangement. The Caps and Num Lock toggles have status lights so you won't forget when they're on.

Another nice feature is a Hold key that stops display scrolling; the IBM PC requires a difficult combination of Ctrl and Num Lock to do the same thing. Unfortunately, the 2000's Hold key is right above the up-arrow cursor key where it is too easy to hit accidentally. Finally, the 2000 has 12 function keys that are arranged horizontally across the top of the key-

(continued)



Photo 2: The Tandy 2000 keyboard features 12 function keys, Caps and Num Lock keys with lighted indicators, and a large Enter key.

*The Tandy 2000's  
HFORMAT command  
can keep you from  
accidentally trashing  
the entire contents of  
your hard disk.*

board instead of vertically on the left side. This arrangement is better than IBM's for associating the keys with on-screen menus.

Keyboard touch is very subjective. I find the 2000's touch to be nearly perfect—fairly light but not "nervous." One aspect many will appreciate is the lack of clickety-clackety noise from the keyboard.

#### DISK STORAGE

The basic 2000 comes with two half-height, 5¼-inch, Mitsubishi M4853 floppy-disk drives. Disk-storage capacity on the 2000 is twice that of the IBM PC (720K versus 360K), a result of doubling the number of tracks (and track density) from 40 to 80 tracks per disk. This makes a world of difference for many uses of the machine. The 2000's drives are quiet and the disk ejection mechanism works well. One complaint—as in its earlier computers, Tandy put the A drive on the bottom and the B drive on the top.

The hard-disk 2000 system substitutes a Tandon TM502, dual-platter, 5¼-inch, 10-megabyte Winchester hard-disk drive for one of the floppies. A hard-disk system that retains both floppies is not currently supported but probably will be eventually.

#### SOFTWARE

For this review, I used Tandy's recently released MS-DOS version 2.02. The differences between the 2000's and the IBM PC's MS-DOS implementations are fairly minor. The 2000's FORMAT command has a few extra options and the commands for copying and comparing disks are slightly different. For example, DISKCOPY

does not automatically include FORMAT—they are two separate steps.

One small but important feature of the 2000's MS-DOS is the use of separate commands for formatting a floppy and a hard disk. The IBM PC uses the same command to format both and can cause you to accidentally trash the entire contents of the hard disk. The 2000 uses a completely separate command (HFORMAT) that is much less likely to cause this problem.

One MS-DOS command conspicuous by its absence from the 2000 is MODE. On the IBM PC, you can use this command to switch display modes, configure parallel/serial ports, and redirect output from the parallel port to the serial port. Without this command, accessing the 2000's serial port directly from the operating system is difficult. The lack of any redirection provision also hurts; it virtually requires that you have a printer with a parallel interface. Tandy has apparently recognized the need to address this problem: the company says it has a new version of MS-DOS coming that includes a MODE command.

Tandy should also include some diagnostics with the basic 2000 system. The MS-DOS disk does not contain any diagnostics programs, and I could find no reference to diagnostics in any of Tandy's documentation.

Microsoft's GW-BASIC interpreter is included with the 2000 system. The Tandy 2000 differs from the IBM PC in that the interpreter is implemented as a single program (BASIC.EXE), which includes graphics commands. The 2000's BASIC automatically senses whether you have installed the graphics expansion board. If you have, the graphics routines work; otherwise, you get a syntax error whenever you attempt to execute a statement that uses a graphics routine.

Although the 2000 has more options for color and resolution than the IBM PC, the 2000's BASIC includes the lower-resolution modes that the IBM PC uses. All other things being equal, most IBM PC BASIC programs

should run on the 2000 without changes.

#### APPLICATION SOFTWARE

The question most people ask about application software for the 2000 is "Will it run Lotus 1-2-3?" With the recent release of a 2000 version of the popular Lotus program, Tandy can now respond with a definitive yes.

Model 2000 owners have four basic ways to get the application software they need. First, Tandy markets many mainstream MS-DOS products under its own label, customized and optimized for the 2000 with documentation in the standard 2000 gray binders. A second option is Tandy's Express Order program. With this system, you order the software you want from a catalog at your local Radio Shack Computer Center. Within two or three days, the software is express shipped to your dealer so you can pick it up. Programs ordered through the Express Order program will usually be "generic" MS-DOS and might or might not take advantage of certain 2000 features.

A third option is the Reviewed Software catalog, which lists software that Tandy has tested and knows will work on the 2000. You order the software directly from the vendor or through a distributor. The fourth option is to buy IBM PC programs, some of which will work fine while others won't even load from disk.

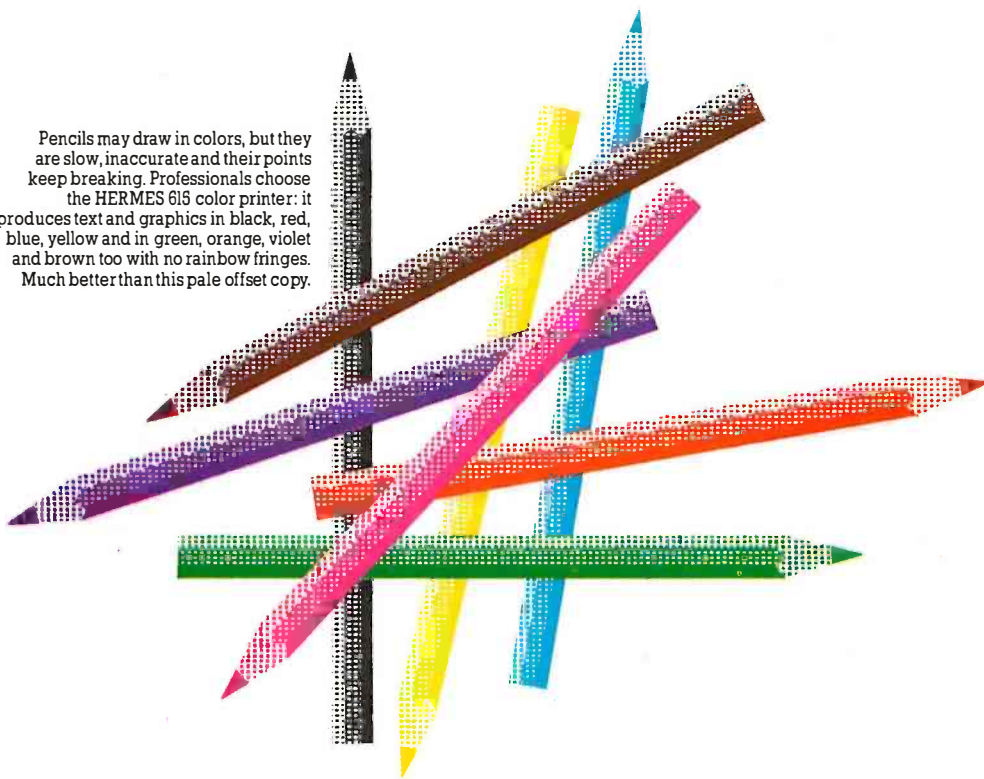
I was able to briefly test Tandy 2000 versions of 1-2-3, Multiplan, SuperCalc3, MultiMate, dBASE II, WordPerfect, and all the Microsoft compilers and assemblers. All performed well on the 2000 and most seemed significantly faster and more responsive than the IBM PC versions.

Certainly the most impressive of these packages is 1-2-3. The software is extremely quick and responsive on the 2000. Because the 2000's hardware configuration is more stable, fewer ancillary files hang around on the disks and you do not need to configure the system to get it up and running. I was displaying spectacular seven-color bar charts with 640- by

*(continued)*

# Although our HERMES 615 multi-mode printer comes in a plain black and white casing it prints text and graphics beautifully in 8 colors.

Pencils may draw in colors, but they are slow, inaccurate and their points keep breaking. Professionals choose the HERMES 615 color printer: it produces text and graphics in black, red, blue, yellow and in green, orange, violet and brown too with no rainbow fringes. Much better than this pale offset copy.



Printing and graphics in 8 colors are just two of the numerous outstanding features of the HERMES 615. Professionals who only pick the best will also appreciate:

**Its speed.** Bi-directional, shortest path printing. 400/480 cps Data, 100/120 cps Near Letter Quality (single pass).

**Its resolution.** Finest print quality available on a matrix printer. So good you can even print signatures. Bit mapped graphics in single and double density modes, 6 dot densities in each mode. A circle on the screen means a circle on the paper too!

**Its quality.** Swiss high quality construction. Quality that lasts – thanks to its exclusive «moving-ruby» head.

**Its versatility.** Wide range of attractive characters sets in 16 national versions, as well as math symbols, bar codes and Teletex. Dual ports, parallel (Centronics™/Epson™ compatible) and serial (RS-232C/RS-422) interfaces. DIABLO™ 630 emulation optional.



## HERMES®

The impressive printers

Manufactured in Switzerland by HERMES PRECISA INTERNATIONAL, CH-1401 Yverdon.

HERMES printers are distributed in Austria, Canada, Cyprus, Finland, France, Greece, Jordan, Kuwait, Lebanon, Saudi Arabia, South Africa, Spain, Sweden, Switzerland, United Kingdom, USA, West Germany.

Circle 177 on inquiry card.



Troquet Adverteam

To receive a sample of the finest quality matrix print-out and additional information on the HERMES 615 please return the coupon below.

I want to know more about your printers.

Name \_\_\_\_\_ Title \_\_\_\_\_

Company \_\_\_\_\_

Street \_\_\_\_\_ City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_ Phone ( ) \_\_\_\_\_

Send to: HERMES PRODUCTS, Inc. – Printer Division  
1900 Lower Road, LINDEN, NJ 07036, (201) 574 0300

*Most sophisticated application programs go outside the operating system to implement special features.*

400-pixel resolution three minutes after taking 1-2-3 out of the box.

#### IBM PC COMPATIBILITY

Because the 2000 runs MS-DOS and uses a software-compatible microprocessor, it offers some compatibility with IBM PC software. To run IBM PC software, the Tandy 2000 must be able to read PC disks, i.e., have the same disk format. Furthermore, the software itself must interact with the 2000's hardware through MS-DOS system calls or through compatible BIOS calls.

As for disk-format compatibility, numerous reviewers have commented that the 2000 can read but not write to IBM PC disks. This is not entirely true. What the 2000 could not do, until recently, was *format* an IBM PC disk. To write a file to an IBM PC disk, the disk had to be formatted on an IBM PC. Thereafter, the 2000 could read, write, and erase files just as if the disk were formatted on the 2000.

Apparently, however, this formatting limitation has been alleviated. Tandy is now including an extra formatting program (PC Maker) that allows the 2000 to format IBM PC disks. According to Tandy, all registered 2000 owners will receive this upgrade.

Granted, I have had some minor erratic problems in getting the 2000 to read a file written by an IBM PC and vice versa. After transferring hundreds of files (text and binary) between the 2000 and an IBM PC, I have yet to be thwarted—although a few transfers have been a bit stubborn. Part of the problem might be due to individual head alignment and rotation speed variations in the disk drives; the bottom drive on my 2000 seems to read and write to IBM PC disks much more reliably than the top

drive. Also, disks that are relatively "fragmented" (due to repeatedly writing and erasing files) are less likely to work. So far, using the bottom drive on the 2000 and a newly formatted IBM PC disk has been a sure-fire way of transferring any file.

Suppose you've put your favorite IBM PC program on a disk that the 2000 can read. Will it run? That depends on how the program communicates with the computer hardware.

If the program calls the PC hardware directly, it will definitely not run; the memory maps and I/O ports of the 2000 and the IBM PC are very different. This rules out copy-protected programs, programs that write directly to display memory (e.g., some programs with high-speed graphics), and many communications programs.

If the program communicates with the hardware through the BIOS, it will probably run. However, the 2000 uses a different system for character attributes and graphics that can cause incompatibility. One programmer's utility that I use in my work uses the BIOS to play around with different combinations of color and character attributes (bold, underline, blinking) depending on whether it is run on a monochrome or color system. This program does not work properly on the 2000. It is a fact of life that most sophisticated application programs go outside the operating system to implement special features.

As for IBM PC hardware compatibility, there is none. The expansion bus used on the 2000 is completely different from the IBM PC's. Aftermarket hardware vendors will need to develop completely separate products for the 2000.

I called the major IBM PC aftermarket board developers (Tecmar, AST Research, and Quadram) and asked them if they had any plans to develop products for the 2000. For the most part, their attitude was "wait and see."

#### DOCUMENTATION

The 2000 comes with four pieces of documentation. *Introduction to the Model*

2000 is aimed at novice users; it presents a short overview of the system. The MS-DOS and BASIC manuals are much larger and are similar in size and format to the IBM PC's DOS and BASIC manuals. Finally, Tandy provides a pocket-reference guide to the system. For some reason, however, Tandy doesn't put the loose-leaf MS-DOS and BASIC manuals in slipcases; this tends to add to bookcase clutter.

Overall the 2000's manuals, while attractive and easy to use, are less than complete. A great deal of technical information is left out of the MS-DOS manual. For example, it devotes a scant two pages to the subjects of configuring a system and device drivers. The 2000's manual is also missing key documentation of batch commands. Finally, the general manual, *Introduction to the Model 2000*, is much less comprehensive than IBM's *Guide to Operations*.

Some information missing from the standard manuals is in the recently released technical manuals: *Programmer's Reference* and *Technical Reference*. The programmer's reference manual gives information on how to access MS-DOS and the BIOS from assembly language. The technical reference manual provides detailed information about the 2000's hardware. It covers every circuit in great detail and even includes manufacturers' data sheets for most of the critical chips in the system. Unfortunately, the technical manual seldom presents any overview information that puts the details in perspective; I found it nearly impossible to read.

#### SERVICE AND SUPPORT

With well over 1000 Radio Shack Computer Centers (of which about 400 have complete service facilities), the 2000 is well supported in the field. My 2000 has performed flawlessly, so I have no direct experience with Radio Shack's service department. I have heard that it is above the industry average.

Tandy provides a customer service support number to help with hardware and software problems. I called

(continued)



# WHAT AN ASSAULT ON MT. EVEREST TAUGHT US ABOUT HIGH PERFORMANCE PERSONAL PRINTERS.

**Up, up and print.** The expedition was named Ultima Thule, a Greek and Latin phrase meaning "the outer limits of achievement." And for an Okidata printer, that's exactly what it was.

Along with 16 adventurers, 7 tons of equipment, 8 Tibetan porters and 20 yaks, an Okidata Microline 92 scaled the treacherous Northeast Buttress of Mt. Everest.

The conditions couldn't have been more hostile... high altitudes... winds approaching 60 mph... temperatures of 15 degrees below zero. How did the Okidata perform?

According to expedition member Robert Berg, "You would have thought the printer was in Miami Beach. Our Okidata never once let us down. Even in the worst, coldest weather it printed perfectly. In fact, we used it so much we ran out of computer paper. We had to feed it sheets from a yellow legal pad and it even printed on that."

Circle 288 on inquiry card.

**Yak-tested tough.** Shipped halfway around the world. Packed and re-packed countless times. Dropped, banged and bounced along on the back of a yak. And this Okidata printer didn't even notice. We're not surprised. The performance and durability of Okidata Microlines is downright legendary. Their reliability record is the best in the industry, with a warranty claim rate of less than 1/2 of 1%.

**The peak of performance.** Their versatility is unequalled as well. Three print modes; data processing at speeds up to three pages a minute, a print mode for enhanced or emphasized text and letter quality that rivals a daisywheel with full graphics printing capabilities.

Okidata Microline printers are fully compatible with all of today's popular software packages and personal computers. Special configurations are available for IBM and Apple Macintosh™ at no additional cost.

And while service may be a little difficult to find in suburban Tibet, it's easy to find at Xerox Service Centers across the U.S.

The Okidata Microline. The printer that's built to take the toughest trek. Call 1-800-OKIDATA (609-235-2600 in NJ) for the Authorized Okidata Dealer nearest you. Okidata, Mt. Laurel, NJ 08054.



## OKIDATA

an OKI AMERICA company

Technological Craftsmanship.

Macintosh is a trademark of Apple Computer Inc.

# PC SOFTWARE SALE!

WE'LL MATCH PRICES ON MOST PRODUCTS

|                                         |                                                   |
|-----------------------------------------|---------------------------------------------------|
| LOTUS 1-2-3/<br>SYMPHONY<br>\$309/\$425 | FRAMEWORK<br>\$375                                |
| dBASE II/III<br>\$279/\$375             | EASYWRITER II<br>SYSTEM<br>\$185                  |
| WORDSTAR<br>PROF PACK<br>\$275          | PRO KEY<br>\$87                                   |
| CROSTALK<br>\$99                        | HAYES<br>SMARTMODEMS<br>1200/1200B<br>\$489/\$409 |

## LOOK AT THESE SPECIAL PRICES!

|                              |             |
|------------------------------|-------------|
| ATI Training Power           | CALL        |
| AST Products                 | CALL        |
| Crosstalk                    | \$ 99       |
| dBase II/III                 | \$279/\$375 |
| EasyWriter II System         | \$185       |
| Hayes 1200/1200B             | \$489/\$409 |
| IUS Accounting               | CALL        |
| Lotus 1-2-3/Symphony         | \$309/\$425 |
| MicroPro Products            | CALL        |
| Microsoft Products           | CALL        |
| Multimate                    | \$265       |
| Norton Utilities             | \$ 59       |
| PFS Products                 | CALL        |
| ProKey                       | \$ 87       |
| Quadram Products             | CALL        |
| RBase 4000                   | \$289       |
| SuperCalc 2/3                | \$149/\$199 |
| Volkswriter Deluxe           | \$175       |
| Wordstar                     | \$209       |
| Wordstar Prof. Package       | \$275       |
| All Other Products/Diskettes | CALL        |

To order:  
Call TOLL-FREE:  
800-227-4780 or 415-845-2651

Or write:  
ECONOMY SOFTWARE  
2040 Polk Street  
San Francisco, CA 94109

# ECONOMY SOFTWARE

- We guarantee our products against manufacturer's defects.
- Quantity discounts available. We are experienced with Corporate accounts.
- No surcharge added for charge cards. No charges until products are shipped.
- Purchase orders accepted.
- Call for shipping charges.
- Prices subject to change.



*The Tandy 2000 breaks no new ground; it is a refinement of the basic IBM PC system.*

it with some typical problems and was favorably impressed. I also called Tandy's headquarters in January 1984 when the 2000 had been on the market for a few weeks. I had not yet purchased the computer and had a number of technical questions. After getting passed around for a few minutes, I was able to talk to a knowledgeable technical person. This is something I have been unable to do with IBM and Apple.

### GRIPES

Tandy seems to have an aversion to DIP (dual-inline package) switches; changing the 2000's hardware configuration often requires cutting traces on circuit boards. For example, adding the color-graphics chip kit to the graphics expansion board requires cutting a trace. Adding a numeric coprocessor will involve major surgery; the technical reference manual mentions cutting several traces on the non-visible side of the main board. How expensive can it be to add a DIP switch or a couple of pins that can be jumpered?

Perhaps Tandy wants to discourage customers from installing options on their own. The thought of cutting into a circuit board will scare many customers down to their local Computer Center. This hypothesis is confirmed by other aspects of the 2000's design. Adding the 128K-byte internal memory board requires you to take the bottom cover off the computer. Tandy doesn't like you to do this; a prominent seal warns about loss of warranty coverage. If you have it done at a Computer Center, you pay \$15. I would have preferred that Tandy include 256K in the basic computer or, better yet, put in sockets to let you install your own memory chips.

I think that requiring a separate (and expensive) internal memory board has more to do with marketing than with engineering. Tandy aggressively prices the basic 128K, two-floppy system at \$2750. Adding the monochrome monitor raises the price of a working system to \$3000—quite a bargain considering how much computer you are getting.

Tandy makes money by selling the add-ons people inevitably buy. If you decide you want a 512K color system, you will need to add the graphics board (\$450), color-graphics chip kit (\$200), RGB monitor (\$550 more than the monochrome), 128K internal memory board (\$300), 128K external memory board (\$500), and a 128K chip kit (\$300). Suddenly, your \$3000 computer costs \$5300. Some of these prices seem a bit high.

A gripe list wouldn't be complete without mentioning the constant scheduling slips that have plagued the entire 2000 program. I know that all computer manufacturers are optimistic in predicting when items will be on the market, but Tandy has pushed optimistic scheduling to new extremes. I especially dislike the way Tandy lists items in its catalog that are not available. For example, MultiMate was listed as available in a January 1984 catalog; it finally appeared in June. Any prospective 2000 purchaser should beware of Tandy's "Real Soon Now" promises.

### CONCLUSIONS

Unlike Apple's Macintosh, the 2000 breaks no new ground; it is a refinement of the basic IBM PC system. If you want an "IBM PC type" computer, you have three basic choices: you can go with Big Blue, you can save a little money and buy an IBM PC-compatible, or you can buy a higher-performance version of the IBM PC.

The 2000 is definitely the computer to consider for the last option. In nearly every measurable way, the 2000 is superior to the IBM PC. And when higher-performance software comes into wider use, the 2000's advantages will become even more evident. ■



# No Matter How You Slice It.



Our surge protectors sliced open reveal an advanced printed circuit board—not a mumbo jumbo of wires. It's your assurance that your expensive electronics are receiving state-of-the-art protection. In fact, we are so confident in our products that we give you a lifetime performance guarantee through a world-famous insurance underwriter based in London, England.

Whether you choose our colorful fruit line, The LEMON™, LIME™, PEACH™ and ORANGE™ or their beige-colored cousins, EC-I™, EC-II™, EC-IV™ and EC-V™, remember that technology is more than skin deep. After all, you'll never know how good your protection is until it's too late.

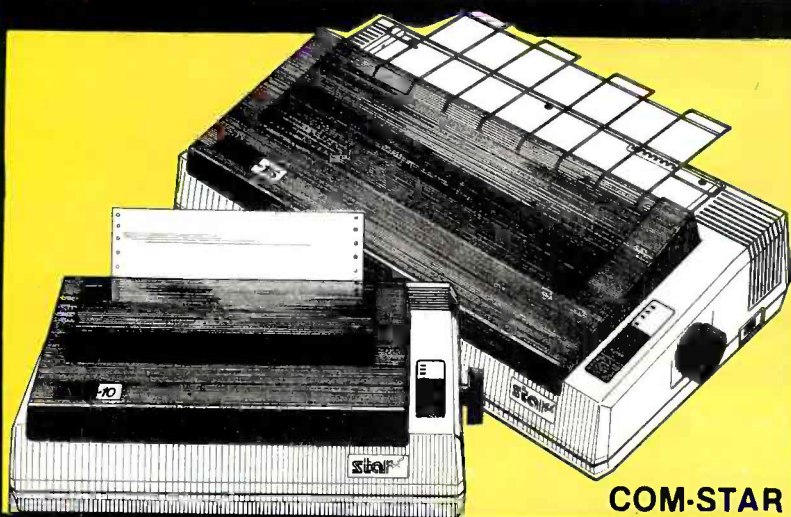
Ask for them by name at your local dealer. If they are out of stock, ask the store manager to call us at 1-800-343-1813.

*DON'T PLUG IN WITHOUT US.*

**EPD**

Electronic Protection Devices Inc.  
P.O. Box 673, Waltham, MA 02254  
(617) 890-2518 • 1-800-343-1813

# FANTASTIC COMPUTER PRINTER SALE!!!



## COM-STAR T/F

Tractor  
Friction  
Printer

only \$ **169\*\***

• **Lowest Priced, Best Quality, Tractor-Friction Printers in the U.S.A.**

- **Fast 80-120-160 Characters Per Second** • 40, 46, 66, 80, 96, 132 Characters Per Line Spacing
- **Word Processing** • **Print Labels, Letters, Graphs and Tables** • **List Your Programs**
- **Print Out Data from Modem Services** • **"The Most Important Accessory for Your Computer"**

### \*\* DELUXE COMSTAR T/F 80 CPS Printer — \$169.00

This COMSTAR T/F (Tractor Friction) PRINTER is exceptionally versatile. It prints 8 1/2" x 11" standard size single sheet stationary or continuous feed computer paper. Bi-directional, impact dot matrix. 80 CPS. 224 characters (Centronics Parallel Interface).

### Premium Quality 120-140 CPS 10" COM-STAR PLUS+ Printer \$249.00

The COM-STAR PLUS+ gives you all the features of the COMSTAR T/F PRINTER plus a 10" carriage. 120-140 CPS. 9x9 dot matrix with double strike capability for 18 x 18 dot matrix (near letter quality), high resolution bit image (120 x 144 dot matrix), underlining, back spacing, left and right margin settings, true lower decenders with super and subscripts, prints standard, italic, block graphics and special characters. It gives you print quality and features found on printers costing twice as much!! (Centronics Parallel Interface) (Better than Epson FX80). List \$499.00 **SALE \$249.00**

### Premium Quality 120-140 CPS 15 1/2" COM-STAR PLUS+ Business Printer \$349.00

Has all the features of the 10" COM STAR PLUS+ PRINTER plus 15 1/2" carriage and more powerful electronics components to handle large ledger business forms! (Better than Epson FX 100) List \$599 **SALE \$349.00**

### Superior Quality 10" COM-STAR+ H.S. HIGH SPEED 160-180 CPS Business Printer \$369.00

This Super High Speed Com-Star+ Business Printer has all the features of the 10" COM-STAR+ PRINTER with HIGH SPEED BUSINESS PRINTING 160-180 CPS, 100% duty cycle, 8K Buffer, diverse character fonts, special symbols and true decenders, vertical and horizontal tabs. **A RED HOT BUSINESS PRINTER** at an unbelievable low price (Serial or Centronics Parallel Interface) List \$699.00 **Sale \$369.00.**

### Superior Quality 15 1/2" COM-STAR PLUS+ H.S. High Speed 160 - 180 CPS Business Printer \$469.00

This Super High Speed COM-STAR+ 15 1/2" Business Printer has all the features of the 10" COM-STAR BUSINESS PRINTER with 15 1/2" Carriage and more powerful electronic components to handle larger ledger business forms! Exclusive bottom feed. (Serial Centronics Parallel Interface) List \$799.00 **Sale \$469.00**

### Olympia

### Executive Letter Quality DAISY WHEEL PRINTER \$379.00

This is the worlds finest daisy wheel printer **Fantastic Letter Quality**, up to 20 CPS bidirectional, will handle 14.4" forms width! Has a 256 character print buffer, special print enhancements, built in tractor-feed (Centronics Parallel and RS232C Interface) List \$699 **SALE \$379.**

• **15 Day Free Trial - 1 Year Immediate Replacement Warranty**

#### PARALLEL INTERFACES

For VIC-20 and COM-64 — \$49.00 For Apple computers — \$79.00 Atari 850 Interface — \$79.00 For ALL IBM Computers — \$89.00

Add \$14.50 for shipping, handling and insurance. Illinois residents please add 6% tax. Add \$29.00 for CANADA, PUERTO RICO, HAWAII, ALASKA, APO-FPO orders. Canadian orders must be in U.S. dollars. **WE DO NOT EXPORT TO OTHER COUNTRIES.**

Enclose Cashiers Check, Money Order or Personal Check. Allow 14 days for delivery. 2 to 7 days for phone orders. 1 day express mail!! VISA—MASTER CARD—We Ship C.O.D. to U.S. Addresses Only

## PROTECTO ENTERPRIZES (WE LOVE OUR CUSTOMERS)

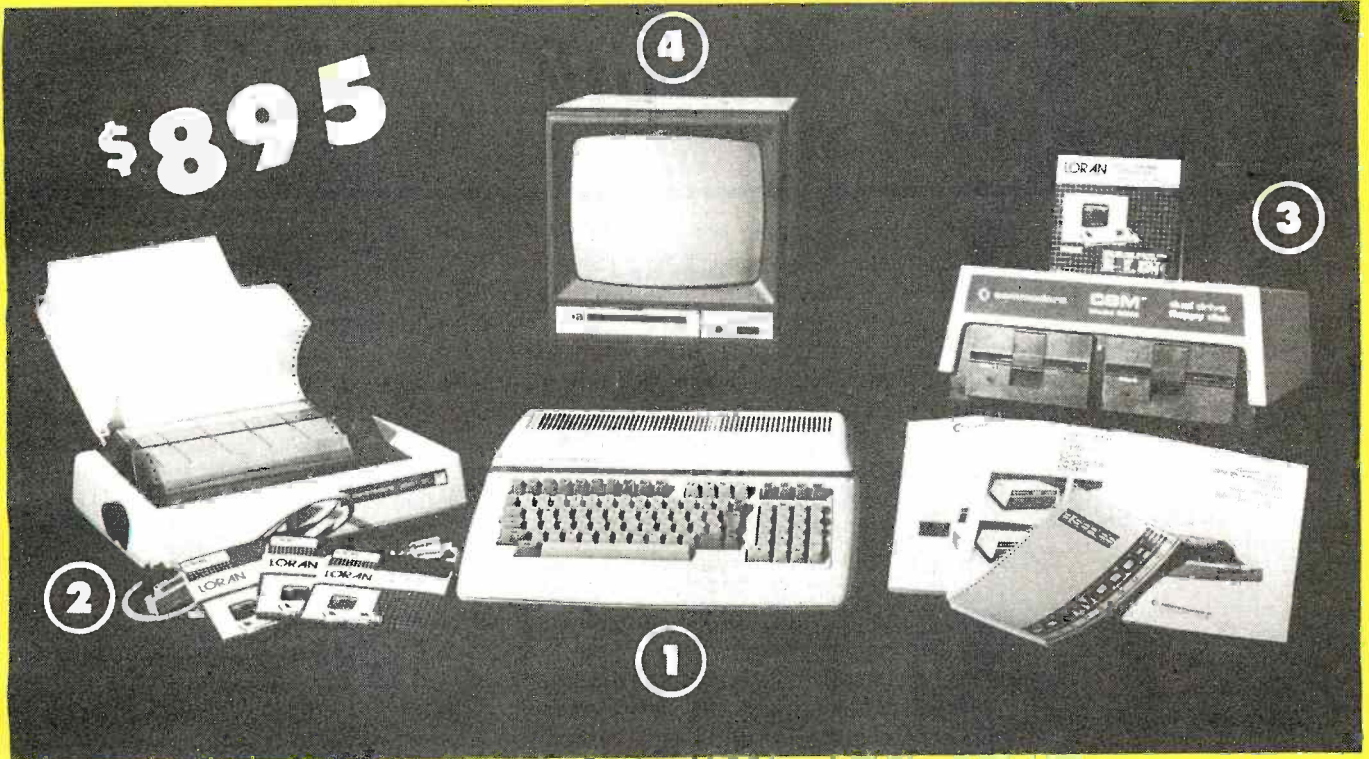
BOX 550, BARRINGTON, ILLINOIS 60010  
Phone 312/382-5244 to order

COM-STAR PLUS+ **ABCDEFGHIJKLMN OPQRSTUVWXYZ**  
Print Example: **ABCDEFGHIJKLMN OPQRSTUVWXYZ 1234567890**

NEW 128K —MEGA BYTE DUAL DISK DRIVE—80 COLUMN

# COMPUTER SYSTEM SALE!

HOME • BUSINESS • WORD PROCESSING



LOOK AT ALL YOU GET FOR ONLY **\$895.**

- |                                                    |            |           |
|----------------------------------------------------|------------|-----------|
| ① B128 COMMODORE 128K 80 COLUMN COMPUTER           | LIST PRICE | \$ 995.00 |
| ② 4023 - 100 CPS - 80 COLUMN BIDIRECTIONAL PRINTER |            | 499.00    |
| ③ 8050 DUAL DISK DRIVE (over 1 million bytes)      |            | 1795.00   |
| ④ 12" HI RESOLUTION 80 COLUMN MONITOR              |            | 249.00    |
| • BOX OF 10 LORAN LIFETIME GUARANTEED DISKS        |            | 49.95     |
| • 1100 SHEETS FANFOLD PAPER                        |            | 19.95     |
| • ALL CABLES NEEDED FOR INTERFACING                |            | 102.05    |



**TOTAL LIST PRICE \$3717.95**

**PLUS YOU CAN ORDER THESE BUSINESS PROGRAMS AT SALE PRICES**

|                                       | LIST     | SALE           |                        | LIST     | SALE           |
|---------------------------------------|----------|----------------|------------------------|----------|----------------|
| Professional 80 Column Word Processor | \$149.95 | <b>\$99.00</b> | Payroll                | \$149.95 | <b>\$99.00</b> |
| Professional Data Base                | \$149.95 | <b>\$99.00</b> | Inventory              | \$149.95 | <b>\$99.00</b> |
| Accounts Receivable                   | \$149.95 | <b>\$99.00</b> | General Ledger         | \$149.95 | <b>\$99.00</b> |
| Accounts Payable                      | \$149.95 | <b>\$99.00</b> | Financial Spread Sheet | \$149.95 | <b>\$99.00</b> |

**PRINTER REPLACEMENT OPTIONS**

(replace the 4023 with the following at these sale prices)

|                                                            | LIST     | SALE            |
|------------------------------------------------------------|----------|-----------------|
| • Olympia Executive Letter Quality Serial Printer          | \$699.00 | <b>\$399.00</b> |
| • Comstar Hi-Speed 160 CPS 15 1/2" Serial Business Printer | \$779.00 | <b>\$499.00</b> |
| • Telecommunications Deluxe Modem Package                  | \$199.00 | <b>\$139.00</b> |

**15 DAY FREE TRIAL.** We give you 15 days to try out this SUPER SYSTEM PACKAGE!! If it doesn't meet your expectations, just send it back to us prepaid and we will refund your purchase price!!

**90 DAY IMMEDIATE REPLACEMENT WARRANTY.** If any of the SUPER SYSTEM PACKAGE equipment or programs fail due to faulty workmanship or material we will replace it IMMEDIATELY at no charge!!

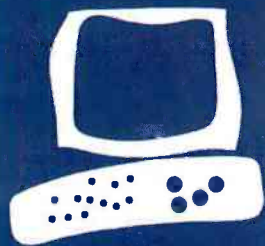
**Add \$50.00 for shipping and handling!!**  
**\$100.00 for Alaska and Hawaii orders.**

**WE DO NOT EXPORT TO OTHER COUNTRIES**

Enclose Cashiers Check, Money Order or Personal Check. Allow 14 days for delivery, 2 to 7 days for phone orders, 1 day express mail!! We accept Visa and MasterCard. We ship C.O.D. to continental U.S. addresses only.

**PROTECTO ENTERPRISES** (WE LOVE OUR CUSTOMERS)

**BOX 550, BARRINGTON, ILLINOIS 60010**  
**Phone 312/382-5244 to order**



## The Zenith Z-150 PC

This IBM PC  
clone is  
also available  
in kit form

BY WAYNE RASH JR.

If you're shopping for an IBM PC-compatible computer, take a look at Zenith's entry into this market, the Z-150. Zenith has produced an almost perfect clone at a very reasonable price.

A Z-150 with two 360K-byte disk drives, an RS-232C serial port, a Centronics-type parallel port, and 320K bytes of RAM (random-access read/write memory) retails for \$2799 (see photo 1). And it runs at the same clock rate, too. Electronically, the Z-150 is as identical to the IBM PC as it legally can be. Physically, the Z-150 is smaller and lighter than most other IBM PC-compatible machines.

The benchmark tests I ran show that the Z-150 essentially duplicates the performance of an IBM PC in all areas except those involving disk access. I suspect that the half-height disk drives were responsible for the differences in this area. See the "At a Glance" page for the benchmark times.

When you turn on the Z-150, you will notice that it doesn't have a long memory test like the IBM PC has. The Zenith does test its memory, but the operation takes place quickly, so you're up and running soon after you power up.

Another difference between the Z-150 and the IBM PC will present itself if you don't put a disk in the Z-150's drive when you power up the system. The Z-150 does not run BASIC in ROM (read-only memory); like other compatibles, it uses a disk-based version of BASIC.

If you look inside the Z-150 you will see that there is no motherboard. The Z-150 uses a backplane to support its IBM bus; all of the other cards, including the central processor, are plugged into the backplane. This arrangement is much more compact than that of the IBM PC.

### HARDWARE

The Z-150 uses half-height disk drives. In the floppy-disk version, the two drives are stacked one above the other, with drive A on top. The hard-disk version has the floppy

disk on top and the hard disk below.

The drives supplied with the Z-150 are manufactured by Mitsubishi and operate somewhat differently from other 5¼-inch disk drives. In fact, if you have used 8-inch drives, you will probably feel a sense of déjà vu when you first use the Mitsubishi drives. You insert the disks against spring tension until they click into place and then you close the latch. You can remove the disks by pressing a bar opposite the latch. When the disk-drive door opens, the disk pops out about an inch, just like with 8-inch drives.

The Mitsubishi drives operate quietly, but you will notice a clicking sound when you select them. In normal use they perform flawlessly.

It's easy to remove the Z-150's metal cover. When you take the cover off, you will notice that the compact switching-power supply is located behind the disk drives. The rest of the interior is for circuit boards. The power supply provides 168 watts, so you should be able to run the computer with every slot filled.

The backplane containing eight IBM PC XT-compatible expansion slots is to the left of the power supply (assuming you're standing in front of the computer). On a floppy-disk-based Z-150 four of these slots will be filled with the disk controller, video card, central-processor card, and a memory card containing 320K bytes of RAM. If you have a hard-disk Z-150, the last slot will hold the drive controller.

The backplane has five LEDs (light-emitting diodes) that provide diagnostic information. As the computer is powered up, each of these LEDs comes on; if the system fails to boot, you can tell at a glance where the failure took place.

Each of the Z-150's cards has more than one function. The central-processor card also contains the audio amplifier and generator for the computer's speaker and the connections for the keyboard. The speaker and a green LED pilot light are attached to the central-processor card. The

Wayne Rash Jr. is a member of the professional staff of American Management Systems Inc. of Rosslyn, Virginia. He consults with the federal government on microcomputers.

video board provides signals for both NTSC (National Television System Committee) composite and RGB (red-green-blue) color monitors. It is functionally compatible with the color-graphics card on the IBM PC. The disk-controller card operates the floppy disks that are built into the computer and has a connector that will let you attach two more disks externally. In addition, the RS-232C serial port is on this card. The memory card contains 320K bytes of RAM and the parallel printer port. When you get a Z-150, it comes complete, and there are still four expansion slots free.

If you choose to use the Z-150 with a monochrome monitor, colors will be represented by eight shades of gray. The video board offers either high resolution of 640 by 200 pixels or medium resolution of 320 by 200 pixels. Bit-mapped graphics are supported, and text resolution is either 80 or 40 characters by 25 lines.

The Z-150 has an Intel 8088 microprocessor operating at 4.77 MHz. It also has a socket for the Intel 8087 math coprocessor. The central-processor card plugs into the expansion bus just like all the other cards. This means that you can remove the central-processor card to repair the machine or to change switch settings. The central-processor card is longer than the other cards, so you have to bend it to get it out of the chassis. The board appears to be fairly tough. Despite the fact that I repeatedly removed and replaced cards, I never managed to break the board.

### GETTING STARTED

To begin using the system, turn on the computer (the switch is on the right rear of the cabinet) and the monitor. After the short memory test, the system will boot. You can disable the automatic boot feature, just as you can on Zenith's other computers. If you prefer, you can override the boot by pressing the Control, Alternate, and Insert keys at the same time to enter the monitor.

The Z-150 monitor ROM has an extensive

set of diagnostic tools for the technically inclined user. As the monitor starts up, you are told how much memory is available and that you may enter a question mark for help. This request will give you an extensive menu of options to choose from, including everything from a full diagnostic test to a color-bar display. Other options allow extensive memory manipulation, program execution, tracing and disassembly, and performing input and output to, or from, any port. You can also choose various text and graphics modes and pick a fast hardware scrolling mode or smooth scrolling for graphics. At this point you also tell the

*(continued)*



Photo 1: A Z-150 with two 360K-byte disk drives.

system to emulate the Zenith Z-100's video if the Z-319 circuit board is present.

### THE KEYBOARD

One of the most persistent complaints about the IBM PC concerns its non-standard keyboard. Touch-typists find the odd locations of the Shift and Return keys frustrating. Had IBM used a keyboard similar to the Z-150's (as it did in the IBM PC AT), this criticism would have been avoided. The Z-150 has the same keyboard layout as the IBM Selectric typewriter, although obviously some keys have been added (see photo 2). The feel of the keys is similar to that of the excellent Z-100 keyboard.

The Caps Lock and Num Lock keys have LEDs embedded in them so you can tell when they are toggled. These LEDs work fine when you actuate the key yourself, but they give no indication if they are toggled by software. There is an Enter key to the right of the numeric keypad, which makes using the numeric keypad a little easier than using the IBM PC's numeric keypad.

Other than the placement of the Shift, Return, and Enter keys, the detachable Z-150 keyboard closely resembles that of the IBM PC. The function keys are in the same place,

and the bezel surrounding the keyboard is the same shape, so your templates will fit fine. (Incidentally, the Z-100's keyboard is plug-compatible with the IBM unit, and it is available separately.)

The Zenith keyboard has some of the same cryptic symbols on it as the IBM PC keyboard. Fortunately, the symbols are supplemented by words explaining their function. This can be helpful to people who use computers infrequently.

The keyboard can generate the full ASCII character set, as well as block graphics and some international, mathematical, and scientific symbols. There are some 256 characters available. An electronically generated key click is also available.

### USING THE Z-150

The Z-150 operates unobtrusively. It does not have roaring fans or grinding disk drives, and the keyboard is quiet. The only noise you will notice it making is an occasional software-generated "beep."

When using the Z-150 there are no troublesome conversions or alternate installations to make. You don't even have to worry about which operating system is on the disk you are trying to boot. IBM's PC-DOS runs fine on the Z-150, and the Z-150's MS-DOS

runs fine on the IBM. However, you will run into a problem if you swap operating systems and then try to use BASIC. BASICA on the IBM requires ROM BASIC, but the Z-150's BASIC is on disk.

I do have one complaint about the monitor that came with the Z-150 I reviewed. Zenith's ZVM-122 green monochrome monitor does not have nonglare glass so reflections were always a problem. Zenith's other monitors do have nonglare screens, and I think you will find it worth the slightly higher price to buy one of those. Incidentally, almost any monitor (except the IBM green monitor) will work with the Z-150 because it has both composite-video and RGB output jacks.

### SOFTWARE

Unlike some other IBM PC-compatible computers, the Z-150 does not come bundled with a lot of software. Even BASIC is optional. In fact, the only software it does come with is Microsoft's MS-DOS, but both versions 1.25 and 2.11 are included, so you should be able to run almost any program you can find for the IBM PC on the Z-150. Also included with the Z-150 is an excellent demonstration disk that introduces new users to the machine.

Because a great many IBM programs depend on your system having BASIC, you will probably have to buy Microsoft's GW-BASIC (\$100 list price). GW-BASIC is an almost perfect emulation of the BASIC used by the IBM PC. I could not find any software designed for IBM's BASICA that did not run under GW-BASIC.

### DOS UTILITIES

Every Z-150's MS-DOS comes with all of the standard MS-DOS files plus several added by Zenith to make life easier for the user. In some cases these programs are similar to ones you would get with PC-DOS.

One of these added utility programs, Configur, has been a Heath/Zenith standard since the company first started using CP/M. Although the content of this utility has changed ac-

(continued)



Photo 2: The Z-150's 84-key keyboard.

## AT A GLANCE

### Name

Zenith Data Systems Z-150

### Manufacturer

Zenith Data Systems  
1000 Milwaukee Ave.  
Glenview, IL 60025  
(312) 391-8744

### Dimensions

Central processor: 17 by 16  
by 6 inches  
Keyboard: 8 by 18½ by 1¼  
inches  
Weight: 41 pounds

### Components

Processor: 4.77-MHz 8088  
Memory: 320K bytes of RAM  
Display: 80- by 25-character  
line display includes graphics  
and smooth scrolling  
capability; graphics resolution  
is 320 by 200 pixels with four  
colors or 640 by 200 with two  
colors  
Keyboard: IBM PC-type  
Mass storage: two 360K-byte  
half-height double-sided  
double-density floppy-disk  
drives

### Communications

One parallel port, one  
RS-232C serial port

### Software

MS-DOS versions 2.11 and  
1.25

### Options

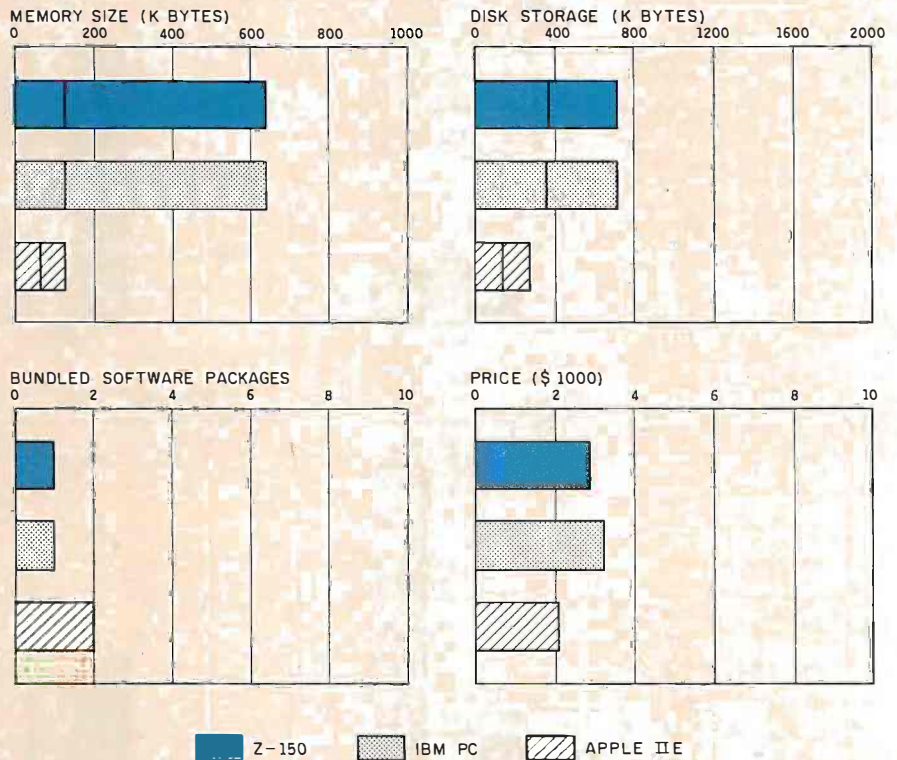
10.6-megabyte hard disk:  
\$1499; 8087 coprocessor:  
\$225; Z-319 high-resolution  
video board: \$499; ZVM-133  
RGB color monitor: \$599;  
GW-BASIC: \$100

### Documentation

Z-100 PC operations manual,  
includes user's guide and  
hardware manual

### Price

\$2799  
With monochrome monitor and  
GW-BASIC: \$3040

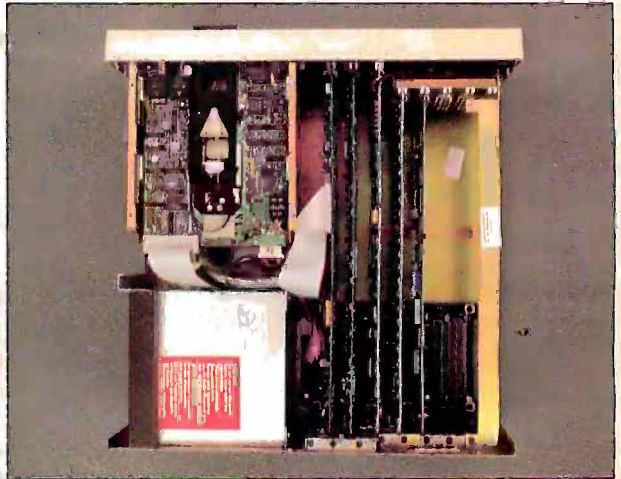


The Memory Size graph shows the standard and optional memory available for the computers under comparison. The graph of Disk Storage capacity shows the highest capacity of one and two floppy-disk drives for each system. The Bundled Software Packages graph shows the number of software packages included with each system. The Price graph

shows the list price of a system with two high-capacity floppy-disk drives; a monochrome monitor; graphics and color-display capability; a printer port and a serial port; 256K bytes of memory (64K for 8-bit systems); the standard operating system for each system; and the standard BASIC interpreter for each system.

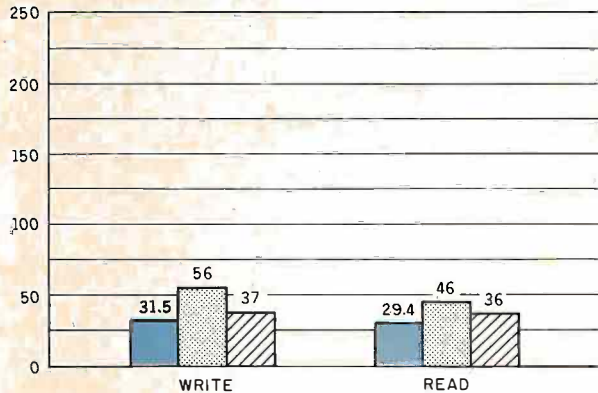


The rear of the Z-150 computer looks almost the same as the rear of an IBM PC.

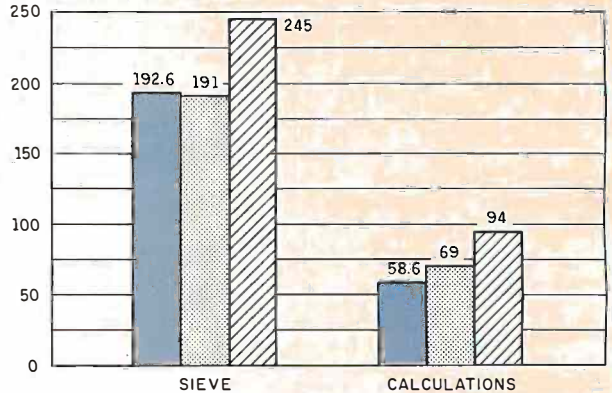


The inside of the Z-150. Note that there is no motherboard in this computer.

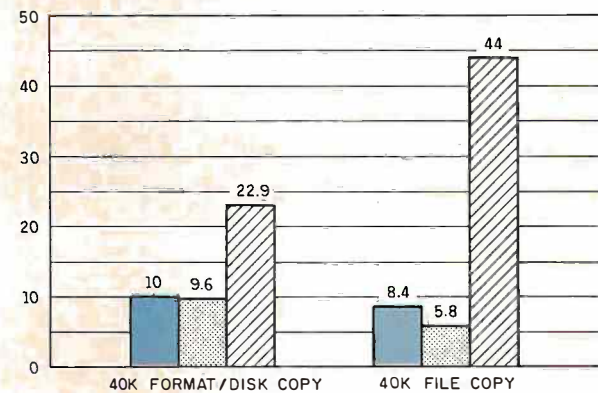
**DISK ACCESS IN BASIC (SEC)**



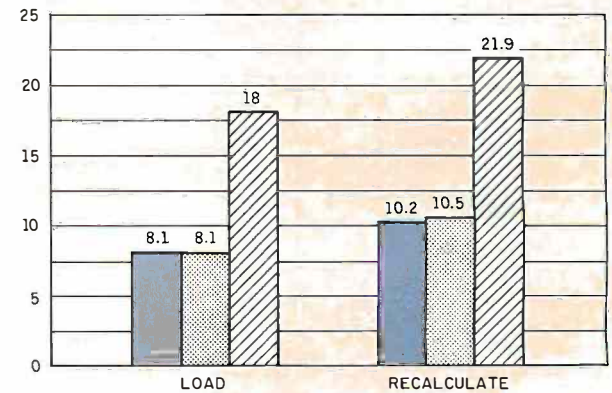
**BASIC PERFORMANCE (SEC)**



**SYSTEM UTILITIES (SEC)**



**SPREADSHEET (SEC)**



■ Z-150    ▨ IBM PC    ▩ APPLE II E

The graphs for Disk Access in BASIC show how long it takes to write a 64K-byte sequential text file to a blank floppy disk and how long it takes to read this file. (For the program listings see June BYTE, page 327 and October, page 33.) The Sieve graph shows how long it takes to run one iteration of the Sieve of Eratosthenes prime-number benchmark. The Calculations graph shows how long it takes to do 10,000 multiplication and division operations using single-precision numbers. The System Utilities graphs show how long it took to for-

mat and copy a disk (adjusted time for 40K bytes of disk data) and the Spreadsheet graphs show how long the computers took to load and recalculate a 25-by-25-cell spreadsheet where each cell equals 1.001 times the cell to its left. The spreadsheet program used was Microsoft Multiplan.

The tests for the Apple IIe were done with the ProDOS operating system. The Apple IIe Multiplan test was done with DOS 3.3. The IBM PC was tested with PC-DOS 2.0.



cording to the computer for which it is designed, its general purpose has always been to match the operating system to the peripherals.

As the state of the art in microcomputing has progressed, the complexity of the Config program has decreased. To use this program with the Z-150, the only thing you have to do is tell the operating system about the communications ports. Normally, the operating system assumes that the Z-150 is using a parallel printer and that the first serial port, COM1, is being used for a modem connection. You can change this if you have a serial printer by mapping the parallel output to either one of the serial ports. You can also reconfigure the serial ports as necessary. To operate the Config program you use a menu containing most common choices. You can even set the system up for many of the most common serial printers and modems by using the menu. If your printer is not listed, you can assign almost any value to the serial ports, and the computer will prompt you for the information it needs.

Another well-known Zenith utility that was carried over from the Z-100 is RDCPM. This program can read a CP/M disk directory and transfer files from CP/M disks to MS-DOS disks. According to the Z-150's manual, this utility can read CP/M-86 disks from the IBM PC and the Z-100, and CP/M disks from the Z-100. This utility also lets the Z-150 read soft-sectored Heath CP/M disks and Radio Shack Model 4 CP/M+ disks. If you already have a machine that can write the Z-100 CP/M disk format (such as a Kaypro with Uniform), you will be able to trade data between machines at will. The RDCPM utility can make a great deal of difference when the time comes to buy an additional computer.

The Cipher utility program allows you to encrypt and decrypt disk files. This utility is handy when users of hard-disk-equipped machines must let a number of other people use them.

The FC utility is the same as the Comp utility that comes with PC-DOS. Both of these utility programs let you compare disk files to see if they are

identical, but the FC program is more flexible. It lets you set software switches to force a binary comparison or to ignore case when comparing the files.

The PSC utility is an expanded version of PC-DOS's Graphics utility. The PSC program lets you print graphics screens on any one of six printers: IDS, MPI, Okidata, Epson MX-80, Printek 920, and Transtar 315. Once the Z-150 is in the graphics mode, you can print any graphics screen by pressing the Shift and Print Screen keys.

The Z-150's Search utility lets you search the main directory and all sub-directories for a particular file or for several files. The Search program will also display a graphic representation of the directory structure. This utility is somewhat similar to the PC-DOS Tree utility, although it is more flexible and has more functions, such as the ability to find a specific file.

The Sort program allows you to sort the contents of a file, usually to another file or output device. You can also sort the disk directory by sending the directory listing to Sort and then to the screen. This is helpful when you use MS-DOS's "pipes." You can pipe the output from one file or device into Sort. The output from Sort can go to a device such as the screen or a printer or it can go to yet another file.

The Apply utility also makes good use of the MS-DOS pipes. This program can be used to provide a list of files upon which a certain program is to act. One obvious use for this is to provide a list of files to be backed up and have them copied to another disk one at a time.

## DOCUMENTATION

Zenith and Heath have long been known for the quantity and the quality of their documentation. Although there is not as much documentation for the Z-150 system as there is for the Z-100, the quality remains high.

The Z-150's 50-page user's guide explains the basic operation of the system and shows you how to hook up your peripherals. The explanations and illustrations are clear. The manual

tells you how to keep the case clean and who to call if you need to get your computer fixed. This book explains a few technical terms, but for the most part it is written for the beginning user.

Experienced users will find the hardware manual more useful. For example, this manual tells you the proper settings for the DIP (dual-inline package) switches when you expand memory. Most of the features of the Z-150 are described in some detail, although the explanations are not as thorough as they might have been in earlier Zenith manuals.

The hardware manual is useful as a sort of quick-reference guide. You will find short explanations of MS-DOS commands, the use of the monitor ROM, and the diagnostic LEDs. This manual also contains charts and lists of specifications. Finding what you need is not difficult because the index is excellent. The appendix contains a complete glossary, so even if you're new to computers, you will be able to understand the manual.

The hardware manual is written clearly and concisely. It includes drawings and diagrams that add a great deal to the explanations and make them understandable to most users. In fact, most users will probably never need any more of a hardware manual than this.

The End User Demonstration Disk is not listed as a part of the documentation, but it should be. It is one of the best computer orientations I have encountered. For example, the hardware portion of the demonstration takes you on a tour through the parts of the computer, drawing each one on the screen and telling you about it. It also highlights the drawings where necessary to aid the discussion. You start the demonstration program using a batch file, so a novice user need not even know how to get a program up and running.

The orientation program is divided into five parts; to select one you choose it from a menu. I drafted a novice user to try out this program, and her response was positive. With

*(continued)*

it, she was able to learn enough about the Z-150 to begin using it immediately.

Users who like detailed technical documentation will love the MS-DOS manual. It is complete, detailed, and large. Fortunately, it is also organized so that less experienced users will be able to find out what they need to know without being bogged down.

This usually is done by labeling parts of each section as "Basic" or "Advanced" concepts. Readers are also shown what the screens will look like when the program is run, and each of the possible responses is explained.

#### SERVICE AND SUPPORT

Zenith has a number of authorized repair facilities around the country

and overseas. You can also have your Zenith computer repaired at a Heathkit store if one is nearby. Although you have to bring your computer to the Heathkit store to have it fixed, the other repair stations will fix your computer at your location. Zenith is the only manufacturer I know of that will do on-site warranty service.

I never needed service for the Z-150.

## BUILDING THE H-150 COMPUTER KIT

BY HENRY B. COHEN

Assembling the Heathkit H-150 computer kit is fairly straightforward. The manual takes you smoothly through the first steps (building and testing three printed-circuit boards) but leaves you searching for the final assembly process. You have to look in three different places to find all the directions. It took me about 22 hours to build the computer to factory quality. A Heathkit store manager told me that the average time to assemble the H-150 was 20 hours. Heath even includes a practice soldering course so that novices won't make mistakes soldering the H-150 together.

As with any complex electronics kit, and especially one subject to upgrades, addenda abound. There were roughly 20 pages of corrections to be added into the manual. I found it helpful to mark the manual wherever the addenda sheets called for a change and reference the addenda sheets as necessary.

To save time, place the parts in separate piles or cups before you begin to stuff and solder a board. Then sort the different-sized chip sockets into groups. I think it's a waste of time to check the parts against the parts list—if you're missing anything you'll find out soon enough as work progresses.

Even through the manual illustrates the parts, it's sometimes hard to find them. When this happens, it's best to work around the part you can't identify; eventually it will show up.

In its manual, Heath recommends certain tools you should have to complete the project. The list is helpful, but you'll need other tools as well. A volt-

meter is essential for calibrating the disk-controller circuit board and an ohmmeter is necessary for resistance checks of all boards. You'll need either a VOM (volt-ohmmeter), digital voltmeter, or multimeter, which are similar products. It is also preferable to use a temperature-controlled soldering station and an automatic wire stripper; a desoldering station would be handy for those prone to hurried work and errors.

Heath provides much more solder than you actually need. This is a good idea but it may invite oversoldering. Use the minimum amount of solder necessary to completely solder a part to the board. There should be no open areas around a connection and each connection should be well rounded and shiny. Since the board has a tendency to swallow solder through capillary action, don't be surprised if a joint is flat. With a heat-controlled iron you can solder first for integrity, and then go back at a lower heat to solder for appearance.

To ensure that all sockets lie flat use adhesive tape to hold them to the board, then solder the first pin of the first row and the last pin of the second row. Remove the tape and solder all the pins.

Solder flux—the shiny, dirty residue you won't find on factory boards—can be removed from a completed board with Carbona or a commercial flux remover and a toothbrush. It is important to remove the residue because the board will be electronically better, it will look professionally constructed, and by removing the residue you may reveal a hidden imperfect joint.

On the factory-built disk-controller board, the two controls that set critical voltages are topped with a dot of melted wax. You can duplicate their appearance by melting a crayon over the adjustment screws after you've finished calibration.

To facilitate the installation of all chips, the pins must lie perpendicular to the bodies. Carefully bend them as shown in the manual. None will fit smoothly without this adjustment.

Why *build* a Heathkit when you can buy a *factory-built* version (under the Zenith Data Systems name) from a discount dealer for the same money?

Because with the kit you get a diagnostics program on disk and a service manual that would cost about \$200 if ordered separately.

If you build your own it will also be easier for you to upgrade your kit. You know how it's put together and have learned how to configure or reconfigure it. If the high cost of Heath-supplied memory leaves you cold, you can buy the same chips from a mail-order house at a fraction of the cost. It couldn't be quicker or easier.

For users who need to run specific programs this might not be important, but for those of us interested in computing as a tool, a hobby, or an avocation, these "fringe" benefits are invaluable. My machine works as well as any from the Zenith plant and my boards are every bit as good as those factory-assembled.

Henry B. Cohen (240 East 35th St., New York, NY 10016) is technical editor of *Electronic Games and Home Electronics* editor of *Mechanics Illustrated*.

although I once had a Z-100 repaired. That time the repair was completed within a few hours after my call. I did call Zenith's technical service department about the Z-150 shortly after I received it. I wanted to add more memory, and at that time the hardware manual was not available. The service department was courteous and helpful and they gave me precisely the information I needed over the telephone.

Software support for the Z-150 seemed to be good also, although I didn't need much help in that area. If the software technicians don't know the answer to your question, as sometimes happens, they will find out the answer and call you back. The biggest problem in getting help from the company is getting them on the phone. They don't have a toll-free number and the lines are frequently busy.

#### CONCLUSIONS

The Zenith Z-150 PC could be the best deal around for someone who needs an IBM PC-compatible desktop computer. It costs a great deal less than a similarly configured IBM PC, it takes up less space, and it has more room for expansion.

The problems I encountered while reviewing this machine were minimal. One serial port could not be configured when I first received the system but that was corrected through a ROM upgrade. The hardware manual was not available at first, which made expansion of the machine difficult.

The Z-150 is a sturdy, well-designed machine that should provide reliable service. It is backed by a company with a solid reputation for quality and service. About the only way to get a better deal would be to buy the Heath version of the computer and build it yourself. [Editor's note: In fact, the kit version is more expensive, because you can buy an assembled Z-150 with 360K bytes of memory for about \$2000 from some dealers, whereas a kit with all the features of the Z-150 costs about \$2100. As to why anyone would want to build the kit, see the text box "Building the H-150 Computer Kit," on page 258.] ■

# "MY FAVORITE MODEM"

is the X100 POPCOM from PRENTICE.

Mark Klein  
Fall 1984 BYTE Guide  
to the IBM PC

"The POPCOM works well with practically any data communications program — from the simplest to the most complex."

Frank J. Derfler, Jr.  
August 21, 1984,  
PC MAGAZINE

"This modem offers extra features for 20% less than a Hayes Smartmodem 1200."

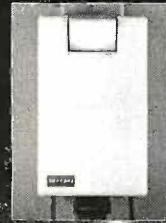
Steven Satchell  
July 23, 1984, Info World

We couldn't have said it better ourselves.

PRENTICE

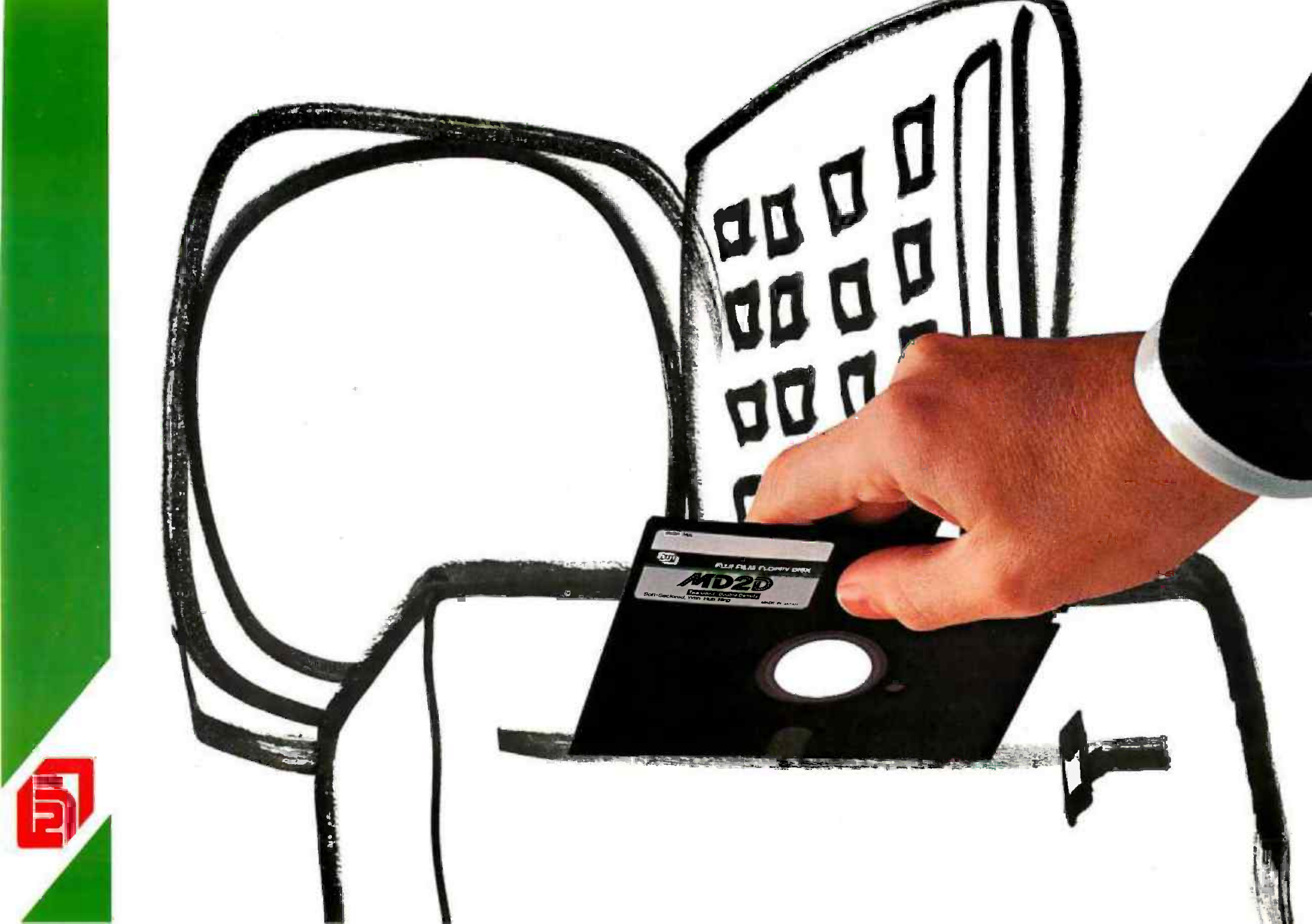
# POPCOM™

PERSONAL COMPUTER MODEMS



POPCOM™ is a trademark of PRENTICE Corporation

P.O. Box 3544  
266 Casplan Drive  
Sunnyvale, CA  
94088-3544



# A year's worth of reports, plans, schedules, charts, graphs, files, facts and figures and it could all be lost in the blink of an eye.

The most important part of your computer may be the part you've considered least—the floppy disk. After all, there doesn't seem to be much difference between one disk and another. But now Fuji introduces a floppy disk that's worth a second look.

We designed our disk with the understanding that one microscopic imperfection can erase pages of crucial data. That's why every Fuji Film Floppy Disk is rigidly inspected after each production process. And that's why each one is backed with a lifetime warranty.

We've even considered how carefully a disk has to be handled, so we designed user-friendly packaging that makes it easier to get the disk out of the

box. And we provided plenty of labeling space, so you won't have any trouble telling which disk is which.

So think twice before buying a floppy disk. And then buy the one you won't have any second thoughts about. Fuji Film Floppy Disks.



## FUJI.

Nobody gives you better performance.

Circle 394 on inquiry card.

# \$18,000\*



# \$10,000\*\*



## The Choice is Yours

The time has come when one computer just isn't enough. You have a choice. . . add more personal computers or move up to multi-user with the **CompuPro 10 PLUS**.

Personal computer networks are one alternative. But in a four-user network, you'll need four personal computers plus a networking package. . . **Cost . . . \$18,000.\***

In contrast, the CompuPro 10 is specifically designed to be a four-user microcomputer. One fully-integrated system with multi-user capability. . . **Under \$10,000.\*\***

Price isn't the only advantage CompuPro 10 has over networked personal computers.

The CompuPro 10's multi-user operating system allows you to run both 8- and 16-bit software at the same time. So you can choose from a library of over 3,000 programs, as well as use your existing CP/M<sup>®</sup> software. And our innovative multi-processor design lets you work faster without the performance degradation associated with personal networks.

For a complete demonstration, visit one of our **Full Service CompuPro System Centers**. Or call (415) 786-0909, ext. 206 for the System Center nearest you.

**Don't get personal, get CompuPro.**

# CompuPro<sup>®</sup>

3506 Breakwater Court, Hayward, CA 94545

\*Suggested list price for four popular personal computers, 40 Mb of hard disk storage and network package. \*\*Includes CompuPro 10 PLUS with 1 Mb RAM, 40 Mb hard disk and applications programs (\$7995 list), plus four terminals. CP/M is a registered trademark of Digital Research, Inc. © 1984 CompuPro

# TK!Solver

## A tool for scientists and engineers

BY ALAN R. MILLER

**A**n application program for solving general mathematical expressions, TK!Solver is most useful to scientists and engineers. It is available for the IBM Personal Computer (PC), PC-compatibles, and the Apple IIe. I used the IBM PC-DOS version for this review. I also briefly tried a CP/M-86 version running on a Digital Equipment Corporation (DEC) Rainbow. The list price of TK!Solver is \$400, but prices as low as \$300 appear in advertisements.

Programming languages such as BASIC and Pascal are useful for performing a sequence of operations and printing out the results. The user's source program includes branching and looping instructions to control the course of the operations. The program seems to grow larger and larger with time. Spreadsheets, on the other hand, are useful for analyzing tables of data. Frequently, time is one coordinate of the table. Although TK!Solver shares some features of each, it is neither a programming language nor a spreadsheet. TK!Solver emphasizes the solution of equations written in their usual form rather than the manipulation of a matrix of data cells.

To use TK!Solver you type one or more mathematical equations and define the variables used. But you do not write a computer program. Many commands begin with the slash (/) symbol, similar to spreadsheet programs like VisiCalc and SuperCalc. Then a list of valid secondary commands appears at the top of the screen.

In some ways, TK!Solver is like the APL programming language (see references 1 and 2). The first similarity is that, in both, scalars and vectors are assigned symbolic names that are used in expressions. Secondly, both have a direct mode and an equation-solving mode. However, TK!Solver expressions are written in the natural style of mathematics rather than in the form used with languages such as BASIC and Pascal. For example, the expression  $EXP(X) = 4 * X$  is in a form that can be solved by TK!Solver. However, the equation can also

be written as  $4 * X = EXP(X)$  or  $EXP(X) - 4 * X = 0$ , and TK!Solver can find the solution. By comparison, the expression would have to appear as  $Y = EXP(X) - 4 * X$  to be used in a BASIC program.

### GETTING STARTED

TK!Solver appears to be a very complex program. Its voluminous manual is difficult to follow. A companion text, *The TK!Solver Book* (see reference 3), provides much additional information, but it is a bit formidable. Fortunately, TK!Solver is really very easy to use when taken little by little.

The TK!Solver disk for the IBM PC version cannot be duplicated, and the main program, TK.COM, cannot be copied to another disk. However, you can speed up the operation by copying the auxiliary programs to a rigid disk or a semiconductor disk. But you first have to boot DOS (disk operating system).

You next place your regular system disk in the left drive (drive A) and turn on the computer. If you have a rigid disk, make that your default drive (drive C). Alternatively, set up a semiconductor RAM (random-access read/write memory) disk in memory for drive C if you have the software and at least 250K bytes of memory. You have to allot 125K bytes to this RAM disk.

After you establish a small print buffer in memory (if you have the software), printouts of various TK!Solver screens can be rapidly obtained. Place a backup disk in the right drive (drive B) so you can save the models you create.

After the computer has started up, you replace the system disk in drive A with one of the two duplicate TK!Solver disks. Then you copy the programs TK.OVL and TK.HLP to your working drive. This is drive C if you use a semiconductor disk or a hard disk, otherwise use drive B. Make your working drive (B or C, depending on your hardware configuration) the default disk. The command A:TK executes the main program

(continued)

Alan R. Miller, a BYTE contributing editor, is a professor at New Mexico Institute of Mining and Technology (Metallurgy Dept., Socorro, NM 87801) where he has taught materials science, thermodynamics, electrical engineering, and programming methods since 1967. He holds a Ph.D. in engineering from the University of California at Berkeley and has written six books on computer languages.

## AT A GLANCE

### Name

TK!Solver

### Type

Application program for solving mathematical equations

### Manufacturer

Software Arts Inc.  
27 Mica Lane  
Wellesley, MA 02181

### Computer

IBM PC and compatibles with PC-DOS, 256K RAM; DEC Rainbow with CP/M-86, 512K RAM; Apple IIe

### Minimum Hardware and Operating System

One disk drive, 96K bytes of RAM, PC-DOS 1.1 or 2 or CP/M-86

### Format

5¼-inch floppy disk (two identical copies)

### Documentation

240-page manual; 16-page reference card; eight program models

### Price

\$400

### Audience

Scientists and engineers

from drive A. After TK!Solver starts up, you can remove the original TK!Solver disk and replace it with the system disk.

When TK!Solver starts up, it displays a title page with the version number and copyright notice. Press the Enter key to begin. There are 13 different tables known as sheets and sub-sheets; however, only one or two sheets are shown at any one time.

TK!Solver then displays two sheets—the Variable sheet on the top half of the screen and the Rule sheet at the bottom. You enter equations in the Rule sheet and define variables in the Variable sheet. You enter information at the location of the cursor, a reverse-video block on the screen. TK!Solver

starts with the cursor in the Rule sheet because you begin a problem by entering equations there.

Before explaining how to solve an equation, let me discuss how to use the calculator mode.

### CALCULATOR MODE

Values can be defined by entering numbers in the Variable sheet. However, it is also possible to enter a mathematical expression and let TK!Solver calculate the value. By this means you can directly determine the value of an expression. This is the calculator mode.

A TK!Solver number can have as many as 11 significant digits, and the exponent can be as large as 120. You can formulate expressions with the usual +, -, \*, and / operators. The BASIC symbol ^ is used for exponentiation. However, the \*\* symbol of FORTRAN is not recognized. There are 17 built-in functions, including SQRT, SIN, ATAN, LN, and PI.

If you enter an expression into the Variable sheet that contains only numbers and operators, TK!Solver provides the answer immediately. For example, if you move the cursor in the input cell of the Variable sheet by pressing the semicolon key, type the three characters 1/3, and then press the Enter key or the down-arrow key, the answer replaces the original input. This is a convenient way to define constants needed for input. For example, you can enter the expression  $\text{PI}() / 180$  when you need to convert from degrees to radians. (The TK!Solver function PI needs an empty pair of parentheses to indicate it is a function.)

### DIRECT-SOLVER MODE

The direct-solver mode can solve an equation if two conditions are met: the unknown variable must not appear more than once in an equation, and the unknown may not appear as an argument to a function that does not have an inverse (for example, ABS, MOD, and INT). Thus, the equation  $X^2 - 2 = 0$  can be solved directly since X appears only once. The positive root is generated. But the

mathematically equivalent expression  $X * X - 2 = 0$  is solved iteratively since X appears twice. Then either root can be found, depending on the initial guess.

TK!Solver variables are formed with all the letters of the alphabet, the digits 0 through 9, the underline, and the @, #, \$, and % symbols. Names can be as long as 200 characters. Of course, a digit must not be used for the first character of a name.

While typing information, you can delete the previously entered character by pressing the Backspace key (but not the left cursor key). The entire line can be canceled by pressing the Break key. Each line is completed by pressing the Enter key or one of the four cursor keys.

After a line is completed, you can alter it with the edit command by moving the cursor to the desired field and typing /E. You can then move the cue, an underline character within the cursor, back and forth in the line by pressing the left and right cursor keys. Any character you type is inserted into the line at the position of the cue. Remaining characters are moved to the right. Pressing the Backspace key deletes the character to the cue's left.

### THE VARIABLE SHEET

TK!Solver automatically adds the variables, such as Y and X, to the Variable sheet when you enter an equation into the Rule sheet. You move the cursor to the upper sheet by pressing the semicolon key. You use the cursor arrows to move the cursor to the input column of the line corresponding to a variable, such as X, in the Variable sheet.

The reverse-video block is where an entry goes. Suppose you define the value of X to be 3. You first press the 3 key, then press either the Enter key or one of the cursor keys. The Enter key leaves the cursor in the current cell, and the cursor key moves it in the desired direction.

After you define the value of X, TK!Solver can calculate the corresponding value of Y with the direct-solver command. Press the ! (exclama-

(continued)



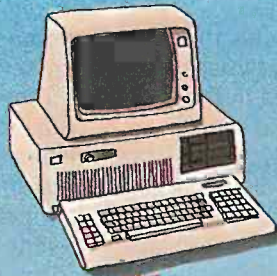
# The PCturbo 186™ takes a good computer and makes it the BEST!



*Good*

## PC

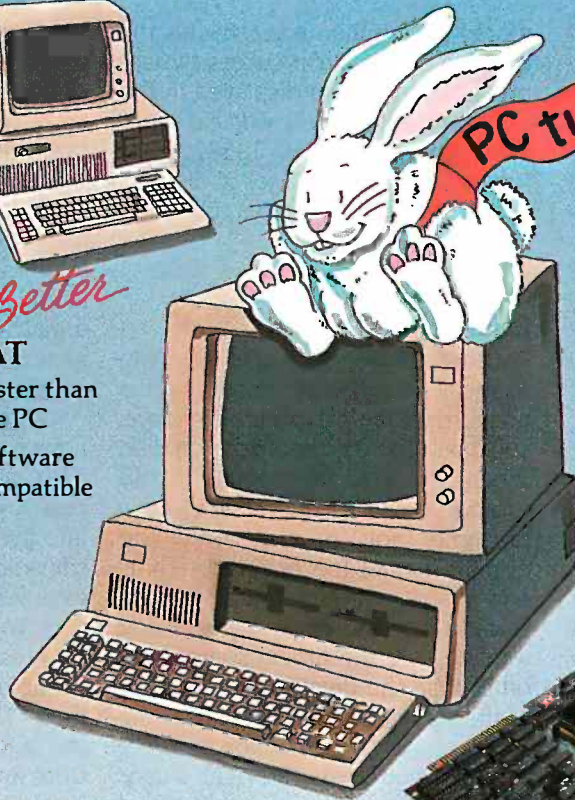
- Vast selection of software



*Better*

## PC AT

- Faster than the PC
- Software compatible



**PC turbo 186**

*Best!*

## PC + PCturbo 186

- Faster than the PC
- Total software compatibility
- Automatic Disk Caching
- More affordable than a PC AT
- 80186 works in complement to 8088



## Orchid's PCturbo 186

First the standard was the IBM™ PC. Then it became the IBM PC AT with its high processing speed. For those, however, who have an IBM PC and need PC AT-like performance, Orchid Technology will put you out in front again with a new standard—the PCturbo 186. The PCturbo outperforms the PC AT in speed with fast disk access, and unmatched performance while providing complete software compatibility.

Best of all, PCturbo allows you to protect your existing hardware and software investment without the cost of replacing your existing PC or the need to learn to use a new computer and its software. Simply install the PCturbo adapter board and Orchid's "Productivity Software" and your PC becomes a powerful turbo-driven computer.

The PCturbo 186 is actually a second computer within your PC. Powered by the advanced Intel 80186 processor, the PCturbo

is transparent to your favorite programs like Lotus 1-2-3™, Symphony™, dBase II or III™, Framework™ and Multimate™, running them at turbo speeds. So, with PCturbo, your PC looks and acts the same as before; it just runs faster.

While the PCturbo is speeding up your processing power the 8088 microprocessor in your PC takes care of the I/O functions. Most importantly, complete compatibility is assured since the PCturbo allows you to switch back and forth between Turbo Mode and PC Mode with a simple command.

Since PCturbo boosts the processing speed of your PC, there's no more waiting to recalculate spreadsheets or to retrieve data. With the unique built-in features like automatic disk caching, electronic RAM disks and print spooling, you can get even more done in less time. Now isn't that why you bought a PC in the first place?

### TECHNICAL DETAILS:

#### Hardware

- Single slot plug-in board with high-speed 16-bit processor (80186).
- Up to 640K memory expansion for a maximum of 1.28 Megabytes total memory.
- Simple "one-step" installation.

#### Software

- Runs IBM PC-DOS 2.x/3.x on either the IBM PC/XT and versions of most compatibles.
- Provides high speed disk caching, RAM disk and print spooling.
- Standard PC (8088) operation for total compatibility.

Write or call for more information today.



ORCHID TECHNOLOGY  
47790 Westinghouse Drive  
Fremont, CA 94539

(415) 490-8586 Telex: 709289

PCturbo 186 is a trademark of Orchid Technology. IBM is a registered trademark of International Business Machines Corporation. Lotus 1-2-3 and Symphony are trademarks of Lotus Development Corporation. dBase II, dBase III, and Framework are trademarks of Ashton-Tate. Multimate is a trademark of Multimate International.

Circle 294 on inquiry card.

DECEMBER 1984 • B Y T E 265

tion point) key to initiate the calculation action and the value 8.0855369 appears in the output column of Y. The result looks like figure 1.

Another feature of TK!Solver appears in the upper right corner of the screen. The "47 I" is a memory indicator. It gives the amount of working memory in kilobytes. When there is less than one kilobyte of memory left, the indicator changes to "Low." When there is no more available memory, the indicator says "Out."

### THE ITERATIVE-SOLVER MODE

As you have just seen, TK!Solver cannot directly solve for a variable that appears more than once or that appears in a function without an inverse. However, TK!Solver can find solutions by iteration if you enter initial approximations for the unknowns. You can see how this works by solving the previous equation for X instead of Y; that is, solve the equation  $0 = \text{EXP}(X) - 4 * X$ .

If you move the cursor to the input cell for Y in the Variable sheet, press the zero key and then the down cursor, the output value for Y disappears as the new input value is accepted. After the cursor has moved to the X-input position, you can enter a first approximation for X. When you press the 3 key and then the left arrow, the cursor moves into the first, or "status," column (labeled St).

Pressing the letter G on your keyboard while the cursor is in the status column of X (without pressing the Enter key or a cursor key) tells TK!Solver that the input value is a guess. (Pressing G a second time tells the program you're not guessing any-

more.) Hitting the ! key activates the iterative solver. Each successive approximation of X is displayed in the input cell replacing the original value. When the solution of 2.1532924 is found, the output cell for X displays it, and the input and status cells automatically clear.

### SAVING AND LOADING EQUATIONS

Because TK!Solver works in main memory, you lose information when you turn off the computer. Therefore, you must save your equations on disk. When you give the command /SS (storage, save), TK!Solver asks for a filename. You provide only the primary name; the extension TK is added automatically. You have to include a specific drive name if you want to save the model somewhere other than the default drive. If a file of the same name already exists, the program asks for permission to delete it. When you press the right cursor key, the names of previously saved models appear successively at the top of the screen.

Loading a saved model is easy. First you have to clear the current work area with the /RAY (reset, all, yes) command and then give the command /SL (storage, load). If you do not remember the model name, you just repeatedly press the right cursor key and the name of each saved model appears at the top of the screen. Pressing Enter selects the displayed name; Break aborts the command.

### WORKING WITH LISTS (VECTORS)

So far, each of the exemplar symbols I have mentioned has a single value.

But sometimes it is more convenient to assign several values to a single symbol. The symbol then refers to a list of data called a vector or a one-dimensional array. For example, if you wanted to find the relationship between temperature and pressure for five different values, you set up a list for T and another for P. Or you could investigate the relationship as a mathematical function,  $Y = f(X)$ , by generating a set of X values and calculating the corresponding Y values.

To create a list with TK!Solver, you have to clear the work area with the /RAY command and enter the equation  $Y = \text{EXP}(-B * X) * \text{COS}(C * X)$  into the Rule sheet. This is a damped sinusoidal curve that is one solution to a second-order differential equation. You move to the Variable sheet by pressing the semicolon key. The variables Y, B, X, and C are already there. Next, you move the cursor to the status column for Y (the far left side) and press the L (list) key. (This is the same column used for the G command in the previous problem.) Similarly, you move to the status column for X and press L again. The L symbol specifies that X and Y are list variables or vectors. After moving to the input column, you enter the values 0.3 for B and 4 for C and put a value of 0 in the input column of X. (This is apparently a bug. You shouldn't have to define a vector on the Variable sheet.) Figure 2 shows the result.

Values for the elements of a list are defined on the List subsheet. While the cursor is in the upper sheet, you give the =L command, which changes the upper part of the screen to the List sheet. Since you need the entire screen, you have to use the /W1 (one-window) command to temporarily remove the lower sheet. The vectors X and Y are already in the List sheet.

With the cursor on the row for vector X, you press the > key (known as the dive command) to change to the List subsheet for the variable X. Now enter 64 values for X. You could enter them one at a time, but it is much

(continued)

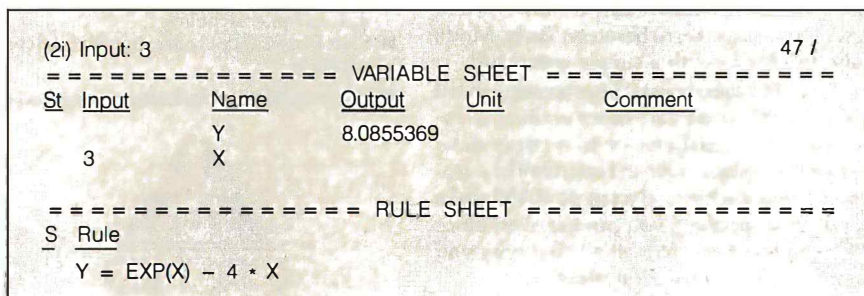
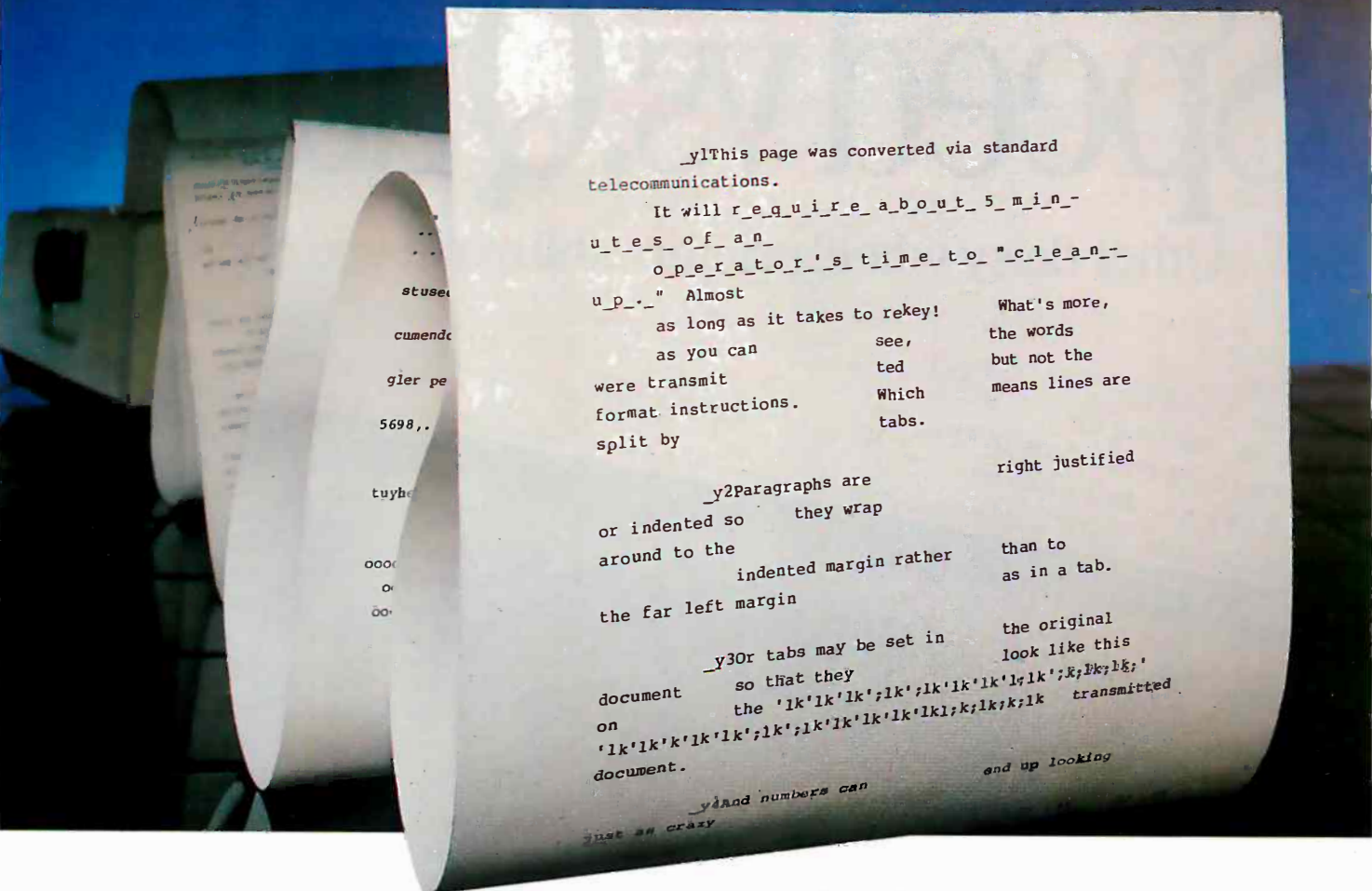


Figure 1: Variable and Rule sheets for  $Y = \text{EXP}(X) - 4 * X$ .



# How to avoid the document conversion trap.

Now, in just minutes, you can convert a full diskette without losing headers, footers, tabs, underlines or any other formatting codes.

And without cleanup.

**Announcing the KEYWORD 7000. A revolutionary new breakthrough in document conversion.**

It's finally happened. Keyword has discovered the key to document conversion. Now documents can be transferred to and from all major office automation systems in letter perfect order. *Automatically.*

That's more, simple on-screen prompts and a special "HELP" feature key make the KEYWORD 7000 extremely easy to operate. In fact, even a beginner can learn to use the 7000 in minutes.

Plus, the KEYWORD 7000 costs just pennies a page, compared to service bureaus at \$3 a page. Or rekeying at about \$4.50 per page.

But that's just the beginning. To find out more about how the KEYWORD 7000 can help you avoid the conversion trap, call 1-800-227-1817 (ext. 801A) and get your free booklet: *How to Win the Compatibility Battle. Exciting New Facts about Today's Office Automation Compatibility Solutions.* Or fill in—or attach your business card to—the tear-off coupon. And mail it to the address below.

**Call 1-800-227-1817 (ext. 801A) for your free booklet.**

**Keyword Office Technologies, Inc.**  
25354 Cypress Avenue • Hayward, California 94544

**Keyword Office Technologies, Inc.**  
25354 Cypress Avenue  
Hayward, California 94544

**Yes!** I want to find out more about the KEYWORD 7000, an exciting new breakthrough in document conversion.

- Call me ASAP at (\_\_\_\_) \_\_\_\_\_ Ext. \_\_\_\_\_
- Send me your free booklet.

Name \_\_\_\_\_  
Title \_\_\_\_\_  
Company \_\_\_\_\_  
Address \_\_\_\_\_ M/S \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_  
Phone (\_\_\_\_) \_\_\_\_\_ Ext. \_\_\_\_\_

Fill in and mail this coupon (Or attach your business card) **TODAY.** Or call 1-800-227-1817 (ext. 801A).

**KEYWORD**



# Speed ~~vs.~~ <sup>and</sup> Quality

Other daisy wheel printers still make you choose.

Diana Davis  
Operations Manager  
Development Company  
E. Graves Avenue  
New York, New York

Thank Ms. Davis:

Thank you for your inquiry on  
DaisyMax 830

At 80 characters per second, the DaisyMax 830 is one of the fastest letter-quality, daisy wheel printers you can buy.

And that means you no longer have to sacrifice image quality to increase productivity!

Speed and superb quality are but two of a long list of benefits you get with the DaisyMax 830.

Multiple users can share the DaisyMax 830 since it is designed for heavy volume word processing environments. Plus, you get standard

## DaisyMax 320™ & 830™



interfaces for easy installation, and friction, tractor and cut sheet feeders to handle all your office forms. All these great features also are available in the DaisyMax 830, offering print speeds up to 48 cps.

And of course *both* printers feature rugged reliability—a hallmark of Fujitsu products earned from over 30 years as a technology leader and equipment supplier to companies worldwide. Reliability backed by TRW service nationwide.

Contact your nearest distributor for your local dealer.

Circle 160 on inquiry card.

# Fujitsu Printers

Maximum Quality. Maximum Value.



# Authorized Fujitsu Distributors

**Algram Computer Products** (415) 969-4533, (714) 535-3630, (206) 453-1136, (916) 481-3466; **Allen Edwards Associates Inc.** (213) 328-9770; **Four Corners Technology** (602) 998-4440, (505) 345-5651; **Gentry Associates Inc.** (305) 859-7450, (305) 791-8405, (813) 886-0720, (404) 998-2828, (504) 367-3975, (205) 534-9771, (919) 227-3639, (803) 772-6786, (901) 683-8072, (615) 584-0281; **Hopkins Associates, Inc.** (215) 828-7191, (201) 273-2774; **Inland Associates, Inc.** (913) 764-7977, (612) 343-3123, (314) 391-6901; **Logon Inc.** (201) 646-9222, (212) 594-8202, (516) 487-4949; **Lowry Computer Products, Inc.** (313) 229-7200, (216) 398-9200, (614) 451-7494, (513) 435-7684, (616) 363-9839, (412) 922-5110, (502) 561-5629; **MESA Technology Corp.** (215) 644-3100, (301) 948-4350, (804) 872-0974; **NACO Electronics Corp.** (315) 699-2651, (518) 899-6246, (716) 223-4490; **Peak Distributors, Inc. (An affiliate of Dytec/Central)** (312) 394-3380, (414) 784-9686, (317) 247-1316, (319) 363-9377; **R<sup>2</sup> Distributing, Inc.** (801) 298-2631, (303) 455-5360; **Robec Distributors** (215) 368-9300, (216) 757-0727, (703) 471-0995; **S&S Electronics** (617) 458-4100, (802) 658-0000, (203) 878-6800, (800) 243-2776; **The Computer Center** (907) 456-2281, (907) 561-2134, (907) 789-5411; **USDATA** (214) 680-9700, (512) 454-3579, (713) 681-0200, (918) 622-8740. **In Canada, Micos Computer Systems, Inc.** (416) 624-0320, (613) 230-4290, (514) 332-1930, (204) 943-3813; **SGV Marketing, Inc.** (416) 673-2323, (1-800) 387-3860 (outside Ontario); **System Inc.** (514) 332-5581.

## Additional Ribbon Distributors

**Altel Data** (403) 259-7814; **EKM Associates, Inc.** (416) 497-0605; **Metropolitan Ribbon & Carbon** (703) 451-9072, (800) 368-4041; **The Very Last Word** (415) 552-0900, (800) 652-1532 CA, (800) 227-3993 USA. **In Canada, Tri-Media, Inc.** (514) 731-6815.

**Fujitsu Printers**  
Maximum Quality. Maximum Value.



Circle 161 on inquiry card.

easier if you enter the first and last values and let the program fill in the rest.

With the cursor on the first empty line below the word Value, you press the zero and Enter keys to define the first value of the variable X. Your value of 0 appears in the second column, and the index or element number 1 automatically appears in column 1. You cannot move the cursor into the first column of this sheet.

You move to row 64 by typing :64 and pressing the Enter key. Next, you type 2\*PI() and press Enter. The

value 6.283... appears in the value column and 64 appears in the element column. When you give the !Y command, the elements 2-63 are automatically filled in. The results would look like figure 3. Pressing the < key returns you to the List sheet.

The =V command returns the Variable sheet. You can also give the /WR command to restore the Rule sheet to the bottom half of the screen, but the cursor is then in this lower sheet.

If you are in the lower sheet, you

(continued)

```

===== VARIABLE SHEET =====
St Input Name Output Unit Comment
L .3 Y B
L 0 X C
L 4 C
===== RULE SHEET =====
S Rule
* Y = EXP(-B * X) * COS(C * X)

```

Figure 2: Variable and Rule sheets for  $Y = \text{EXP}(-B * X) * \text{COS}(C * X)$ .

```

===== LIST: X =====
Comment:
Display Unit:
Storage Unit:
Element Value
55 5.385587406
56 5.485320506
57 5.585053606
58 5.684786707
59 5.784519807

```

Figure 3: List subsheet for X.

```

===== LIST: Y =====
Comment:
Display Unit:
Storage Unit:
Element Value
1 1
2 .8943140789
3 .6576799837
4 .3339767703
5 -.022118623

```

Figure 4: List subsheet for Y after calculation.

## The simultaneous solution of a set of nonlinear equations can be difficult.

can move to the upper sheet by pressing the semicolon key. The list-action command begins computation. The equation is solved 64 times, once for each element of X. The current index number appears at the top of the screen during calculation so you can follow the progress. This process is slow; it takes about 1 second for each element. Perhaps an 8087 coprocessor would speed things up.

You can see the results by going to the List sheet with the =L command. With the cursor on the vector Y row, you use the > (dive) command. The results would appear as in figure 4.

Typing =T sets up a Table sheet that lets you view both vectors at the same time.

### THE PLOT SHEET

Because it may be useful to view data graphically, TK!Solver has a plotting routine. The plot can be displayed on the screen or on the printer, or it can be written to a disk file. (Of course, with the IBM PC you can print an exact duplicate of the screen at any time by pressing the Shift and PrtSc keys.) To obtain a plot, you have to return to the main List sheet with the < command. Next, you move to the first column at the bottom (after Y) and type the variable name ZERO. You go to the Zero subsheet with the > command and enter the value 0 for the first element. After going to the sixty-fourth row with the :64 command and entering another 0, you give the !Y command to fill in the rest

of the array with zeros. This gives you a zero baseline for your plot.

After moving to the Plot sheet with the =P command, you can set up the plot details (see figure 5). The Plot itself is normally displayed only on the screen; however, if the letter P is placed in the upper right field of the Plot sheet, output also goes to the printer. Printer output can alternatively be sent to a disk file by entering the filename into the Global sheet. (You can get there with the =G command.) When you've moved to the second line of the Plot sheet, you can enter the title of the plot.

After moving the cursor to the fourth line and entering X as the independent variable, you move to the bottom left side and enter Y as the first dependent variable. If you move the cursor to the second column, TK!Solver shows that the default plot symbol is an asterisk. You can change it to anything else (see the bottom line of figure 5).

After you set up the Plot sheet, the ! command displays the plot on the screen (see figure 6). Pressing any key returns you to the Plot sheet. If you get an error message, you have to check the spelling and case of the variables in the Plot sheet to make sure they agree with the corresponding variables in the Rule sheet.

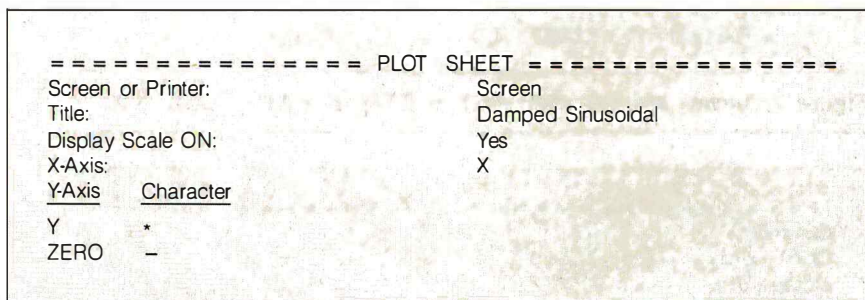


Figure 5: The Plot sheet.

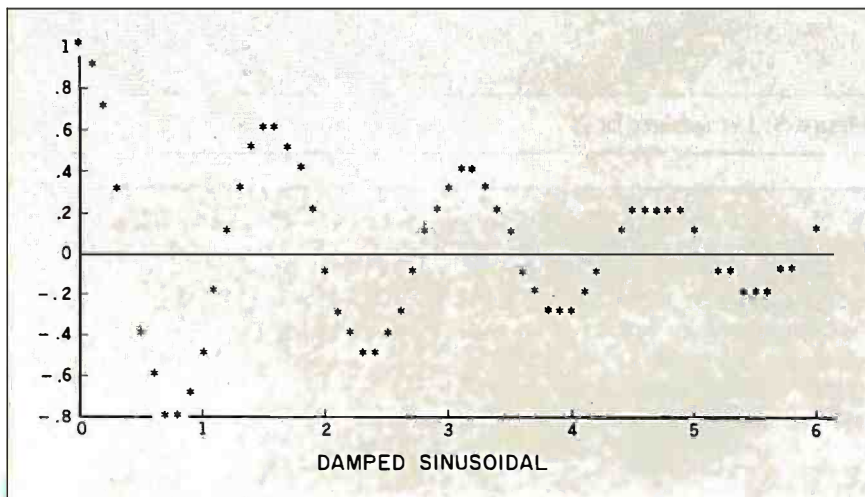


Figure 6: Plot of  $Y = \text{EXP}(-B * X) * \text{COS}(C * X)$ .

### SIMULTANEOUS EQUATIONS

TK!Solver can solve several equations simultaneously. The simultaneous solution of a set of linear equations is easily accomplished by using a programming language such as FORTRAN (see reference 4). However, the simultaneous solution of a set of nonlinear equations can be very difficult.

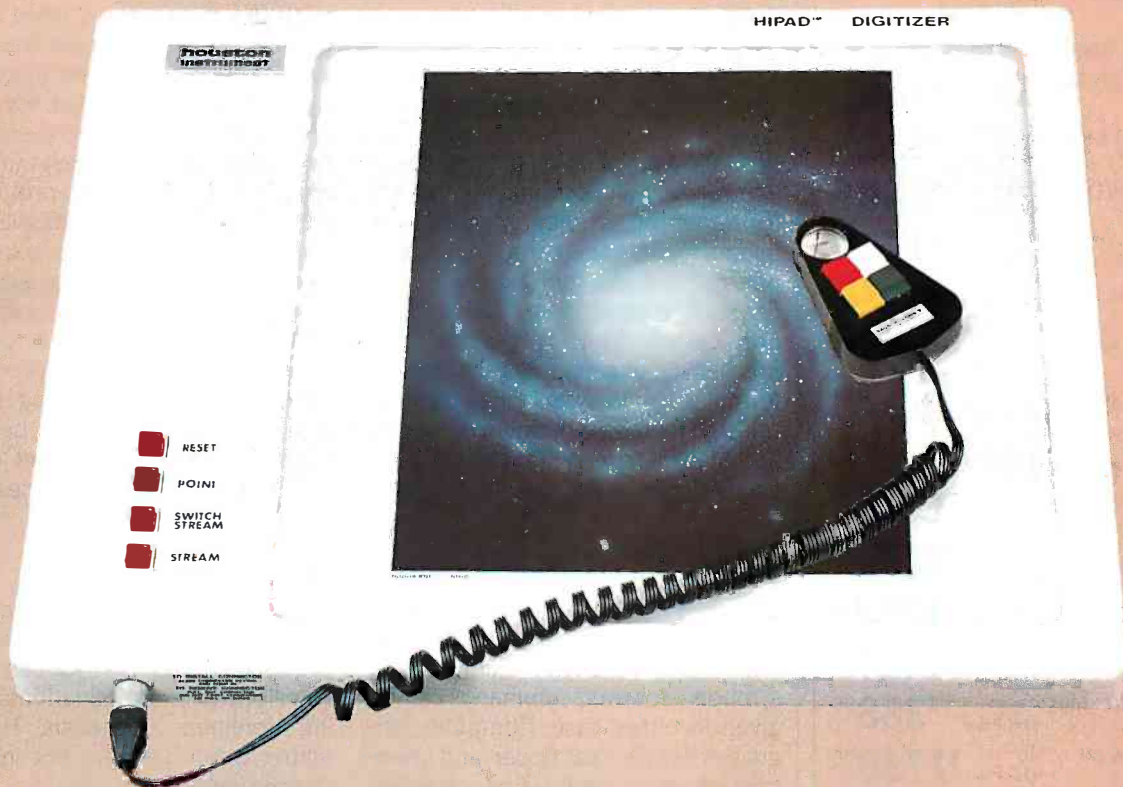
TK!Solver solves all sets of simultaneous equations the same way (iteratively) whether they are linear or not. Consider the three linear equations

$$\begin{aligned} X + Y + Z &= 6 \\ X + Y - Z &= 0 \\ 2 * X + Y - Z &= 1 \end{aligned}$$

for which the solutions are  $X=1$ ,  $Y=2$ , and  $Z=3$ , respectively. You can write

(continued)

# DRAWING YOUR OWN CONCLUSIONS



## ... Is Easy With The Versatile HIPAD™ DT-114 From Houston Instrument.

Enter a whole new universe of graphics, made possible by programs tailored to the HIPAD digitizer.

Exciting new applications in computer-aided drafting are now available, allowing you to create subdivision plats, machine drawings, schematics, architectural elevations and circuit-board artwork . . . with your micro-computer . . . at your desk . . . with no training as a draftsman.

Use of the HIPAD in medicine is increasing. With currently available software, physicians and dentists can prepare graphics of anatomical features for diagnosis and correction.

Artistic efforts are complemented by the HIPAD. With customized software, free-form renditions can be created quickly and precisely. Colors to fit the moment can be selected . . . and easily changed at a later time. The Circle 180 on inquiry card.

HIPAD provides access to the realm of high technology graphics.

The HIPAD features a full-size 11" x 11" digitizing area, and is both UL listed and FCC approved.

**The Conclusions You Draw Are Clearly Correct.  
The HIPAD will open the door to a universe of  
form and color . . . and creativity.**

For the name, address and phone number of your nearest representative, write Houston Instrument, P.O. Box 15720, Austin, TX 78761. Phone 512-835-0900, or 800-531-5205 if outside Texas for the name and location of your nearest representative. In Europe contact Houston Instrument, Belgium NV, Rochesterlaan 6, 8240 Gistel, Belgium. Tel. 059-27-74-45, Tlx. 846-81399.

**houston  
instrument**



HIPAD is a trademark of Houston Instrument

4P013A

# Save big on the world's largest selection of computer printers

**With 125 brands and 425 models, we make printers our only business!**

- Printerland has never raised prices—only lowered them.
- By the time you read this, prices here have probably been lowered again!
- Unlike a mail order house, we provide service and helpful solutions. Call us with questions!

## Unbelievable Buys:

|                                       |           |                           |
|---------------------------------------|-----------|---------------------------|
| SILVER REED 400<br>List Price \$399   | Our Price | <b>\$285<sup>95</sup></b> |
| DAISYWRITER 2000<br>List Price \$1495 | Our Price | <b>\$938<sup>75</sup></b> |
| BROTHER/COMREX 15<br>List Price \$599 | Our Price | <b>\$386<sup>95</sup></b> |
| NEC 2050<br>List Price \$1250         | Our Price | <b>\$777<sup>70</sup></b> |
| OKIDATA 84<br>List Price \$899        | Our Price | <b>\$736<sup>10</sup></b> |
| EPSON RX 80<br>List Price \$399       | Our Price | <b>\$257<sup>95</sup></b> |
| EPSON FX 80<br>List Price \$599       | Our Price | <b>\$414<sup>10</sup></b> |

## Priceless Values:

|                                        |           |                            |
|----------------------------------------|-----------|----------------------------|
| TOSHIBA 1351<br>List Price \$1895      | Our Price | <b>\$1345<sup>50</sup></b> |
| EPSON LQ 1500 P<br>List Price \$1595   | Our Price | <b>\$1237<sup>95</sup></b> |
| ANADEx 9625/COLOR<br>List Price \$1500 | Our Price | <b>\$1252<sup>12</sup></b> |
| CITOH F-10/55<br>List Price \$1995     | Our Price | <b>\$1427<sup>10</sup></b> |
| PANASONIC 1091<br>List Price \$499     | Our Price | <b>\$388<sup>95</sup></b>  |
| QANTEX 7065<br>List Price \$1995       | Our Price | <b>\$1789<sup>25</sup></b> |

## Special Application Savings:

|                                         |           |                             |
|-----------------------------------------|-----------|-----------------------------|
| PRINTEX 930<br>List Price \$1995        | Our Price | <b>\$1845<sup>45</sup></b>  |
| CITOH DELPHAX ION<br>List Price \$9995  | Our Price | <b>\$9627<sup>10</sup></b>  |
| TALLY MT 660L<br>List Price \$7995      | Our Price | <b>\$7425<sup>50</sup></b>  |
| PRINTRONIX P600 XQ<br>List Price \$8550 | Our Price | <b>\$7775<sup>10</sup></b>  |
| CALL US...<br>List Price \$37500        | Our Price | <b>\$34875<sup>20</sup></b> |

Printerland welcomes payments in cash or certified checks—no personal checks please. MasterCard and Visa purchases accepted with slight additional fee. Please add \$7.50 on narrow carriage orders and \$15.00 on wide carriage orders for shipping and handling. Add 7% sales tax for orders in Illinois. Printerland will guarantee your shipment the day your order is received!

**TO ORDER NOW,  
CALL NOW! (312) 255-9888**

5834 Dempster St., Morton Grove, IL 60053  
1740 Algonquin Rd., Arlington Heights, IL 60005

# PRINTERLAND

12/84

## REVIEW: TK!SOLVER

these three equations into the Rule sheet, but approximations must be given for two of the variables. With the cursor in the Variable sheet, you put 0 in the input fields of X and Y and enter the G symbol in the corresponding fields of the Status column to indicate guesses. After the ! command and several iterations, the solution appears.

### OTHER DISKS

The TK!Solver disk provides several models corresponding to examples described in the manual. In addition, you can buy disks containing models for specific subjects, including mechanical engineering, building design, introductory science, and financial management. These disks are called TK!SolverPacks. The mechanical engineering package has formulas for analysis of beams, heat transfer, fluid flow, moment of inertia, and Mohr's circle. A 100-page manual accompanies each disk.

### PROBLEMS

There are no major problems with TK!Solver. The biggest annoyance is the distinction between uppercase and lowercase letters when entering symbols. However, commands can be given in either case. Computer languages usually treat upper- and lowercase letters the same. (Microsoft BASIC converts all letters to uppercase.) Therefore, when using TK!Solver be very careful to type a variable's name the same way every time. On the other hand, if you use both cases, both versions of the symbol appear in the list of variables. It should be easy to find this type of error.

TK!Solver is superb for solving almost any kind of equation. It can also be useful for solving a set of simultaneous nonlinear equations. However, simultaneous solution of linear equations is easier with a programming language such as FORTRAN, Pascal, BASIC, or APL. TK!Solver does not handle matrices, so matrix inversion and other matrix operations are not available. On the other hand, the built-in functions SUM and DOT provide limited vector

operations. (SUM gives the sum of the elements, DOT gives the dot product of two vectors. Of course, the dot product of a vector with itself gives the sum of squares.) With these functions you can perform linear regression. But again, this is easier with a programming language.

TK!Solver has a function to determine if a variable has been defined and another to compare the magnitude of two variables, yet there are no logical variables. You do not write a computer program, and there are no branching operations anyway. You can contrive an APL-type program by combining several TK!Solver functions. But the resulting expression becomes as difficult to understand as a complicated APL expression.

Since TK!Solver does not use relational operators, expressions that arise in linear programming, such as  $A + B + C < 100$ , cannot be solved directly. However, you can convert such equations to regular linear equations for solution.

### SUMMARY

TK!Solver is a powerful tool, useful for scientists and engineers. No similar product exists. TK!Solver can rapidly solve one or more equations, including nonlinear equations. However, matrix operations are not included. Consequently, TK!Solver is a supplement, rather than a replacement, for programming languages such as BASIC and Pascal. On the other hand, it is not a spreadsheet because cells are not related to other cells. Currently, TK!Solver is available only for the IBM PC and PC-compatibles and for the Apple IIe (I've seen it advertised for the Macintosh). A CP/M-80 version would greatly increase the market. ■

### REFERENCES

1. Gilman, L. *APL: An Interactive Approach*. New York: John Wiley & Sons, 1974.
2. Bensimon, Jacques. "STSC APL\*Plus and IBM PC APL: Two APLs for the IBM PC." *BYTE*, March 1984, page 246.
3. Konopasek, M. *The TK!Solver Book*. Berkeley, CA: Osborne/McGraw-Hill, 1984.
4. Miller, A. R. *FORTRAN Programs for Scientists and Engineers*. Berkeley, CA: Sybex, 1982.



# The Ven-Tel Half Card.<sup>™</sup>

## The only 1200 baud modem for your IBM XT or IBM Portable PC.

The Ven-Tel Half Card<sup>™</sup> is the only internal 1200/300 baud modem that fits in the small expansion slots of the IBM-XT and the IBM Portable.

**Free Expansion Slot.** If you own an IBM PC-XT, look inside the chassis sometime. You'll see a number of standard sized expansion slots and one unused half-sized slot. That's where the Half Card<sup>™</sup> fits—in a spot that would otherwise be wasted. So why take up one (or sometimes two) valuable full-size slots for your modem? With the Half Card<sup>™</sup> it's like getting an extra expansion slot for free.

**True Portability.** IBM Portable PC owners will appreciate the true portability offered by the Half Card<sup>™</sup> the only modem that fits in the half-sized slots of the Portable. When you're on the road, you won't need to pack along a bulky external modem, cable and power supply. Your modem will already be inside your computer, ready to go!

Although it's half the size of other modems, the Half Card<sup>™</sup> has all of the high performance features you expect: selection of 1200 or 300 baud,

automatic dialing using the industry standard "AT" command set, automatic answer on any ring, and full compatibility with virtually all software.

The Half Card<sup>™</sup> comes complete with one of the most popular communications software packages available, CROSSTALK XVI by Microstuf. Whether you use an information service such as The Source or Dow Jones News Retrieval, or transfer files and electronic mail, the Half Card<sup>™</sup> connects your Portable or XT to the world.

Effortless Communication

**From Ven-Tel Inc.**

2342 Walsh Ave.  
Santa Clara, CA 95051  
(408) 727-5721



The Half Card<sup>™</sup> with Crosstalk-XVI software, retails for \$549 and is available at Businessland, Computerland, the Genra Group and other fine dealers nationwide.

The Half Card<sup>™</sup> also works in the IBM PC, the Compaq, and the Panasonic Senior Partner. Also from Ven-Tel: an internal modem for the HP 150 and an external modem with all of the features of the Half Card<sup>™</sup>

Circle 377 on inquiry card.

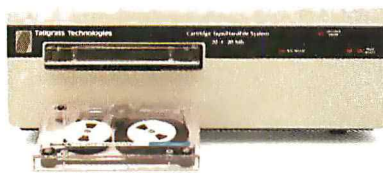
# THE LIGHTS WILL COME BACK ON. YOUR DATA MAY NOT.

When the power goes down, so does your computer — maybe taking your data with it.

If you had last year's sales figures with next year's projections on screen, you're going to be in the dark a long time. Maybe too long.

Unless you backup your data. Every day. No matter what.

The smartest way to do that is with a Tallgrass HardFile™ Mass Storage System.



*Shown above, the 20 megabyte HardFile with 20 megabyte tape for \$2,995.*

**TALLGRASS SELLS MORE HARD DISK STORAGE WITH CARTRIDGE TAPE BACKUP THAN ANYONE IN THE WORLD.**

Tallgrass took the industry's most reliable medium—magnetic tape—and perfected a format that's become the standard for personal computers.

We used a removable tape cartridge to store data out of

harm's way. And made two versions. Our 3000 Series HardFiles combine tape's accuracy with the enormous capacities of hard disk, with 12, 20, 35 or 70 megabytes storage with a removable cartridge tape for backup. Our 4060 tape storage system, for personal computers with hard disks built in, supplies 60 megabytes of backup capacity.

Result: the world's best selling mass storage systems with the most reliable data protection.

And a decidedly enlightened approach to doing business.

For a free brochure, your nearest dealer, and more good reasons to backup, call 1-800-228-DISK.

Before the lights go out.



**TALLGRASS  
TECHNOLOGIES**

COMMITTED TO MEMORY

Circle 362 on inquiry card.

HardFile™ and Tallgrass® are trademarks of Tallgrass Technologies Corporation. © 1984 Tallgrass Technologies.

# "Despite the recent press notices, multiuser microcomputers aren't anything new!"

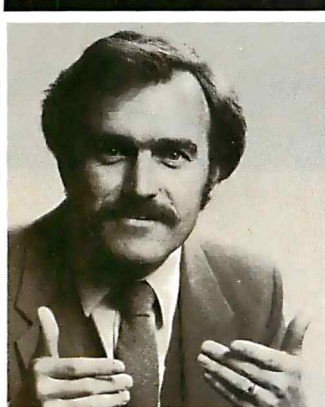
**This is the first in a series of discussions with Rod Coleman, President of Stride Micro (formerly Sage Computer) on the 68000 multiuser market and its current environment.**

**Q:** Why do you say that?

**RC:** "The technology to build a high performance multiuser system has been around for five years. And while some of the leaders in this industry have been pretending that micro multiuser didn't exist, we've been shipping complete systems for nearly three years. The benefits of multiuser are undeniable; it is more cost effective, and offers greater flexibility and utility. But until just recently, the marketing pressure to be compatible instead of being better, has blinded the industry."

**Q:** What do you mean?

**RC:** "Well, for example, the Motorola 68000 processor introduced 16/32-bit technology to the personal computer world a long time ago. It was fully capable of



**"A surprising feature is compatibility. Everybody talks about it, but nobody does anything about it."**

meeting high performance and multiuser design requirements in 1980. Instead of this trend taking off, most energy was spent promoting 8088/8086 products that

were clearly inferior from a technical point of view. This phenomenon leads me to believe that they will soon rewrite the old proverb: 'Build a better mousetrap and the world will beat a path to your door,' but only if they can find the way through the marketing fog."

**Q:** Are things changing now?

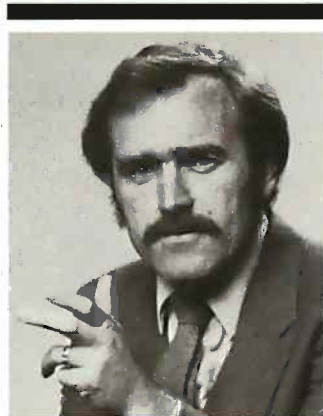
**RC:** "Yes and no. With the business world starting to take more and more interest in microcomputer solutions, the advantages of a solid multiuser system couldn't be kept hidden forever; companies like ours and a few others were beginning to make a dent. Instead of taking a fresh approach, some of the newest multiuser offerings will probably only give the technology an undeserved black eye! Multiuser is far more than the ability to plug in more terminals. It involves things like machine compatibility, fast processors, adequate memory, large storage capacities, backup features, networking, and operating system flexibility."

**Q:** Is this what makes the new Stride 400 Series different?

**RC:** "Exactly. That sounds serving, but it's true. Today a number of companies are introducing their first multiuser system. We've been building and shipping multiuser machines for almost three years. We know the pitfalls, we've fallen into some of them. But we have learned from our mistakes."

**Q:** Give me some examples.

**RC:** A hard disk is almost mandatory for any large multiuser installation. Yet, backing up a hard disk can be a nightmare if you only have floppies to work with. That's why we've added a tape backup option to all the larger Stride 400 Series machines. It's irresponsible for a manufacturer to market a multiuser system without such backup. Another good lesson was bus design. We started with one of our own designs, but learned that it's important not only to find a bus that is powerful, but also one that has good support and a strong future to serve tomorrow's needs. We



**"The marketing pressure to be compatible instead of being better, has blinded the industry."**

think the VMEbus is the only design that meets both criteria and thus have made it a standard feature of every Stride 400 Series machine."

**Q:** What are some of the other unique features of the 400 Series?

**RC:** "A surprising feature is compatibility. Everybody talks about it, but nobody does anything about it. Our systems are completely compatible with each other from the 420 model starting at \$2900, through the 440, on to the powerful 460 which tops out near \$60,000. Each system can talk to the others via the standard built-in local area network. Go ahead and compare this with others in the industry. You'll find their little machines don't talk to their big ones, or that the networking and multiuser are incompatible, or that they have different processors or operating systems, and so on."

**Q:** When you were still known as Sage Computer, you had a reputation for performance, is that still the case with the new Stride 400 Series?

**RC:** "Certainly, that's our calling card: 'Performance By Design.' Our new systems are actually faster; our standard processor is a 10 MHz 68000 running with no wait

states. That gives us a 25% increase over the Sage models. And, we have a 12 MHz processor as an option. Let me add that speed isn't the only way to judge performance. I think it is also measured in our flexibility. We support a dozen different operating systems, not just one. And our systems service a wide variety of applications from the garage software developer to the corporate consumer running high volume business applications."

**Q:** Isn't that the same thing all manufacturers say in their ads?

**RC:** "Sure it is. But to use another over used-term, 'shop around'. We like to think of our systems as 'full service 68000 supermicrocomputers.' Take a look at everyone else's literature and then compare. When you examine cost, performance, flexibility, and utility, we don't think there's anyone else in the race. Maybe that's why we've shipped and installed more multiuser 68000 systems than anyone else."



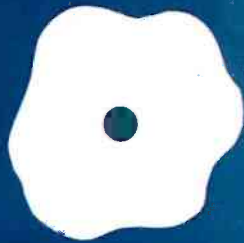
**STRIDE**  
MICRO

Formerly Sage Computer

For more information on Stride or the location of the nearest Stride Dealer call or write us today. We'll also send you a free copy of our 32 page product catalog.

Corporate Offices:  
4905 Energy Way  
Reno, NV 89502  
(702) 322-6868

Regional Offices:  
Boston: (617) 229-6868  
Dallas: (214) 392-7070



# WordPerfect

**Powerful  
capabilities  
—and some  
annoyances**

BY RICARDO BIRMELE

**T**housands of years ago, people put their thoughts down on clay tablets. It was inexpensive and permanent, and they never ran out of ink. However, they had to write quickly before the clay tablets had a chance to dry. Later they wrote on sheepskin parchment—better all around, except for the sheep. Now everyone had time to compose ideas and write them more clearly. However, mistakes were expensive; there were only so many sheep.

During the Middle Ages, people used feathers plucked from birds to write on paper made from wood and cotton. It was a time-consuming process and hard on the local bird population. Then the typewriter appeared. People could write clearly and quickly, fix mistakes easily, and not bother the local fauna. However, they were limited by paper size.

Modern authors have the word processor. Fixing mistakes is no more than a small inconvenience; the bottom edge of the paper no longer exists. In fact, word processors are such a good idea that everyone is trying to write one. So many exist now that you must choose the one that includes the features you find most convenient.

## THE BASIC QUESTIONS

WordPerfect, a capable and very easy-to-use piece of software, was first conceived by Alan Ashton, a computer science professor at Brigham Young University, and Bruce Bastion, one of his graduate students. They received immediate feedback on the program by testing each new feature on the secretaries who would be using it in their jobs. When the IBM PC appeared, they decided to implement WordPerfect on that machine. Unlike most other word-processing programs (which were first written for 8-bit machines and then scaled up to a 16-bit microprocessor), WordPerfect was scaled down to the 16-bit machine and thus can use its capabilities fully.

The package runs on the IBM PC (and its clones), the Victor 9000, the DEC Rainbow

100, the Zenith Z-100, and the Tandy 2000.

WordPerfect is actually a collection of several closely integrated programs, including a bundled 30,000-word dictionary with room for 10,000 user-included words, and extensive mathematical and merge functions. It provides automatic text reformatting, automatic footnotes, proportional spacing, document encryption, and macro instructions. The package comes on two non-copy-protected disks: one contains the program and supporting files and the other contains the dictionary. A comprehensive, well-written tutorial/reference-style manual is also included.

Instead of extensive on-screen menus, WordPerfect provides a keyboard template and key stick-on labels for the various word-processing commands. It uses all the IBM's keys, some in combination with the Control, Alternate, and Shift keys.

This word processor requires a minimum of 128K bytes of memory, two double-sided disk drives, a color or monochrome display, MS/PC-DOS, and a printer.

It also uses a programming concept called virtual memory. This means that your document can be as large as your memory and the program can access any part of the document without your having to actively reload it. However, if you were writing a book you would want to break it into chapters. Scrolling from one end of a 100K-byte document to the other, even if it is in memory, can take a while.

## THE SCREEN

When you first boot up WordPerfect by pressing WP at the A> prompt, you see an almost blank screen. In the bottom right corner are the obligatory line and column position indicators (column in this case called "Pos"), and two other bits of information.

"Doc" refers to WordPerfect's ability to edit two documents without going through a save/reload process—you can go from one

(continued)

Ricardo Birmele (714 Cherry St., Berrien Springs, MI 49103) is an independent computer consultant and technical writer. His other main interests are flying, nature, and his family.

document to another by pressing Alt-Alternate-F1 and answering the prompting menu with a "1". It takes about two seconds with a hard disk, somewhat longer with a floppy. You cannot quit

WordPerfect if either of these documents is still open.

The other bit of information is "Pg", or page number. WordPerfect is a page-oriented word processor; the

document appears to the machine to be a number of related documents, rather than one continuous piece of information. You can print any one of these related documents independently of the rest.

One of the best ideas in WordPerfect is "what you see is what you get." In order to insert commands to boldface, underline, or center text, you press a function key and the text appears bold (highlighted), underlined, or centered. Nothing in this program interferes with your thoughts (see photo 1). If you need to see the hidden formatting commands, you use the reveal functions command (Shift-F2). One caution: because of the way in which the character-attribute bit for underlining is manipulated, any characters underlined on a monochrome monitor will appear in blue on a color monitor; if fed by a color video drive board, they will appear in reverse video on the monochrome monitor.

WordPerfect also lets you select in which colors you would like your background and text to appear. You can change color combinations before starting your word-processing session by entering WP/S (WordPerfect, slash, System) from a DOS prompt. (This is how you change basic system default parameters from one session to another.)

With IBM's built-in international/mathematical-character screen-mapping capability, you can easily set up WordPerfect for French, German, Oxford English, or mathematical Greek (see photo 2). Screen mapping refers to "what you press is what you should get," unless previously redefined. This means that if you need an A-umlaut you should get one. One method of adding accents to your printed text is with overstrike. This involves typing a letter, A for example, then Shift-F5 (overstrike), and finally an accent, such as a double quotation mark for an umlaut.

FORMATTING

All word processors get your thoughts down on paper. The best ones make  
*(continued)*

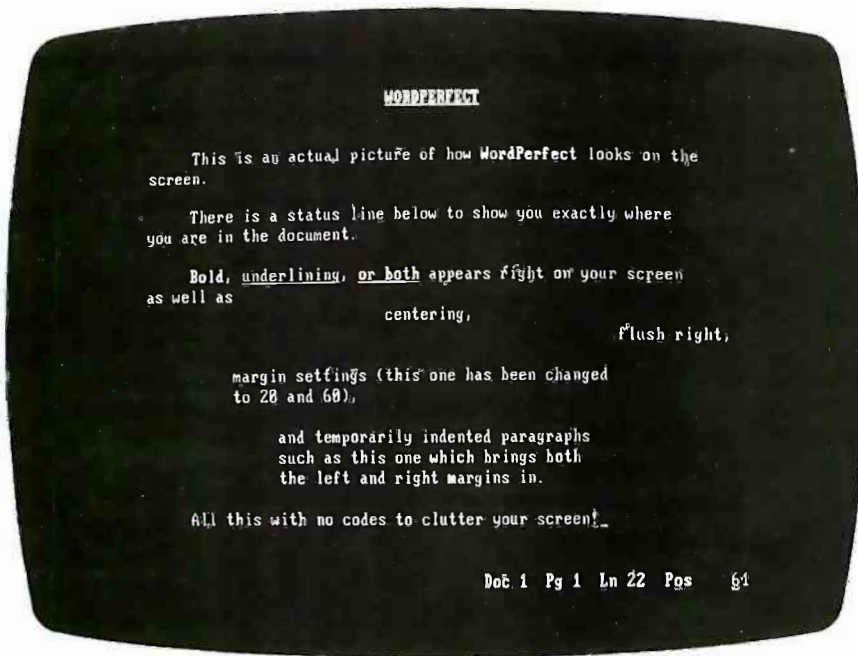


Photo 1: An example of WordPerfect's "what you see is what you get" screen.

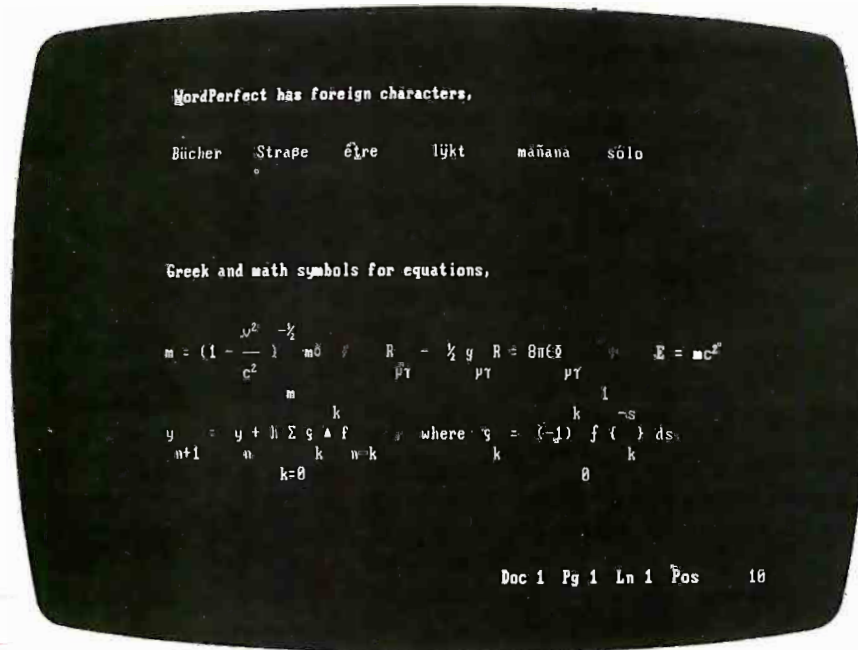


Photo 2: Some of the foreign characters and mathematical symbols available with WordPerfect.

## AT A GLANCE

### Name

WordPerfect

### Type

Word processor

### Manufacturer

Satellite Software International  
288 West Center St.  
Orem, UT 84057  
(801) 224-4000

### Computer

IBM PC (and compatibles),  
Victor 9000, DEC Rainbow  
100, Zenith Z-100, Tandy 2000

### Other Versions

Personal WordPerfect, also for  
the IBM PC, and WordPerfect  
Jr. for the PCjr

### Disk Format

MS/PC-DOS 2.0, double-  
sided, double-density

### Language

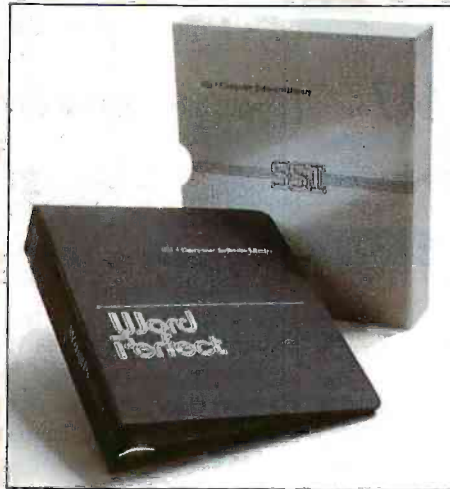
8088/8086 assembly  
language

### Documentation

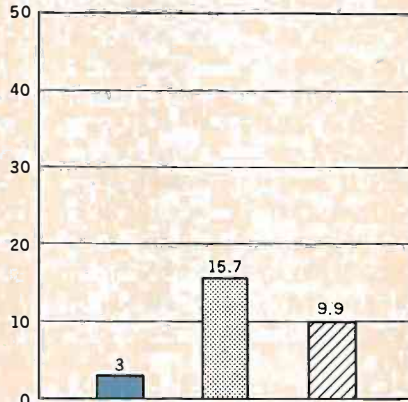
Loose-leaf manual with index  
in a three-ring binder

### Price

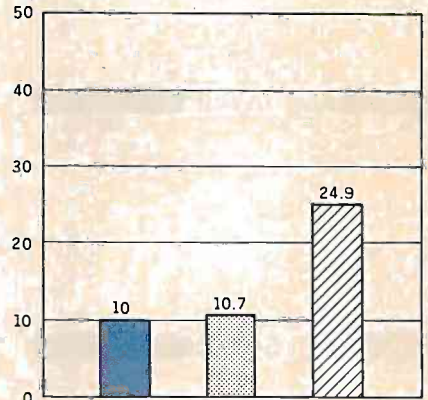
\$495



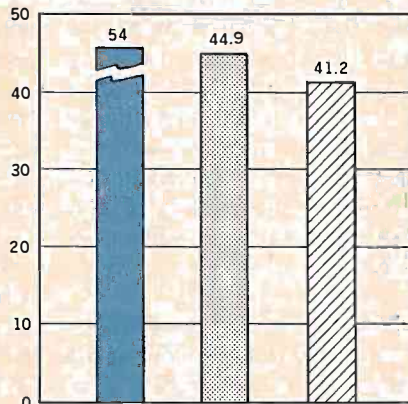
FIND (SEC)



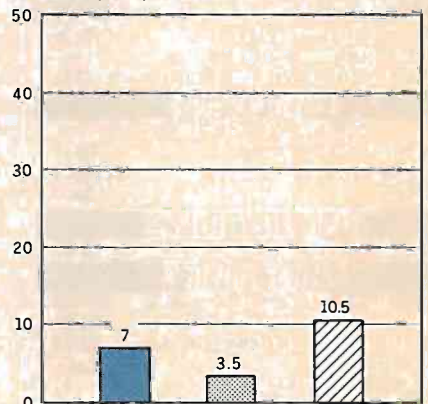
SAVE (SEC)



SCROLL (SEC)



SEARCH (SEC)



WORDPERFECT VOLKSWRITER WORDSTAR 3.3

These graphs show the timing results of performing various standard word-processing functions using a 4000-word text file. The times

are for WordPerfect, Volkswriter, and WordStar version 3.3. The tests were performed using an IBM PC with monochrome monitor.

# COMPUTER BROKERAGE SERVICES

"We do the Shopping for You"  
**800/233-1147**



TX Residents  
713/240-5515



4242 BLUEBONNET • STAFFORD, TX 77477

## MONITORS

|                                 |         |
|---------------------------------|---------|
| TAXAN 121 Green/122 Amber       | 135/140 |
| Direct IBM Plug In              |         |
| 115 Green/116 Amber             | 125/130 |
| 411 RGB-IBM Look Alike          | 365     |
| High Res/With mono switch       |         |
| 425 RGB-IBM Look Alike          | 465     |
| Super High Res/With mono switch |         |
| AMDEK New Color Monitors        | CALL    |
| 310 Direct IBM Plug In          | CALL    |
| 300 Amber/Green                 | CALL    |

## BOARDS

|                                                                            |            |
|----------------------------------------------------------------------------|------------|
| TECMAR All Boards                                                          | SAVE\$\$\$ |
| TAXAN Monocard with Parallel Port                                          | 199        |
| Color Graphics Card                                                        | 165        |
| PERSYST                                                                    | CALL       |
| APSTEK HandiOne Plus/1 yr. warranty                                        | 195        |
| Same features as Six Pac Plus But Much Lower Priced Bare Memory Board 256K | 120        |

## PRINTERS

|                                 |              |
|---------------------------------|--------------|
| OKIDATA All Models              | SAVE\$\$\$   |
| EPSON All Models                | BEST PRICE   |
| PANASONIC 1090                  | LOWEST PRICE |
| 1091                            | CALL         |
| TOSHIBA P1351/P1340             | SAVE\$\$\$   |
| TI 855                          | CALL         |
| NEC LQ PRINTERS                 | CALL         |
| DIABLO LQ PRINTERS              | CALL         |
| TTX LQ PRINTER w/Pin Feed Guide | 370          |
| STAR PRINTERS All Models        | SAVE\$\$\$   |

## MODEMS

|                 |      |
|-----------------|------|
| ANCHOR MARK XII | 245  |
| MARK X          | 105  |
| MARK VII        | 89   |
| HAYES           | CALL |

## DISK DRIVES

|                                          |            |
|------------------------------------------|------------|
| TANDOM TM100-2                           | 195.00     |
| TEAC HALF HEIGHT FLOPPY                  | 175.00     |
| I <sup>2</sup> INTERFACE Internal 10 Meg | CALL       |
| External 10 Meg/Will boot from Disk      | SAVE\$\$\$ |

## COMPUTERS

THE VERY BEST PRICES

|                           |            |
|---------------------------|------------|
| IBM PC All Configurations | CALL       |
| COLUMBIA                  | SAVE\$\$\$ |
| CAMPAQ                    | CALL       |

## MEMORY CHIPS

|                |       |
|----------------|-------|
| 64K D-RAM KITS | 43.00 |
|----------------|-------|

## ACCESSORIES

|                                    |            |
|------------------------------------|------------|
| SWITCH BOXES Parallel 2/3 Position | 96/109     |
| Serial 2/3 Position                | 66/84      |
| DESK TOP PRINTER STANDS Lg./Sm.    | 29/24      |
| DUST COVERS                        | CALL       |
| DISKBANK MEDIA MATE 5              | 12         |
| Holds 50 Diskettes                 |            |
| CABLES IBM PARALLEL                | 19         |
| PRINTER BUFFERS                    | CALL       |
| DISKETTES Nasua DSDD               | 17         |
| SURGE SUPPRESSORS/All Types        | BEST PRICE |

**TERMS** • We guarantee our products against Manufacturer's defects. • Add 3% for shipping charges. \$5.00 minimum. • Checks: Allow two weeks for clearance. • Texas orders +6% Sales Tax. • C.O.D.'s payable w/certified check, money order or cash.

Availability and prices subject to change.

IBM is a registered trademark.

APPROVED CORPORATE ACCOUNTS WELCOME.

## REVIEW: WORDPERFECT

your thoughts look good. WordPerfect formats headers and footers: up to four of either or two of each. It also displays the current output page number by including a Control-N in the header or footer text.

Footnotes are taken care of almost automatically. Superscripted numbers and formatting are also taken care of within the program by using command keys. All you have to do is enter text. If you need to insert a footnote between two previously written footnotes, WordPerfect rennumbers all of them for you.

Another formatting feature is WordPerfect's block-handling facility. To define a block, or discrete portion of text, you position your cursor at its beginning, press Alternate-0 (zero), then position your cursor at its end. Then you may print it, make it bold, underline it, save it to disk, append it to an existing file, delete it, cut or copy it, or convert it to upper- or lowercase. If you cut a block unintentionally, you can recall it unless you have defined another block in the meantime.

You can place page numbers almost anywhere on your page—centered, on the right or left, or on the top or bottom. You can also alternate your page numbers from right to left as you would find in a book. You can force a page break or reset margins or spacing at any time. If you later change your mind, WordPerfect will automatically reformat your document. You can also suppress the printing of page attributes, such as page number, on any page.

## CONTROLLING THE DOCUMENT

When you type a document using WordPerfect, what you see is what you get. A number of different methods will get your cursor from one end of a document to the other. Along with the normal Page Up and Page Down keys, you have single keys for screen up (the number pad "-" key) and screen down (the number pad "+" key). To get to the bottom of your document from anywhere in the file, you press Home twice and then down arrow. Getting to the top of a

file is a similar Home, Home, and up arrow combination.

You scroll up and down with the "n" function. When you press Escape, you see "n =" at the bottom of your screen. The program is asking how many lines you want to jump at a time—the default is eight. You can change this temporarily by entering a number after pressing Escape and more or less permanently by using the WP/S command. You can also activate word-left and word-right functions by pressing Control-left arrow and Control-right arrow, respectively, as well as line-left (Home-left arrow) and line-right (Home-right arrow) functions.

Finally, you may go directly to any document page by pressing Control-Go To (the number pad 7, or Home, key).

Setting margins and tabs is a little indirect. First press Shift-F6 (set format). On the bottom line you see an options menu: Set Format? 1 Tabs; 2 E-Tabs; 3 Margins; 4 Spacing; 5 H-Zone; 0. Tabs and margins are both numbered from the absolute left position on the screen. In other words, if your left margin is 10, you will see your text lined up at the tenth character position from the left side of your screen. If you set a tab stop at position 15, this tab stop is actually five columns to the right of that margin. This gets confusing if you decide to change the left margin, for example, to 5. Your tab is still set at 15, which means it is now 10 columns to the right of your margin.

It is a good idea to set up a series of tab stops across the width of your screen. Tab positions are available through column 158 with regular tab settings, and farther beyond to column 250 by using E-tabs. Unfortunately, to set tabs with WordPerfect you must stop what you are doing, figure out where you want a tab, then set the tab stop. You cannot merely indicate that you want a tab in the column where your cursor is.

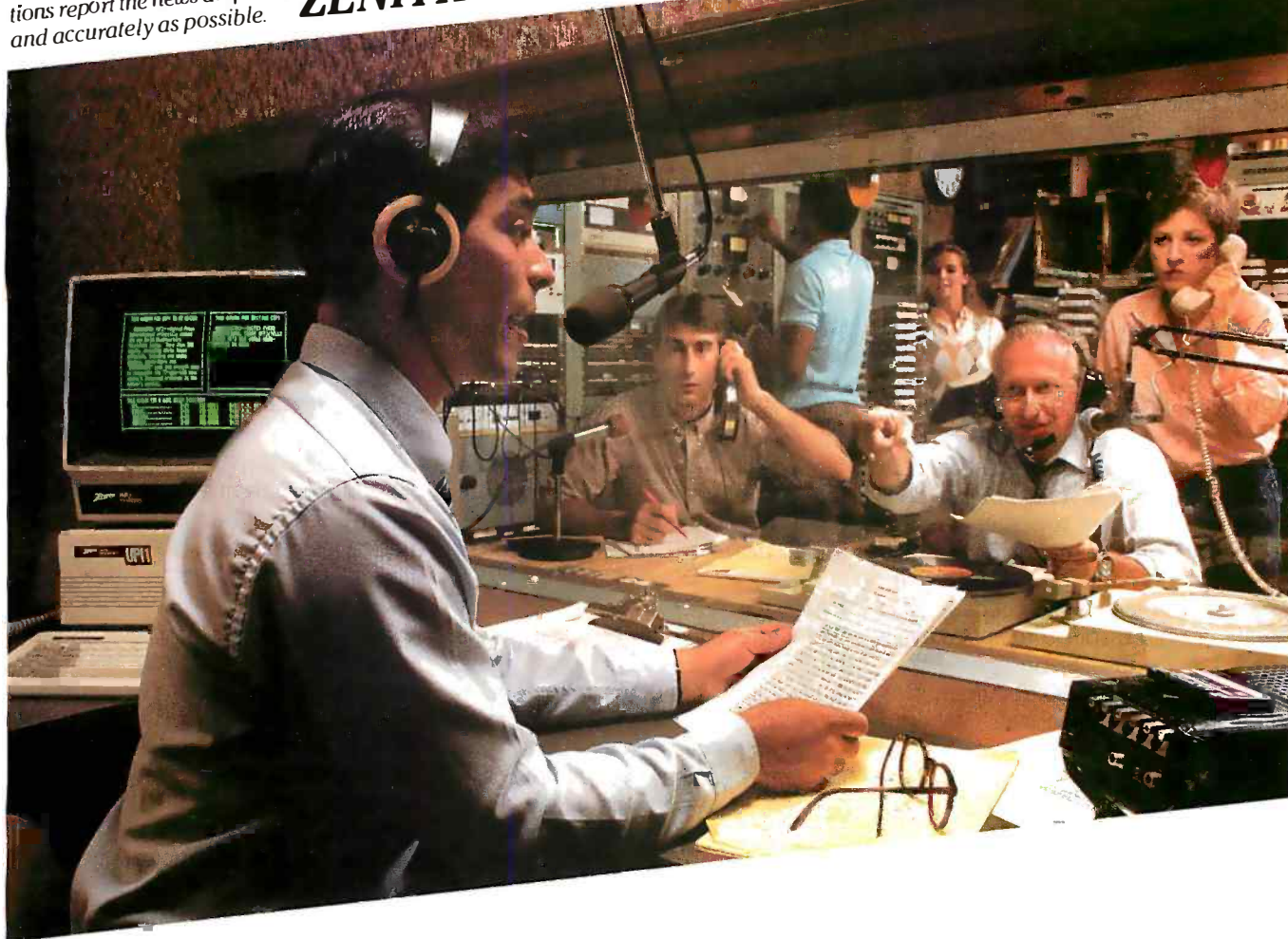
Spacing in increments of half a line is accomplished from the same options menu as tabs and margins. The

(continued)



When a big story breaks, you'll hear about it faster thanks to the new **UPI 1 Computer System**, which utilizes the Zenith Z-150 PC as its central hardware component. UPI chose the Zenith Z-150 only after testing and even "roughing up" dozens of leading microcomputers, because it delivers the total performance that helps radio and TV stations report the news as quickly and accurately as possible.

**ZENITH COMPUTERS MAKE NEWS WITH UPI!**



## WHEN TOTAL PERFORMANCE IS THE ONLY OPTION.

The IBM PC-Compatible Zenith Z-100 PC's.

Total performance. It's a must for United Press International, in reporting news that changes the face of the world. And for you, in handling information that changes the face of your business.

The IBM PC-compatible Zenith Z-100 PC's deliver that total performance, with enhanced features that include greater internal expandability. Storage that can expand up to 11 megabytes. The ability to run virtually all IBM PC software. A detached keyboard with a "smarter" key layout. And much more.

When total performance is the only option for you, call 1-800-842-9000, ext. 1, for your free Z-100 PC information kit and the name of your nearest Zenith Data Systems dealer.



Desktop Z-150 PC

**ZENITH** | data systems

THE QUALITY GOES IN BEFORE THE NAME GOES ON.

H-Zone on that menu refers to the hot zone, an area around the right and left document margins that is used to determine hyphenation and word wrap. When a single word in your text goes beyond the hot zone, you are prompted to position the hyphen where you want it and then press Escape. You can hyphenate your text as you enter it or use the WordPerfect option to leave out the hyphenation help.

**FILING THE DOCUMENT**

Once you write a document, you will want to save it. WordPerfect's file management offers several options conveniently grouped together.

The system commands or file utilities include commands to save, rename, or delete a file, check its size in bytes, and display the space available for file storage on your disk.

You can also save documents as straight ASCII (American Standard Code for Information Interchange) text files. This is a savings because you don't have to buy a dedicated ASCII text editor to build program files for compilation. WordPerfect does the job just as well. It also simplifies transferring files from one

computer using WordPerfect to another using a different word-processing program, or sending a file electronically, such as through electronic mail.

WordPerfect supports MS/PC-DOS 2.0's tree structure very well. You can change the default directory or drive at any time. When you call them up, the program displays disk-file directories alphabetically, including file size in bytes and time and date information. You can call up a list of files from within a directory with a wild-card search—using the asterisk to represent any character or characters—and then retrieve, rename, delete, or print them. WordPerfect also lets you save a file encrypted under a password.

**PRINTING**

WordPerfect does all its printing in the background, working from a queue, while you edit another document on the screen. You have full access to all the word processor's functions while printing is going on, though they can run a little slower than usual.

The program works with almost any printer available, serial or parallel. There are 32 types of printers already defined, including the old faithful line

printer. If your particular printer is not on the list, you can easily set it up with the included Printer.EXE program.

Printing column output is one of WordPerfect's strong points. You can define from two to five columns, spaced any way you like. If you want even spacing, WordPerfect asks how many spaces to put between the columns and then calculates each column's right and left margin. You can also break columns up on a page, such as when you want a headline and then text in columns, as in galley sheets.

Finally, WordPerfect supports true proportional spacing under program control. It uses WordPerfect's automatic incremental spacing commands, which you define when you set up your printer. If your printer supports super- and subscripts, WordPerfect can use that capability for footnotes and mathematical formulas.

**MATH, MACROS, AND MERGE**

WordPerfect boasts some of the most extensive math capabilities of any word-processing program I know. It has the normal arithmetic functions (addition, subtraction, multiplication, and division) and more. While it is not a spreadsheet in the sense that you know electronic spreadsheets, you can perform the common arithmetic operations between columns (and rows) and display the result in a different column (or row) as shown in photo 3.

You can use math functions almost anywhere in your document. A math section can extend over page boundaries to column 250 and can contain both numbers and text. This makes putting together a professional-looking balance sheet or financial report easy. As a matter of fact, Satellite Software International claims to use the math functions included in WordPerfect to store its own monthly accounts.

Often in word processing you need to do the same thing over and over again. WordPerfect can be taught to remember a series of keystrokes, file them, and retrieve them as needed.

*(continued)*

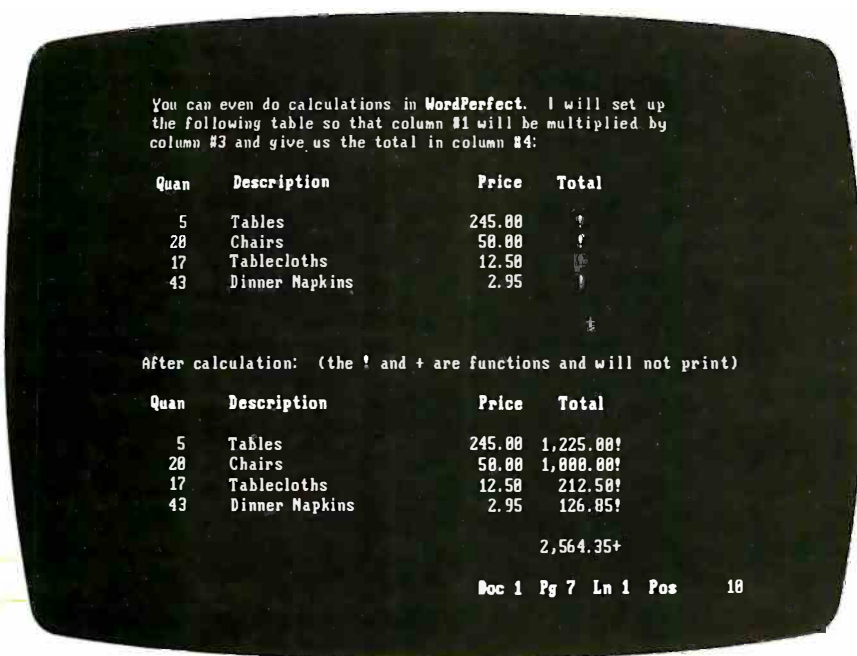


Photo 3: An example of the row and column calculations present in WordPerfect.

# You need a plotter that's compatible with your hardware, software and, especially, you.

More and more companies are discovering that color graphics help them communicate faster and more persuasively.

When you make this discovery, you'll want a Colorwriter™ pen plotter from Gould. Because Colorwriters are easy to use, and can meet all of your business and technical graphic needs. They'll work with virtually any computer and the most popular software packages available.

Whether you want simple bar charts or complicated CAD/CAM drawings in 8½" x 11" or 11" x 17" formats,

we've got a plotter to suit your needs and your budget. Plus, we've got a unique automatic chart advance option for volume graphics applications.

When you buy a Gould Colorwriter plotter you're getting 45 years of proven experience in hard copy graphics technology. That's why you also get one of the best warranties in the business.

For more information and the name of the Colorwriter dealer nearest you, call toll free **800-447-4700**, operator 99. Or write Gould Inc., Recording Systems Division, 3631 Perkins Ave., Cleveland, Ohio 44114.



**Gould  
Colorwriter.  
The compatible  
plotters.**

For example, I have defined a macro called "envelope." When I write a business letter using the normal business form of address at the top, the macro almost automatically writes that address on an envelope for me.

You can chain macros under WordPerfect. This may occur conditionally depending on the success or failure of a search operation. It may also occur repetitively, as when you search for a phrase and each time the phrase occurs you want to perform one ac-

tion, and when the search fails, you want to perform another.

One of the most work-intensive functions of a word processor is writing a form letter. Putting the names and addresses in correct order and repeating a name or part of an address within the body of the letter is difficult with some word processors, but not with WordPerfect. The program treats each line of the address—name, street, city, zip code—as a field. A complete name and address is

treated as a record, and you can repeat any field in the record within the body of your letter as often as you wish, personalizing it with the addressee's name or city, for example.

WordPerfect handles the merge in the following way. First, you create the file (name and address records) and save it; then you enter your form letter. When it is finished, you initiate the merge (Shift-F9) and WordPerfect executes it. When the merge is com-

*(continued)*

Circle 272 on inquiry card.

# Super 5™ HAS THE ANSWER!

STATE OF THE ART

## HIGH SPEED 7 COLOR PRINTER

THE FIRST NEW RIBBONLESS PRINTER



- \* High Speed - 180 CPS
- \* Features 7 Colors
- \* 18 Pin Printer Head
- \* Color Bars - Completely Ribbonless
- \* Near Letter Quality

### Super 5™ Series

\* **PRINTERS**

- 7 Color Printer
- Near Letter Quality Printer 120 CPS
- Block Matrix Printer 100 CPS
- Block Matrix Printer 80 CPS

\* **MONITORS**

- Hi-Res Composite Color
- Hi-Res Composite Amber
- RGB Color
- Hi-Res Green TTL
- Hi-Res Amber TTL

\* **DRIVES**

- Slim Line Hard Disk, 10M & 20M For Internal IBM
- Slim Line Floppy Disks for Apple IIe & Apple IIc

\* **ACCESSORIES**

- Controller Cards for Apple & IBM
- IBM Expansion Cards

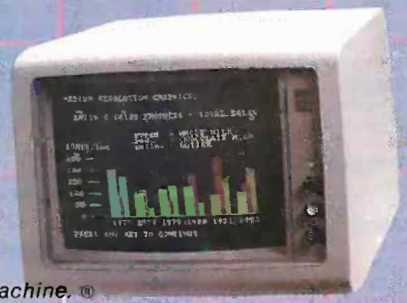
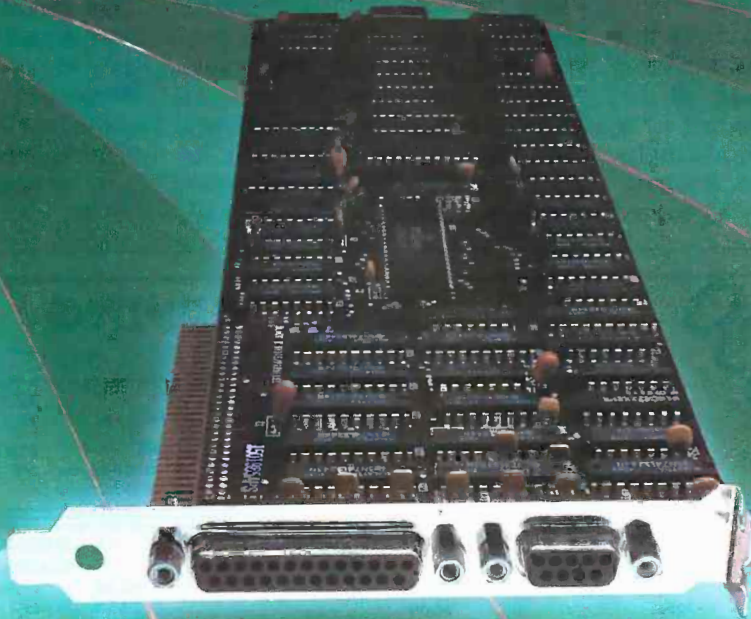
## Mitsuba Corporation

284 E. Arrow Hwy.  
 San Dimas, CA 91773  
 TEL: (714) 592-2866  
 Outside Calif. 1-800-MITSUBA (Dealers Only)  
 Japan TLX: 23325 EI-EN ENT  
 NJ Warehouse & Service (201) 530-8456

# Make an Intelligent Connection Today

## THE INTELLIGENT CARD FEATURES:

- Compact single board design
- Replaces both IBM monochrome and color graphics adapters
- Software support in monochrome graphics mode
- Automatically switches modes
- Printer port available in both monochrome and color graphics modes
- VLSI design saves system's power
- Easily upgradable to 64K for additional function
  - High resolution color graphics and interlace
  - Monochrome graphics and interlace
- One year warranty
- Priced competitively at \$299.00



IBM is a Trademark of International Business Machine. ®



**INTELLIGENT  
DATA SYSTEM INC.**

Circle 196 on inquiry card.

14932 Gwenchris Ct.  
Paramount, CA 90723

800•325•2455  
(213) 633-5504  
TLX: 509098

plete, you can print the letter.

You can use this same file of names and addresses to print out mailing labels—either one-up (a single strip of labels, one label across) or several across on a sheet of labels (using WordPerfect's column printing capabilities).

**SPELLING DICTIONARY**

WordPerfect's spelling dictionary comes bundled with the program and is almost integral to it, but it is only 30,000 words long with room for an additional 10,000 user-installed words. It also suffers somewhat from its implementation.

The dictionary lets you check the spelling of the current word, all the words on the current page, all the words in the current document, or a specific word or template you supply. (Template refers to a prefix, followed by a dash, that retrieves all words

beginning with those letters.) If the program finds an error, it is not immediately corrected. Rather, the program asks if you would like to look up the word in a list of suggested spellings or correct it yourself now. While this method more or less forces you to learn the correct spelling of the words you use most often, it would be more efficient to have the program offer you a list of words from which you could select the one you want.

As you check the spelling of words in a document and the dictionary comes to one it does not know, you have the options of continuing, updating the word into the dictionary, correcting the word, or looking it up. This brings me to another problem. If you need to look up the word "disarmed," for example, it appears in the first dictionary lookup screen for words starting with "dis." However, you cannot exit the dictionary look-

up area until you have viewed three and a half more screens. It doesn't take that long to get through the screens, and the words are alphabetized and easy to find, but it is still an unnecessary annoyance.

**SUMMARY**

I have been using WordPerfect and its updates almost every day since I bought version 2.3 in the spring of 1983, and I have found it to be a capable, easy-to-use word processor. Like all software packages, however, it has both good points and bad points.

On the plus side, because it has been scaled down (rather than up) to the 16-bit microcomputer, WordPerfect can fully use the capabilities of the IBM PC. Also, its use of virtual memory lets your document be as large as your memory with all parts

(continued)

ORDER LINE  
800-354-7330

## FREE SHIPPING

### WE PAY THE SHIPPING ON THESE SELECTED PRODUCTS

|                                |                                      |                                                                           |                                                   |                                                        |
|--------------------------------|--------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------|--------------------------------------------------------|
| <b>EPSON</b><br>RX-100 Printer | <b>OKIDATA</b><br>82A Printer        | <b>STAR MICRONICS</b><br>Radix 10 & 15 Printers<br>Delta 10 & 15 Printers | <b>WYSE</b><br>75 Terminal                        | <b>TELEVIDEO</b><br>TPC-2 Dual Drive Portable Computer |
| <b>NEC</b><br>2015 Printer     | <b>QUME</b><br>Letter Pro 20 Printer |                                                                           | <b>SONY</b><br>19" RGB Monitor<br>25" RGB Monitor | <b>MAXELL</b><br>MD-1 Diskettes                        |

Free shipping is by U.P.S. ground only

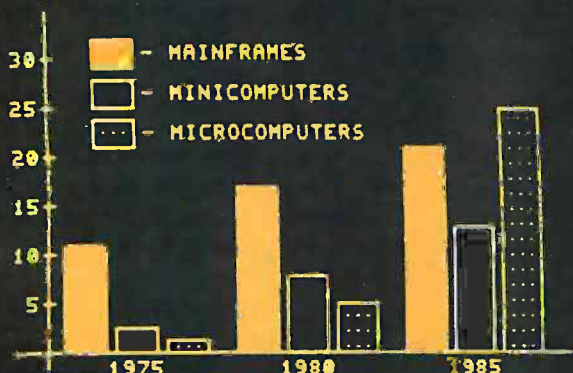
| PRINTERS                              | TERMINALS                        | DISKETTES                         |
|---------------------------------------|----------------------------------|-----------------------------------|
| <b>NEC</b>                            | <b>ADDS</b>                      | <b>MAXELL</b>                     |
| 2010, 2015, 2030 ..... \$639          | A-2 ..... \$469                  | MD-1 (Qty 100) ..... \$175        |
| 2050 ..... \$669                      | A-3 ..... \$469                  | MD-2 (Qty 100) ..... \$225        |
| 3510, 3515, 3530 ..... \$1215         | Viewpoint 60 ..... \$485         | <b>SCOTCH</b>                     |
| 3550 ..... \$1359                     | Viewpoint 90 ..... \$849         | 5 1/4 SS/DD (Qty 100) ..... \$175 |
| 7710, 7715, 7730 ..... \$1649         | <b>ALTOS</b>                     | 5 1/4 DS/DD (Qty 100) ..... \$245 |
| <b>OKIDATA</b>                        | Smart II ..... \$699             | <b>ELEPHANT</b>                   |
| All Printer Models ..... Save         | <b>QUME</b>                      | 5 1/4 SS/DD (Qty 100) ..... \$155 |
| <b>PANASONIC</b>                      | QVT102, 103, 108 ..... Save      | <b>COMPUTERS</b>                  |
| All Printer Models ..... Save         | <b>TELEVIDEO</b>                 | <b>ALTOS</b>                      |
| <b>SILVER REED</b>                    | All Terminal Models ..... Save   | All Computer Models ..... Save    |
| All Printer Models ..... Save         | <b>WYSE</b>                      | <b>EAGLE</b>                      |
| <b>STAR MICRONICS</b>                 | All Terminal Models ..... Save   | All Computer Models ..... Save    |
| All Printer Models ..... Save         | <b>MONITORS</b>                  | <b>NEC</b>                        |
| <b>STAR MICRONICS</b>                 | <b>AMDEK</b>                     | 8201 Computer ..... Save          |
| MT-160Lw/Tractors ..... \$555         | All Models ..... Save            | <b>SANYO</b>                      |
| MT-180Lw/Tractors ..... \$769         | <b>VISUAL</b>                    | All MBC Models ..... Save         |
| Spirit 80 ..... \$255                 | Commuter ..... Save              | <b>ZENITH</b> All Model           |
| <b>TOSHIBA</b>                        | <b>ZENITH</b>                    | Z-150 & Z-160 ..... Save          |
| P1340 Parallel or Serial ..... \$719  | All Monitor Models ..... Save    |                                   |
| P1351 Parallel or Serial ..... \$1249 | <b>MODEMS</b>                    |                                   |
| <b>DISK DRIVES</b>                    | <b>HAYES</b>                     |                                   |
| <b>RANA</b>                           | Smartmodem 300 Baud ..... \$189  |                                   |
| Elite I ..... \$215                   | Smartmodem 1200 Baud ..... \$459 |                                   |
| Elite II ..... \$340                  | Smartmodem 1200 B ..... \$389    |                                   |
| Elite III ..... \$410                 | <b>US ROBOTICS</b>               |                                   |
|                                       | Password 1200 Baud ..... \$309   |                                   |

Prices reflect 3% to 5% cash discount. Product shipped in factory cartons with manufacturer's warranty. Please add \$8.00 for U.P.S. handling and shipping costs. Prices & availability subject to change without notice. Send cash or check or money order... all other checks will delay shipping two weeks.

**SILICON SPECIALTIES**  
 2034 WEST SOUTHERN  
 MESA, ARIZONA 85202  
 602-969-0909

# A Picture's Worth:

U.S. SHIPMENTS (\$ BILLIONS)

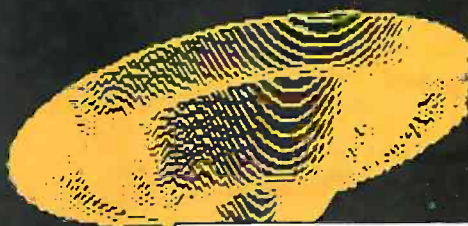


## \*\* GRAPHICS CAPABILITIES \*\*

- ◆ HIGH PERFORMANCE GRAPHICS
- ◆ TEKTRONIX 4010 COMPATIBILITY
- ◆ AUTOMATIC SCALING (1023x1023) WITH 250x512 RESOLUTION
- ◆ ALPHA MODE (35 LINES x 73 COLS)
- ◆ OPTIONAL JOYSTICK
- ◆ CONNECTION TO LOW COST PRINTER FOR GRAPHICS HARDCOPY
- ◆ ASCII AND APL CHARACTER SETS
- ◆ BLOCK FILL, DOTTED/DASHED LINES

## \*\* DISPLAY TERMINAL CAPABILITIES \*\*

- ◆ ANSI STANDARD CONFORMANCE
- ◆ DEC SOFTWARE COMPATIBILITY
- ◆ 80/132 COLUMNS, WINDOWING
- ◆ 4 PAGES OF MEMORY STANDARD (UP TO 8)
- ◆ 46 PROGRAMMABLE FUNCTIONS
- ◆ ASCII AND APL MODELS
- ◆ COMPACT ULTRA-THIN KEYBOARD
- ◆ HIGH INTENSITY AMBER PHOSPHOR



High performance graphics at a new low price!

**\$1190\***

## CONCEPT GVT+™ Graphics Display Terminal

\*Small quantity price



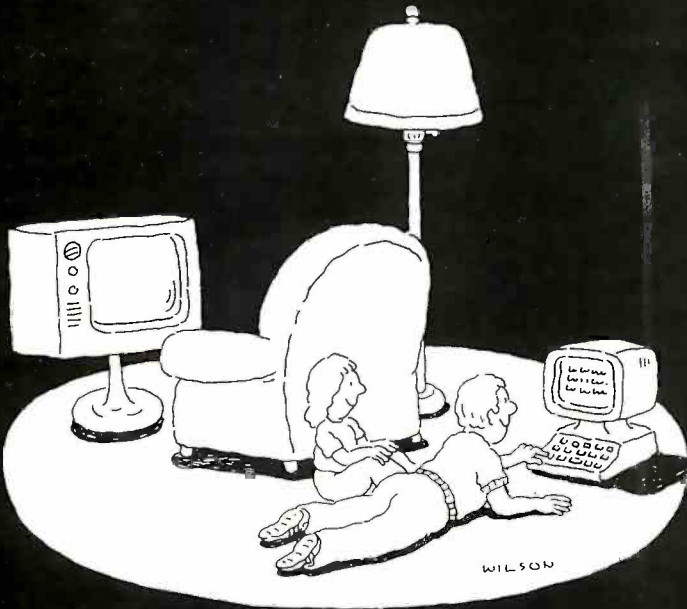
human designed systems, inc.

Whether used in video display mode or in its high-performance graphics mode, Human Designed Systems' GVT+™ Graphics Display Terminal offers more user friendliness, more design features, and more advanced functionality to optimize productivity — and encourage creativity — for the terminal operator, interactive user, and applications developer than any other terminal available today.

Atlanta — (404) 391-9763; Boston — (617) 449-6446; Chicago — (312) 825-2960; Dallas — (214) 437-1888; Delaware — Infocon: (302) 239-2942; Denver — (303) 469-1953; Detroit — (313) 471-2807; Hawaii — Gray Associates: (808) 261-3751; Houston — (713) 952-1403; Los Angeles — (213) 410-9454; Northern New Jersey — Infocon: (201) 624-1372; New York City Area — Infocon: (212) 689-8833; New York State — Naco Electronics: Rochester: (716) 223-4490; Syracuse: (315) 699-2651; San Francisco — (415) 692-4184; Washington, DC — International Systems Marketing: (301) 279-5775; Argentina — Iron SA: (01) 774-9369; Australia — Computer Clarity Pty. Ltd.: (02) 241 3385; Belgium — BELCOMP: 091-31-52-22; Canada — CALL Systems: Toronto: (416) 362-1063; Denmark — ADCOM Data Aps: 1-19 44 66; Finland — Valtamatic Oy: 0-742 011; France — Walton: (1) 226 06 90; Japan — Ampere: 03 (365) 0825; Portugal — Soc. Com. Crocker, Dellatorre Co. Ltd.: 1-6801 41; Singapore — DTS Singapore: 33-88-566; South Africa — Psitac (Pty.) Ltd.: (11) 836-9181; Switzerland — Mitek ag: 01/461 22 52; United Kingdom — Shandell Systems Ltd.: 2407-2027; Venezuela — H. Blohm SA: 2541.21.22; West Germany — COMKO Computersysteme GmbH: 221-48 30 51. INTERNATIONAL DISTRIBUTORSHIP INQUIRIES INVITED.

Circle 181 on inquiry card.

GVT+ is a trademark of Human Designed Systems, Inc.



## Complacency or curiosity?

Move your children away from the passive nature of TV and turn them on to the excitement and fun of interactive learning with Dow Jones News/Retrieval®.

You probably thought Dow Jones News/Retrieval only provided business and financial information. *Wrong.* We've got something of value for the whole family.

With our 20-volume, 30,000 article Academic American Encyclopedia, Dow Jones News/Retrieval will pique your children's curiosity about the world and help them develop new skills. The information they need for school is easy to access, always up-to-date, always ready. And kids love to use it!

There are timely news reports

from Washington, our nation and the world. You also get current schedules and rates from the Official Airline Guide™; Comp-U-Store, a convenient shop-at-home service; Cineman Movie Reviews; sports highlights, weather reports and MCI Mail—the new electronic mail service that lets you send letters to anyone, *anywhere*, even if he or she doesn't own a terminal.

Overall, you'll find a wide variety of high-quality data bases accessible quickly and easily with most personal computers.

To get your children involved, excited and turned on to the fun of learning, turn them on to Dow Jones News/Retrieval.

**DOW JONES**  
**NEWS/RETRIEVAL**®

Copyright © 1984 Dow Jones & Company, Inc. All Rights Reserved.  
 Dow Jones News/Retrieval® is a registered trademark of Dow Jones & Company, Inc.

**FOR FULL DETAILS, CALL 800-345-8500, EXT. 5**

Alaska, Hawaii and foreign, call 1-215-789-7008, Ext. 5

of it accessible to the program at any time without action on your part. The "what you see is what you get" approach lets you see bold, underlining, centering, and margins on the screen as they will appear in the printed copy. You can select your own screen colors, both background and text. And if you don't like the ones you chose yesterday, you can change them today. Finally, you can use WordPerfect both as a word processor and as a program text editor because of its ability to save documents as straight ASCII text files. This saves you both money and the time, effort, and confusion involved in switching back and forth between editors.

On the minus side, the character-attribute bit for underlining is manipulated differently for monochrome and color monitors (this might not be a problem, depending on your application). The tab stops are established relative to a zero screen position, so if you change your left margin, your tabs all change with respect to that margin. Setting tabs in WordPerfect is a chore because you must stop what you are doing, figure out where you want a tab, and then set it. Also, the spelling dictionary is only 30,000 words long with room for an additional 10,000 user-defined words. If it does find an error, WordPerfect asks if you want to look up the word in a list of suggested spellings or correct it yourself, rather than correcting the word automatically. And, no matter where you find the correct spelling for your word, you must continue to peruse any additional screens containing words that meet your search criteria. [Editor's note: Satellite Software International has scheduled version 4.0 of WordPerfect for release about the time of publication of this article. It might solve some of the problems mentioned by the author.]

All in all, I am extremely impressed with WordPerfect. Its powerful capabilities far outweigh the problems mentioned. As I said at the beginning of this article, you should choose the word processor that includes the features you find most convenient. My choice is WordPerfect. ■



# THE SAKATA CONNECTION

## Your personal computer deserves the unequalled monitor quality of Sakata

Your computer deserves the most monitor quality value possible...and so do you. SAKATA CRT DISPLAY MONITORS give you more monitor quality than the most expensive monitors available. Each SAKATA MONITOR provides unequalled color reproduction; sharpest and most vivid graphics; text that you read more easily than you ever expected; and technical characteristics and capabilities that will amaze you.

Protect your personal computer's

performance by utilizing SAKATA CRT MONITORS which provide the utmost in monitor value. Choose from an entire line of Composite Color; RGB High Resolution Color; RGB Super High Resolution Color and two monochromes (green and amber) that have more quality than other monochrome monitors. **"We promise performance".**

SAKATA CRT MONITORS are available wherever personal computers are sold or write for technical and illustrated literature and prices.

SAKATA U.S.A. CORPORATION  
651 Bonnie Lane, Elk Grove Village, IL 60007  
(312) 593-3211 800-323-6647 (outside Illinois)

# Sakata

"Serving industry worldwide since 1896"

SC-100  
COLOR COMPOSITE



SC-200  
RGB HIGH  
RESOLUTION COLOR



SC-300  
RGB SUPER HIGH  
RESOLUTION COLOR



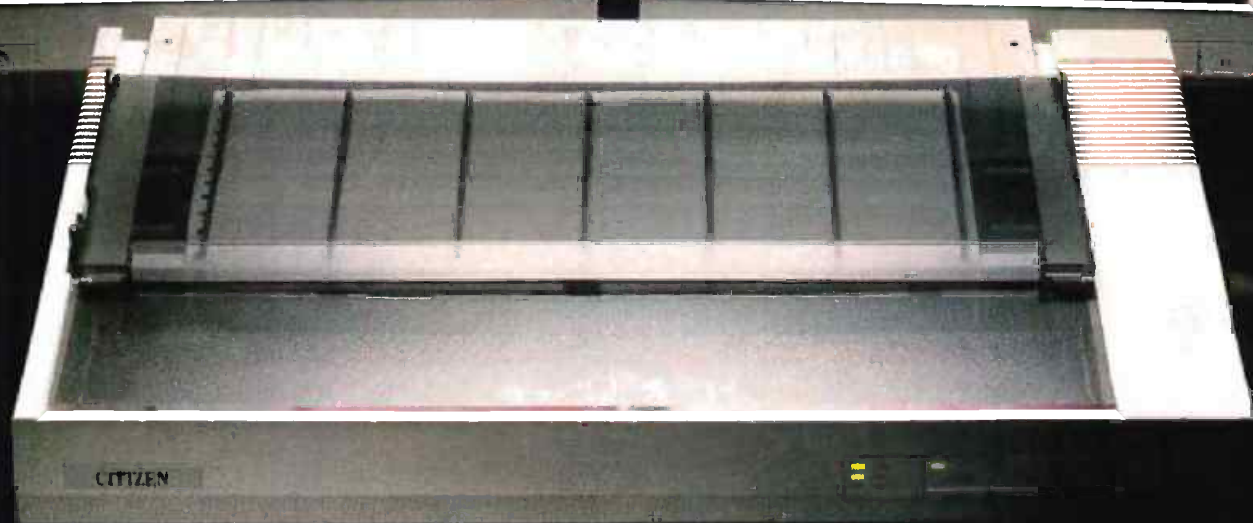
SG-1000  
MONOCHROME GREEN



SA-1000  
MONOCHROME AMBER

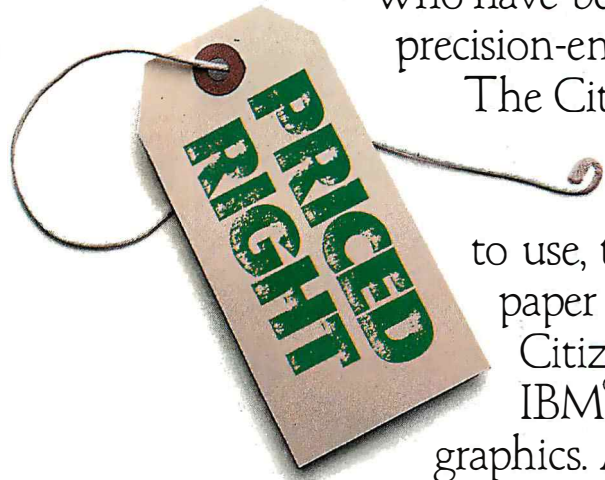


# SOLID CITIZENS.





Here are a couple of fine, upstanding Citizens who'll give you service and value, above and beyond the call of duty for many years to come. Citizen™ dot matrix printers, precision-engineered by the people who have become a wristhold word in fine, precision-engineered watches.



The Citizens are very sleek, very quiet, and reliable as the day is long. They're also exceptionally easy to use, thanks to a unique new push-feed paper loading system. What's more, the Citizens are very versatile. They're both IBM® and Epson®-compatible. Can print graphics. And give you the flexibility of changing your output speed from a throughput-minded 160 cps to 40 cps correspondence-quality—at the flick of a switch.

The Citizens. Precision-engineered printers at a price precision-engineered to put a smile on your face.

Stop by one of our dealers today and watch what the Citizens can do for you.

For more information, call 1-800-556-1234, Ext. 34.



In California, 1-800-441-2345, Ext. 34. Or write Citizen America Corporation, 2425 Colorado Avenue, Santa Monica, CA 90404.



© 1984 Citizen America Corporation. Citizen is a trademark of Citizen America Corporation. IBM is a registered trademark of International Business Machines Corporation. Epson is a registered trademark of Epson Corporation.



*The Pascal-2 system is available on Digital's VAX, MicroVAX; PDP-11/RSX, RSTS, RT-11, UNIX, TSX-Plus; and Professional Computer running P/OS, RT-11.*

## We put a lot of ourselves into Pascal-2. Put us to work on your VAX.

Everything we know about software development is built into Pascal-2. We created a straight-forward, robust compiler with rugged predictability that has already become a legend. Pascal-2 has proven its performance and its reliability in more than 2,000 installations in 36 countries.

**Pascal-2 on VAX** Now Pascal-2 can give you that same performance on the Digital Equipment Corporation's VAX, the premier software development computer system.

Pascal-2 provides the strength and flexibility essential for real utility in scientific, engineering, business, and industrial applications.

Using the advanced capabilities of this optimizing compiler, your development cycle will be shorter and your applications more efficient.

Digital, PDP, VAX, VMS, RSTS, RT-11, RSX, Professional 350 and P/OS are trademarks of Digital Equipment Corporation. UNIX is a trademark of AT&T Bell Laboratories. TSX-Plus is a trademark of S & H Computing, Inc. Pascal-2 is a trademark of Oregon Software.

Circle 295 on inquiry card.

Pascal-2 is the only language compiler that provides a uniform development environment across the full line of Digital systems from the Professional 350 to the VAX. All versions of the compiler provide identical language features, with the same interface for the operating system and hardware, and the same set of language extensions.

### Portability

As a result, your application can be moved easily from one environment to another.

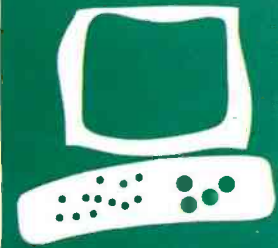
The Pascal-2 System Development Package for the Digital VAX and MicroVAX includes an optimizing Pascal compiler; an interactive, source-level Debugger; a Profiler that pinpoints execution bottlenecks; and other utilities to aid program development.

If you would like to put Pascal-2 to work on your VAX, call us at 1-800-874-8501.

# Oregon Software

6915 S.W. Macadam Avenue  
Portland, Oregon 97219

SEE US AT DEXPO/WEST, BOOTH #2836



## The Epson LQ-1500

### A double-duty dot-matrix printer

BY KEN SHELDON

**D**ot-matrix printers are fast and inexpensive and produce output that can literally be a pain to read.

Daisy-wheel printers are easy on the eyes but hard on the pocketbook, and they usually don't print much faster than you do.

Enter the Epson LQ-1500—a dot-matrix printer that attempts to provide the best of all possible worlds: speed, legibility, and affordability.

The LQ-1500 has three print modes: a high-speed draft mode, a lower-speed "letter-quality" mode, and a high-resolution graphics mode. The unit also features proportional spacing, a variety of type styles, international character sets, a 2K-byte buffer, and the capacity to print user-defined character sets. The cost is \$1395.

#### FIRST LOOK

The LQ-1500 is a well-designed product, similar in looks to the earlier Epson MX-100 and FX-100 printers. This 31-pound machine is not one that you will want to move a lot. Like Epson's MX and FX series printers, the LQ-1500's controls are on the top right, next to the paper-feed knob. The on/off switch, however, has been moved from the right rear (as on the MX-80) to the left rear, which is somewhat less convenient.

Setup of the LQ-1500 is very easy, thanks to a well-designed manual that guides you step by step through the process, with clear illustrations accompanying each procedure. Even the trickier tasks usually performed by the dealer, such as installing the optional tractor-feed unit or the parallel, serial, or IEEE-488 interface board, should take no more than a few minutes with the help of the manual.

On the back of the unit are the interface, power connection, and two sets of DIP (dual-inline package) switches that allow you to initiate and disable the buffer, automatic line feed, and alarm bell, and to control print modes and character sets. All of these tasks can be controlled from your computer, which is good, since the sheet guide

makes the DIP switches a little hard to reach.

#### PRINTING

The LQ-1500's major selling point is its variable print modes. For routine work there is a draft mode, which is fast and produces the usual "dotty" looking output. The letter-quality mode provides easier-to-read type by utilizing all 24 of the pins in the LQ-1500's print head. I must admit that I was annoyed with Epson for calling the higher-quality mode "letter-quality"—a term that has come to be associated with daisy-wheel printers, which the LQ-1500 is not. "Near letter-quality" or "virtual letter-quality" would be more accurate.

Nomenclature aside, the LQ-1500 produces a nice, dark, moderately smooth typeface. It isn't daisy-wheel quality, but it is better than the "emphasized" or "enhanced" modes of this and other printers, and infinitely better than usual dot-matrix printouts.

According to the manual, the LQ-1500 provides 224 different printing styles—which sounds pretty good, until you realize that the styles are all varieties of pica and elite in italic, compressed, emphasized, double-strike, enlarged, and underlined modes (see figure 1). I suppose it is nice to have all those options, but the differences between some of them (such as "elite emphasized expanded" and "elite double-strike expanded") are negligible. Also, some of the styles get pretty silly, such as "elite condensed emphasized double-strike" (which is barely legible) and several varieties of "compressed expanded" type.

#### GRAPHICS

The LQ-1500 was designed to be compatible with Epson's FX line of printers. I used it to print single-, double-, triple-, and quadruple-density graphs using the FX-80 printer driver in Lotus 1-2-3 with no trouble (see figure 2). I was also able to produce graphs

(continued)

## AT A GLANCE

### Name

Epson LQ-1500

### Manufacturer

Epson America Inc.  
3415 Kashiwa St.  
Torrance, CA 90505  
(213) 539-9140

### Physical Dimensions

24 by 14 by 5 inches,  
31 pounds

### Features

Draft (9- by 17-dot characters at 116 cps), letter-quality (15- by 17-dot characters at 52 cps), and graphics modes (240 dots per inch horizontally by 180 dots per inch vertically); 2K-byte buffer; friction paper feed; parallel, serial, or IEEE-488 interface; compatible with FX-80 printer; will accept 128 user-designed characters

### Options

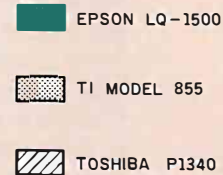
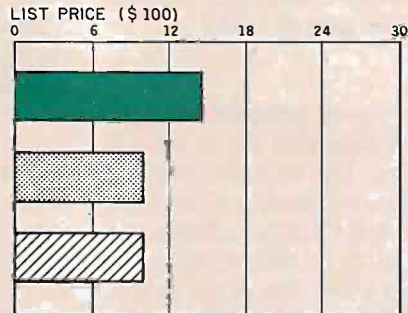
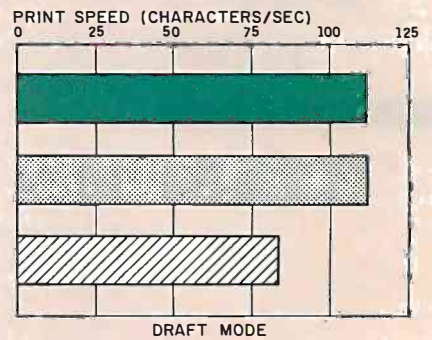
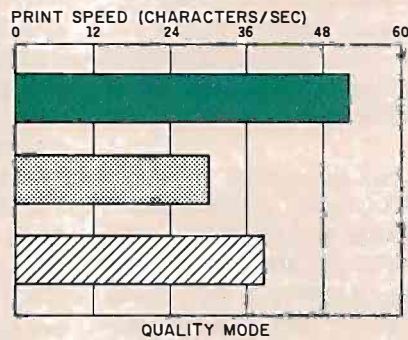
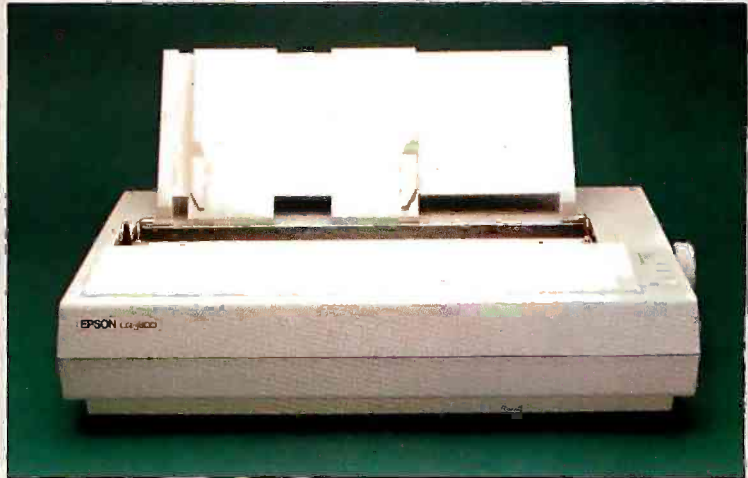
Tractor feed (\$55)  
*LQ-1500 Programmer's Manual* (\$17.50)

### Documentation

LQ-1500 user's manual, spiral-bound, 97 pages; quick-reference card

### Price

\$1395



**This is the Epson LQ-1500, letter-quality**  
 This is the Epson LQ-1500, dot-matrix mode.  
 This is the Texas Instruments Omni 800/Mod  
 This is the Texas Instruments Omni 800/Mod  
**This is the Toshiba P1340 in high-quality**  
 This is the Toshiba P1340 in high-speed mo

A comparison of the Epson LQ-1500 printer with the Texas Instruments Omni 800/Model 855 and the Toshiba P1340. All three are high-density dot-matrix printers. Print samples are given for both the quality and draft modes. The TI Model 855 sample was obtained by using

the Courier WP print module. A printing pitch of 10 characters per inch was used for each test. In the print-speed tests, each printer was programmed to print 50 lines of 80 As each. The prices shown include a tractor-feed mechanism.

|                        |                         |
|------------------------|-------------------------|
| Pica regular           | Elite regular           |
| Pica emphasized        | Elite emphasized        |
| Pica double-strike     | Elite double-strike     |
| <i>Pica italic</i>     | <i>Elite italic</i>     |
| <u>Pica underlined</u> | <u>Elite underlined</u> |
| <b>Pica expanded</b>   | <b>Elite expanded</b>   |

Figure 1: The Epson LQ-1500 offers pica and elite type in a variety of styles.

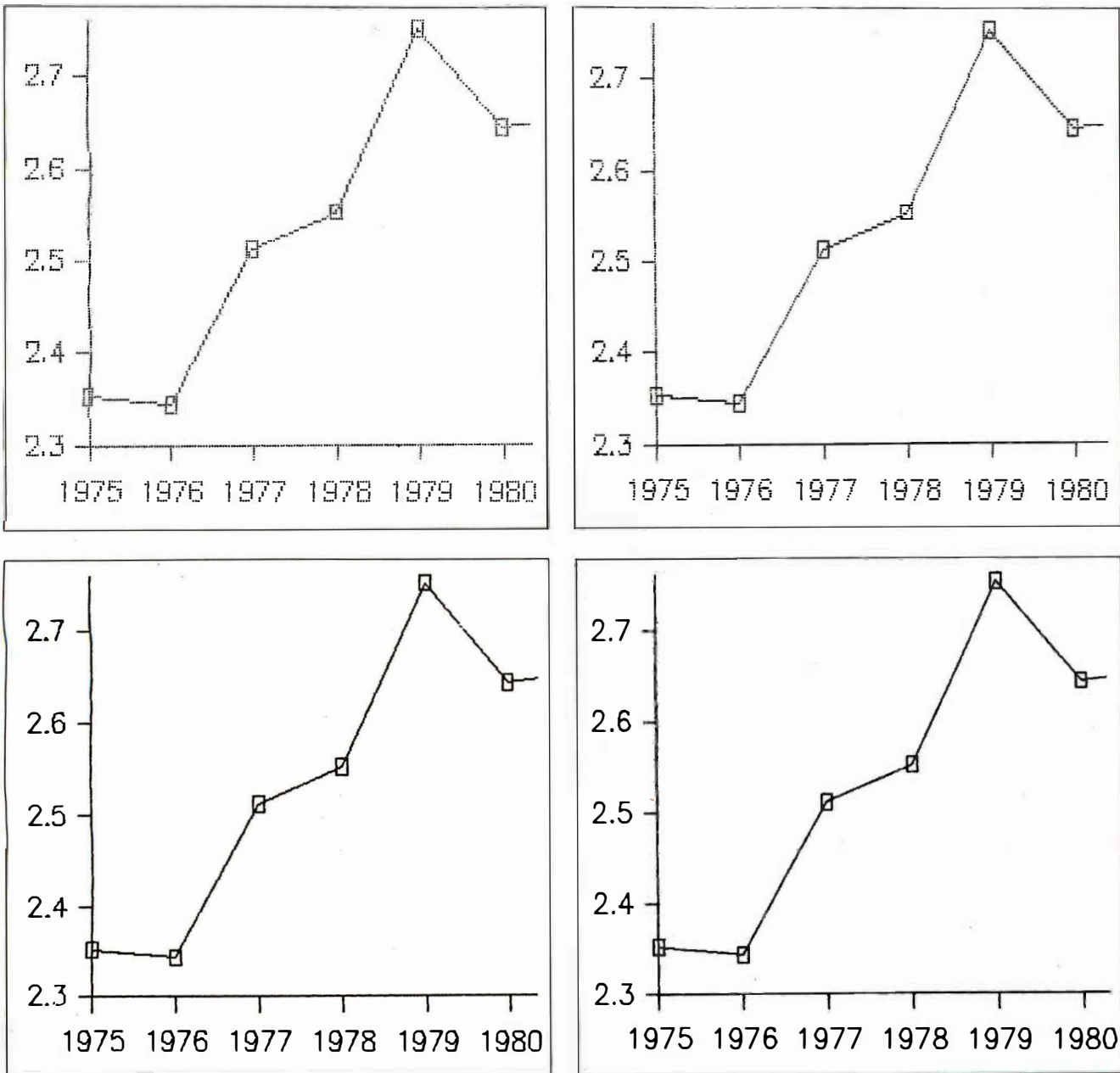


Figure 2: Quadruple-density graph printed by the LQ-1500 using the Epson FX-80 printer driver on Lotus 1-2-3.

© 1984, Fox & Geller, Inc.

**SOFTWARE'S DYNAMIC DUO**

**FOX & GELLER PRESENT**

**QUICKCODE III**

**NEW FEATURES**

**dBASE III**

**POWERFUL, FAST, EFFICIENT; QUICKCODE III**

**FOX & GELLER**  
604 Market Street, Elmwood Park, N.J. 07407

culations on data entry screens including line totals, column totals and running balances. Finally you can do all those jobs you bought your database management system to do.

Introducing QUICKCODE III! The new program generator for Ashton-Tate's dBASE III. QUICKCODE III has Jumbo Files, which store 8 times as much data as normal files. There's no tedious code writing. Perform database searches, catch typing errors, print form letters; all without programming. QUICKCODE III can perform hundreds of cal-

**The Power of the World's Most Popular Database Made Better!**

dBASE III and QUICKCODE III are registered trademarks of Ashton-Tate, Inc.

EPSON LQ-1500

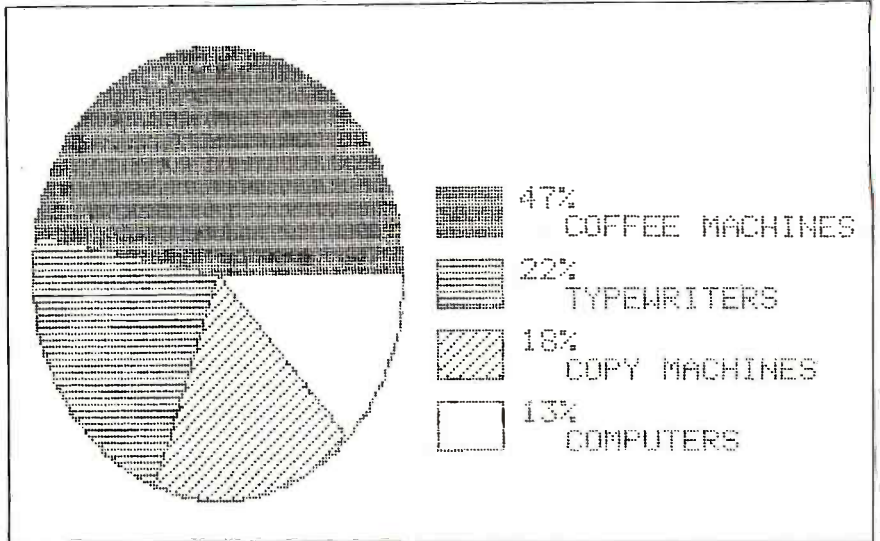


Figure 3: A pie chart generated by pfs:Graph and printed on the LQ-1500.

by using the Epson printer driver in pfs:Graph (figure 3).

**DOCUMENTATION**

One of the best things about the LQ-1500 is its small, spiral-bound user's manual. The manual is short, clear, and includes a good index and a quick-reference card. Sections on control codes, commands, changing print styles, and so on, are also included. And if you want to design your own character sets or write special software for the LQ-1500, you'll have to get the *LQ-1500 Programmer's Manual* (\$17.50), which should be available by now.

Unfortunately, there are a few mistakes in the user's manual, such as confusing pica with elite on a couple of the print-style charts, and using the words "condensed" and "enlarged" on the quick-reference card and "compressed" and "expanded" in the text. These are the exceptions, however, and overall the manual deserves high marks.

**OPERATION**

Epson claims that the LQ-1500 will print 200 characters per second (cps) in draft mode and 67 cps in letter-quality mode. If you have any experience with real-life printing, you know that this is wishful thinking. In

one of BYTE's standard benchmark tests for dot-matrix printers (printing the letter A 80 times in 50 rows), the LQ-1500 operated at 115.6 cps in draft mode and 52 cps in letter-quality mode—not bad, since the letter-quality mode is faster than some printers' draft modes and much faster than most daisy-wheel printers (see "The Art of Benchmarking Printers," by Sergio Mello-Grand, February BYTE, page 193). But it is just as noisy as other dot-matrix printers.

Another operational feature is the 2K-byte buffer, which is enough to store all the information from one screen. For certain kinds of short, repetitive printing that require input from the keyboard, this can save time, but you usually won't notice the difference.

**CONCLUSION**

At \$1395, the Epson LQ-1500 is more expensive than most dot-matrix printers, but it provides features that the others don't have. And although there are printers that do double-duty printing for less money, they don't have the Epson name.

For a printer as versatile and easy to use as the LQ-1500, the price is not bad. And if "virtual letter-quality" type is acceptable for your needs, then the Epson LQ-1500 may be the printer for you. ■



**AND NOW THE GAME BEGINS**

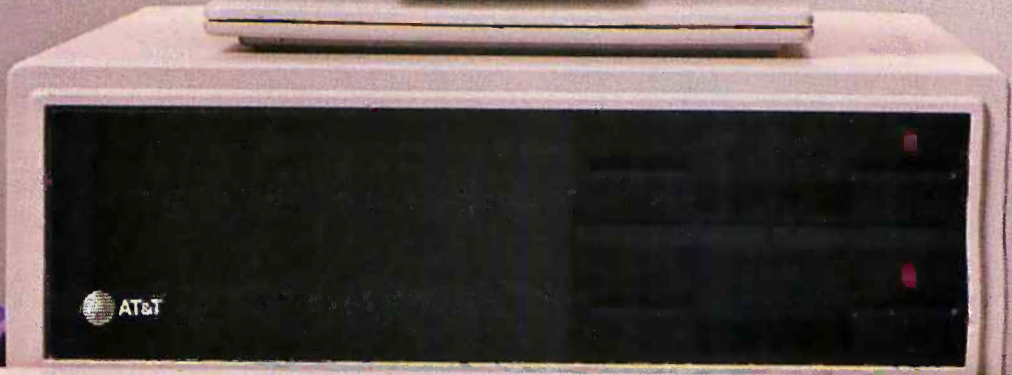
**PERSONAL COMPUTER**  
*The Game*

**BUSINESS EDITION**

# INTRODUCING THE AT&T

NATIONAL PROFIT FORECAST

|     | 1               | 2       | 3       | 4       | 5       | 6       | 7                           |
|-----|-----------------|---------|---------|---------|---------|---------|-----------------------------|
| 1   |                 |         |         |         |         |         |                             |
| 2   |                 |         |         |         |         |         |                             |
| 3   |                 |         |         |         |         |         |                             |
| 4   |                 |         |         |         |         |         |                             |
| 5   |                 |         |         |         |         |         |                             |
| 6   | REGION          | 1984    | 1985    | 1986    | 1987    | 1988    |                             |
| 7   |                 | (\$M)   | (\$M)   | (\$M)   | (\$M)   | (\$M)   |                             |
| 8   |                 |         |         |         |         |         |                             |
| 9   | NORTHEAST       | 8058.8  | 9255.8  | 9812.8  | 9679.8  | 10128.8 |                             |
| 10  | MID-ATLANTIC    | 6298.8  | 7125.8  | 6988.8  | 7336.8  | 7838.8  |                             |
| 11  | SOUTHEAST       | 6548.8  | 7536.8  | 7421.8  | 8128.8  | 8828.8  |                             |
| 12  | CENTRAL         | 5878.8  | 6665.8  | 6238.8  | 7838.8  | 7428.8  |                             |
| 13  | MIDWEST         | 4628.8  | 5629.8  | 5534.8  | 6228.8  | 6698.8  |                             |
| 14  | NORTHWEST*      | 2648.8  | 4299.8  | 3878.8  | 4378.8  | 5298.8  |                             |
| 15  | SOUTHWEST       | 8321.8  | 8888.8  | 8562.8  | 9882.8  | 10881.8 |                             |
| 16  |                 |         |         |         |         |         |                             |
| 17  | TOTAL           | 54435.8 | 64397.8 | 67469.8 | 72524.8 | 76177.8 |                             |
| 18  |                 |         |         |         |         |         |                             |
| 19  |                 |         |         |         |         |         | *INCLUDES ALASKA AND HAWAII |
| 20  |                 |         |         |         |         |         |                             |
| 21  | VALID:          |         |         |         |         |         |                             |
| 22  |                 |         |         |         |         |         |                             |
| 23  | Enter a formula |         |         |         |         |         |                             |
| 24  | R13C6 6.257     |         |         |         |         |         |                             |
| 25  |                 |         |         |         |         |         |                             |
| 26  |                 |         |         |         |         |         |                             |
| 27  |                 |         |         |         |         |         |                             |
| 28  |                 |         |         |         |         |         |                             |
| 29  |                 |         |         |         |         |         |                             |
| 30  |                 |         |         |         |         |         |                             |
| 31  |                 |         |         |         |         |         |                             |
| 32  |                 |         |         |         |         |         |                             |
| 33  |                 |         |         |         |         |         |                             |
| 34  |                 |         |         |         |         |         |                             |
| 35  |                 |         |         |         |         |         |                             |
| 36  |                 |         |         |         |         |         |                             |
| 37  |                 |         |         |         |         |         |                             |
| 38  |                 |         |         |         |         |         |                             |
| 39  |                 |         |         |         |         |         |                             |
| 40  |                 |         |         |         |         |         |                             |
| 41  |                 |         |         |         |         |         |                             |
| 42  |                 |         |         |         |         |         |                             |
| 43  |                 |         |         |         |         |         |                             |
| 44  |                 |         |         |         |         |         |                             |
| 45  |                 |         |         |         |         |         |                             |
| 46  |                 |         |         |         |         |         |                             |
| 47  |                 |         |         |         |         |         |                             |
| 48  |                 |         |         |         |         |         |                             |
| 49  |                 |         |         |         |         |         |                             |
| 50  |                 |         |         |         |         |         |                             |
| 51  |                 |         |         |         |         |         |                             |
| 52  |                 |         |         |         |         |         |                             |
| 53  |                 |         |         |         |         |         |                             |
| 54  |                 |         |         |         |         |         |                             |
| 55  |                 |         |         |         |         |         |                             |
| 56  |                 |         |         |         |         |         |                             |
| 57  |                 |         |         |         |         |         |                             |
| 58  |                 |         |         |         |         |         |                             |
| 59  |                 |         |         |         |         |         |                             |
| 60  |                 |         |         |         |         |         |                             |
| 61  |                 |         |         |         |         |         |                             |
| 62  |                 |         |         |         |         |         |                             |
| 63  |                 |         |         |         |         |         |                             |
| 64  |                 |         |         |         |         |         |                             |
| 65  |                 |         |         |         |         |         |                             |
| 66  |                 |         |         |         |         |         |                             |
| 67  |                 |         |         |         |         |         |                             |
| 68  |                 |         |         |         |         |         |                             |
| 69  |                 |         |         |         |         |         |                             |
| 70  |                 |         |         |         |         |         |                             |
| 71  |                 |         |         |         |         |         |                             |
| 72  |                 |         |         |         |         |         |                             |
| 73  |                 |         |         |         |         |         |                             |
| 74  |                 |         |         |         |         |         |                             |
| 75  |                 |         |         |         |         |         |                             |
| 76  |                 |         |         |         |         |         |                             |
| 77  |                 |         |         |         |         |         |                             |
| 78  |                 |         |         |         |         |         |                             |
| 79  |                 |         |         |         |         |         |                             |
| 80  |                 |         |         |         |         |         |                             |
| 81  |                 |         |         |         |         |         |                             |
| 82  |                 |         |         |         |         |         |                             |
| 83  |                 |         |         |         |         |         |                             |
| 84  |                 |         |         |         |         |         |                             |
| 85  |                 |         |         |         |         |         |                             |
| 86  |                 |         |         |         |         |         |                             |
| 87  |                 |         |         |         |         |         |                             |
| 88  |                 |         |         |         |         |         |                             |
| 89  |                 |         |         |         |         |         |                             |
| 90  |                 |         |         |         |         |         |                             |
| 91  |                 |         |         |         |         |         |                             |
| 92  |                 |         |         |         |         |         |                             |
| 93  |                 |         |         |         |         |         |                             |
| 94  |                 |         |         |         |         |         |                             |
| 95  |                 |         |         |         |         |         |                             |
| 96  |                 |         |         |         |         |         |                             |
| 97  |                 |         |         |         |         |         |                             |
| 98  |                 |         |         |         |         |         |                             |
| 99  |                 |         |         |         |         |         |                             |
| 100 |                 |         |         |         |         |         |                             |



# PERSONAL COMPUTER.

The personal computer game is ready for business—and now it's your move. To win the game your company needs a fast, flexible, reliable personal computer that enables you to call the shots.

Go directly to the new AT&T Personal Computer.

The AT&T Personal Computer is more than just a superior piece of hardware. Behind it is a commitment to a better way of managing information and communications. One that can pay off handsomely in increased productivity and profits.

Because our AT&T PC is designed to be flexible enough to meet all your business needs—today and in the future.

Whether you use it as a stand-alone workstation or as a team player in a fully integrated system, you'll find our PC a high-performance machine. And a hard-working addition to your office.

Its fast processing and high-resolution graphics will help make any computer task a computing pleasure. In addition, you can expect more standard features. More expansion slots. More options for future growth.

## OFF-THE-SHELF SOFTWARE DOES THE JOB

Driven by the MS-DOS\* operating system, the AT&T PC runs the most popular off-the-shelf software for a wide range

of business applications. Financial analysis. Forecasting. Budgeting. Word processing. Inventory. The AT&T PC does it all.

And its flexibility means that when it's time to expand, our PC will actually make your computer growing pains painless.

With our unique PC Interface it can be linked to the more sophisticated, higher capacity world of the UNIX\*\* System V Operating System—the AT&T Computer "brain" that is emerging as the operating system standard for multi-user, multi-tasking machines.

## THE AT&T TRADITION CONTINUES

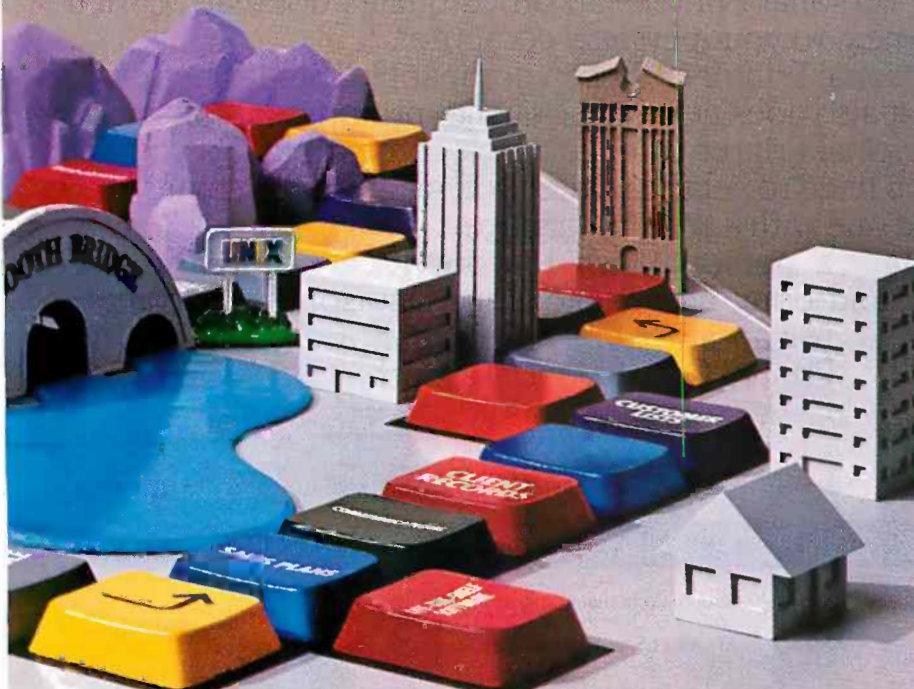
Some things about our PC cannot be measured in bits and bytes, but are of immeasurable value.

For instance, the unmatched service and support of AT&T. The built-in reliability—and outstanding quality—of our products. The century-long tradition of technological innovation and personal attention to detail.

Think about it. Then make your move—to the AT&T Personal Computer, from AT&T Information Systems.

To get in on the game, call your AT&T Account Executive, visit an Authorized AT&T PC Dealer, or call 1 800 247-1212.

**AT&T INFORMATION SYSTEMS.  
WHEN YOU'VE GOT TO BE RIGHT.**



\*MS-DOS is a trademark of Microsoft Corporation.  
\*\*UNIX is a trademark of AT&T Bell Laboratories.  
© 1984 AT&T Information Systems.

# Now you can get personal with a Datasouth.



Say hello to the Datasouth Personal Printer—an office-quality dot matrix printer that makes itself right at home next to your personal computer.

Technically speaking, the Personal Printer is “Epson compatible.” But it’s better than the competing Epson because it also does near-letter-quality printing.

Personally speaking, the Personal Printer is “checkbook compatible.” So you don’t have to sacrifice the money you need to get the printer you want. And it comes in two models—one with a 10-inch and one with a 17-inch carriage.

Make a personal visit to your local computer store, and bring home legendary Datasouth performance for an affordably personal price. The Personal Printer. Only from Datasouth.



*personal*

**datasouth**

H I G H P E R F O R M A N C E M A T R I X P R I N T E R S

Find Datasouth Printers At  
Participating **ComputerLand**® Stores  
And Other Fine Dealers.

Datasouth Computer Corporation  
Box 240947 · Charlotte, NC 28224  
704/523-8500 · Telex 6843018 DASOU UW

CALL TOLL FREE:  
**1-800-222-4528**

## SPEECH AND VOICE SYNTHESIS

I found Tom Clune's "Speech and Voice Synthesis" text box for the "Five Voice Synthesizers" article (September, page 337) to be a concise account of the problems of voice synthesis from the computer's point of view, but a linguist he ain't. In fact, the first three paragraphs were quite painful to read.

Voiced sounds (those in which we use our vocal chords, like vowels and m, n, b, r, etc.) and voiceless sounds (those for which we do not use our vocal chords, like s, sh, f, h, etc.) both have amplitude peaks and a frequency range and thus identifiable formants. If they didn't, our ears could not distinguish the differences between them. Thus, the voiced/voiceless distinction is one of degree only.

The concept of allophone is a central concern in speech synthesis. Simply defined, allophones are different realizations of the same basic sound. For example, the "p" sound in "pat" is measurably different than the "p" sound in "hypnosis".

A phoneme, in general terms, is a minimal unit of sound that cannot be changed past the allophone limit without changing the meaning of the word. If we changed the "p" to "f", "pat" would be "fat". The differences in "p" and "f" are too great for them to be allophones; they are different phonemes.

As an aside, the "oy" in "foil" is not an allophone, it is a diphthong. A diphthong is two vowels that, when taken together, can serve as the nucleus of a syllable and can receive stress as a unit.

Now the interesting part: The occurrence of allophones is determined by the environment in which the basic sound occurs. In other words, it is predictable that the "p" in "pat" will have a puff of air after it, as all "p"s do when they are followed by a vowel. Because allophones are predictable, they are programmable. The stiffness and artificiality of today's voice synthesizers is due in large part to the lack of allophonic variation in the phonemes, as well as other word- and sentence-level stress and intonation phenomena that are largely predictable by linguists.

Speech synthesizers and voice-recognition programs will not approach "natural-

ness" until the predicted changes in the speech stream are indeed programmed.

MICHAEL R. THOMAS  
Port Arthur, TX

*Certainly if unvoiced sounds lacked formants there would only be one unvoiced sound. To repeat the point I made in the text box, the origin of the sound is, in essence, white noise. The creation of formants is a function of vocal-tract resonances, not of the original sound. An analogy may help clarify this point. A drop of water falling into a gallon jug will seem to make a lower sound than a drop of water falling into a dropper bottle. The difference is in the resonance of the container, not the sound the drop makes. However, it is true that the voiced/voiceless distinction is not absolute. The "zh" sound in "azure," for example, straddles the voiced/unvoiced boundary. The linear predictive coding (LPC) model treats the boundary as absolute, which is one of the simplifications involved in the model.*

*Second, I did not call the "oi" sound an allophone, but a phoneme. This is in agreement with the standard linguistic classification schemes, e.g., Fries-Pike and Trager-Smith. Diphthongs are one type of phoneme.*

—Tom Clune  
Technical Editor

## FOUR LOGOS

In his review of "Four Logos for the IBM PC" (August, page 287), Mr. Bridger overlooked the fact that in the Dr. Logo editor, one can continue a statement over several lines by indenting subsequent lines. Thus, if condition [action1] [action2] can also be expressed

```
if condition
 [action1]
 [action2]
```

Formatting can make Logo procedures much more readable. TLC Logo, from The LISP Company, also allows formatting.

He also pointed out that Dr. Logo's primitives are case-sensitive. The same is true for IBM Logo. The difference is that Dr. Logo's primitives are lowercase, while IBM Logo's primitives are uppercase.

There are some typos in listing 2. The reader should insert > . > . > . = . and = at appropriate places in the five IF statements.

Mr. Bridger is to be commended for his useful review.

ROGER B. KIRCHNER  
Northfield, MN

*Sorry about the typos. One of our word processors stopped printing the characters > and = and nobody noticed in time to fix the listing.*

—Rich Malloy  
Product-Review Editor

## FUJITSU MICRO 16S

I feel it is necessary to clarify and update several points made in the recent BYTE review "The Fujitsu Micro 16s" by Alex Pournelle (October, page 246).

The author said the Micro 16s doesn't come with BASIC; in addition, I was misquoted as saying: "the business marketplace doesn't need or want BASIC." The fact is, application programs and programming tools are essential to the business marketplace and Fujitsu has a wide range of business software and programming languages currently available, including CBASIC, which have been available since May 1984. Fujitsu's target market for the Micro 16s is primarily the business professional and its focus is to provide business solutions and productivity tools for its users.

Fujitsu offers multiple operating systems, CP/M-86, MS-DOS, and, most recently, single or multiuser Concurrent CP/M-86. The software offerings include SuperCalc3, WordStar, MailMerge, SpellStar, DR Graph, a variety of languages and mainframe communications packages including ACCULINK, Micro SNA/3270, and BIS-3780, all available in MS-DOS format.

In addition, more than 250 business software packages are available that have been tested by Fujitsu for performance on the Micro 16s family of personal business computers.

Referring to Fujitsu's documentation, Mr. Pournelle stated that, in some cases, it was lean or inadequate. Fujitsu has recently

(continued)

undertaken the task of improving and enhancing its documentation.

Other than the minor points clarified above, we are pleased with the fair and favorable review given our product.

CLAUDIA NATALIA  
Marketing Communications Manager  
Fujitsu Microelectronics Inc.  
Santa Clara, CA

## LISP FOR THE IBM PC

The software review "LISP for the IBM Personal Computer" by Jordan Bortz and John Diamant (July, page 281) contained the kind of high-quality writing that originally prompted my subscription to BYTE. I would like to congratulate these authors on a very understandable overview of the LISP language and a well-considered critique/comparison of muLISP-83 and IQLISP. I would like to see more articles on artificial-intelligence applications in the future.

My only criticism of the article is of figure 1 on page 286 that depicts a list visualized as a tree. Although I was amused by its content ((JOHN AND JORDAN) HACK (C AND LISP)), I believe it to be an incorrect representation of the list as shown in listing 1 on page 282, which is (JOHN (AND JORDAN) HACK LISP). "C AND" is not present in the original listing. Furthermore, the tree depicts three objects: the list (JOHN AND JORDAN); the atom HACK; and the atom LISP. The listing actually contains four objects: the atom JOHN, the list (AND JORDAN), the atom HACK, and the atom LISP.

The concepts of atoms and lists are the basis of LISP. Unresolved confusion at this point could turn off someone's interest rather quickly. This criticism aside, I thoroughly enjoyed the review.

LAWRENCE ROUTHENSTEIN  
Manayunk, PA

*The theme of our April 1985 issue will be artificial intelligence.*

—Rich Malloy  
Product-Review Editor

## ECO-C COMPILER

I read Jack Purdum's letter (August, page 310). He has a good point about the need for a long integer benchmark. The following is my contribution.

Listing 1 is a C program to find factors of a number. Factoring very large numbers is not a trivial task. Public-key cryptography systems depend on that difficulty to give them their security. The algorithm

Listing 1: A long integer benchmark in C that finds a factor of a number.

```

/*
** factor.c—a long integer benchmark in C
*/
#include "stdio.h"

#define BIGNMBR 1394761 /* number to be factored
*/

long p = BIGNMBR;
long x, y, cnt, gcd ();

main ()
{

 puts("Factoring...");
 cnt = 0;
 x = y = 3;
 while (gcd(y - x, p) < 2)
 {
 cnt ++;
 x = (x*x + 2) % p;
 y = (y*y + 2) % p;
 y = (y*y + 2) % p;
 }
 printf("A factor of %ld is %ld\n", p, gcd(y - x, p));
 printf("It took %ld iterations\n", cnt);
}

/*
** gcd—greatest common divisor of a and b
*/

long gcd(a, b)
long a, b;
{
 long q, r;

 if (b < 0)
 b = -b;
 if (a < 0)
 a = -a;
 if (a > 0)
 {
 b %= a;
 if (b == 0)
 r = 0;
 else
 r = 1;
 while (r > 0)
 {
 q = a/b;
 r = a - q*b;
 a = b;
 b = r;
 }
 }
 return (a);
}

```

in the listing is called the Pollard rho algorithm. My program is derived from a Pascal program that appeared in *Pascal Applications for Sciences* by Richard E. Crandall (John Wiley & Sons, 1983).

I think this program is a good one to use to examine the quality of the implementation of long integers among various versions of C. It uses most of the operators applicable to the long data type—addition, subtraction, multiplication, division, and modulus—as well as passing long integers as function arguments and returning long

values from functions. My choice of BIGNMBR is arbitrary. It is the square of the prime number 1181. This value produced short execution times, so I didn't get too bored; however, it isn't short enough to cause errors in hand timing, which would cause significant errors in the result.

Table 1 gives my results for running the benchmark on two popular versions of C: Aztec CII and Ecosoft's Eco-C. The methodology used in preparing these results was the same as for my original article: all

timing was done by hand. For compilation, assembly, and linkage, timing was started when the command line was entered, and it was stopped when the system prompt reappeared. Execution timing was started when the program sign-on message appeared and stopped when the sign-off was displayed. These benchmarks were run on a 4-MHz Z80 system with dual 8-inch double-sided double-density disk drives. When completed, the program prints

A factor of 1394761 is 1181  
It took 871 iterations

Table 1: The results of running the benchmark in listing 1 with the Aztec and Ecosoft compilers. The code sizes are reported in bytes. The Eco-C, Z80asm assembly and link times were obtained using an optional high-speed assembler and linker.

| Compiler      | Comp. | Assem. | Link | Size | Execution |
|---------------|-------|--------|------|------|-----------|
| Aztec         | 0:25  | 0:20   | 0:45 | 9096 | 2:06      |
| Eco-C         | 1:08  | 0:24   | 0:52 | 7280 | 1:41      |
| Eco-C, Z80asm | 1:08  | 0:12   | 0:24 | 7280 | 1:41      |

The Eco-C version reported on in the table was compiled with the -i compile-time option. This causes a version of the printf function that does not format real numbers to be linked into the executable file. When the program is compiled without the -i option, the code size is 9470 bytes, which is roughly comparable to the code size produced by the Aztec compiler. I also timed assembly and linkage of the Eco-C program using the

(continued)

2 YEAR WARRANTY ON CARD AND DRIVE

# 10 Mbyte

**SATISFACTION GUARANTEED**

Suggested retail price \$1095

**\$945** SPECIAL SALE PRICE

100% refundable within 30 days.

For IBM PC\* & compatibles. 2 Years Warranty on disk drive and controller card.

- Half-height drive with controller card
- Low error rate
- Low power
- High performance and reliability
- Easy installation

**20 Mbyte for \$1,495.**

**TO ORDER SEND CHECK OR MONEY ORDER TO:**

**Linde Technology, Inc.**  
8820 S. Sepulveda Blvd., Suite 204  
Los Angeles, CA 90045

**OR CALL TOLL FREE:**

1 (800) 227-2400 x974  
In California call  
1 (800) 227-2666 x974  
Visa and Mastercard accepted.  
California residents add 6% sales tax.

**For dealer inquiry and more information call: (213) 215-9484**

\*IBM is a registered trademark of International Business Machines Corp.

**Yes, send me more information on:**

- 10 Mbyte Disk Drive
- 20 Mbyte Disk Drive

**Linde Technology, Inc.**

8820 S. Sepulveda Blvd., Suite 204  
Los Angeles, CA 90045

NAME \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_



## REVIEW FEEDBACK

optional high-speed assembler and linker. As you can see, the improvement is significant.

DAVID C. CLARK  
State College, PA

### WANTED: NEWS ON HP 110

The purpose of this letter is to request any evaluation/review information available on the HP 110 portable computer, related accessories made by Hewlett-Packard.

Thanks in advance for any independent review information that could be made available.

P. C. SMEDES  
Tampa, FL

*A review of the HP 110 will appear in the January issue.*

—Rich Malloy  
Product-Review Editor

### STATISTICS

In the September Review Feedback (page 358), Jerry M. Lefkowitz stated: "The point

is, if you enter only N significant digits in your input data, you cannot get more than N significant digits in your answers."

Not so. For instance  $1/7 = 0.142856$ , and all six digits can be significant to the internal computation, regardless of the external lack of trailing zeros. A familiar example is temperature conversion from centigrade to absolute. A temperature of  $6^{\circ}\text{C} = 284^{\circ}\text{K}$ , and presto! we turned one significant figure into three.

Worse yet, Anders Celsius would convert the  $6^{\circ}$  into  $94^{\circ}$ , because he had the scale upside down. (See Webster's Unabridged Dictionary under "centigrade.") So 1-, 2-, or 3-figure accuracy is merely an artifact of the way you measure a quantity.

STEVEN J. RHODES  
Willoughby, OH

*Mr. Rhodes raises an interesting, and sometimes confusing, point about significant digits. But the fact still stands that the number of significant digits in a result is equal to the number of significant digits in one's data. Most people assume that the number 1 is equal to 1.000000. . . .*

*To a scientist, a single-digit measurement such as 1 is usually assumed to represent some indeterminable value between 0.5 and 1.5. In the same way, 7 represents a value between 6.5 and 7.5. The result of the division of these two measurements,  $1/7$ , then lies somewhere between  $0.5/7.5$  and  $1.5/6.5$ , or between 0.066 and 0.23. This rather large range is approximately represented by the value 0.1. A resultant value of 0.142856, though mathematically correct, would suggest undeserved precision in one's original measurements.*

—Rich Malloy  
Product-Review Editor

REVIEW FEEDBACK is a new column of readers' letters. We welcome responses that support or challenge BYTE reviews. Send letters to Review Feedback, BYTE Publications, POB 372, Hancock, NH 03449. Name and address must be on all letters.

## DISK COPYING SERVICE

### *Fast • Reliable • Low Cost*

If you produce software, ALF's disk copying service is the quick, convenient answer to your duplication needs. Fifty copies or thousands, standard or copy-protected formats, just disks or a whole package—call ALF. Consider:

- **FAST.** Most orders are shipped in a week or less. Prompt service on custom printing, too.

- **LOW COST.** Set-up charges start at \$15. Copying charges are 25¢ to 35¢ single sided, or 50¢ double sided. **Copy protection for IBM, Apple,** and other systems is available at a reasonable cost.

- **CONVENIENT.** We offer label application, shrink packaging, heat sealing, and other services. Need custom printed labels and sleeves? We can handle it and much more. We have vinyl folders, binders with slip cases, 3-hole vinyl disk pages, and disk mailers in stock—and can custom print them for packaging in a hurry.

- **TOP QUALITY.** We start with the finest disks available. Your choice of **3M, Memorex, Nashua, Verbatim,** or other major brands—or you can supply your own disks. Every disk we copy is verified bit by bit and guaranteed 100% flawless.

- **RELIABLE.** ALF designs and manufactures copying equipment that other copying services and software publishers rely on every day. Our complete understanding of duplication technology assures you of the finest reproduction available—and has since 1980.

*We're eager to meet your duplication and packaging needs. Give us a call today!*

## BLANK DISKS

ALF buys large quantities of top quality, bulk packaged disks for our disk copying service. We avoid the expense of fancy printing and labeling—and can pass these savings on to you! The disks listed below are 5¼", single side (**SS**) or double side (**DS**), double density, soft sector, unlabeled, with hub ring. Call for information on other disks, too.

|                 |                  |                  |
|-----------------|------------------|------------------|
| <b>3M</b>       | call for details |                  |
| <b>MEMOREX</b>  | <b>\$1.46</b> SS | <b>\$1.80</b> DS |
| <b>NASHUA</b>   | <b>\$1.13</b> SS | <b>\$1.35</b> DS |
| <b>VERBATIM</b> | <b>\$1.50</b> SS | <b>\$1.92</b> DS |

| <b>SHIPPING &amp; EXTRAS, ADD:</b>                | <b>For 50 disks:</b> | <b>For 100 disks:</b> |
|---------------------------------------------------|----------------------|-----------------------|
| <i>Without sleeves</i>                            | \$3.50               | \$2.50                |
| <i>With Tyvek sleeves</i>                         | \$7.00               | \$9.50                |
| <i>With Tyvek sleeves &amp; boxed in 10-packs</i> | \$11.50              | \$18.00               |

**ALF** To order, call 1-800-321-4668. VISA & MasterCard welcome.  
ALF Products Inc. 4315F Nelson St. Denver, CO 80245 • Inside Colorado call 1-303-234-0871.



# Kernel

THIS MONTH, JERRY POURNELLE recounts an equipment-repair episode, falls in love with the HP LaserJet printer, begins a quest for a clock board, and has his son Alex take a close look at the TI Professional Computer.

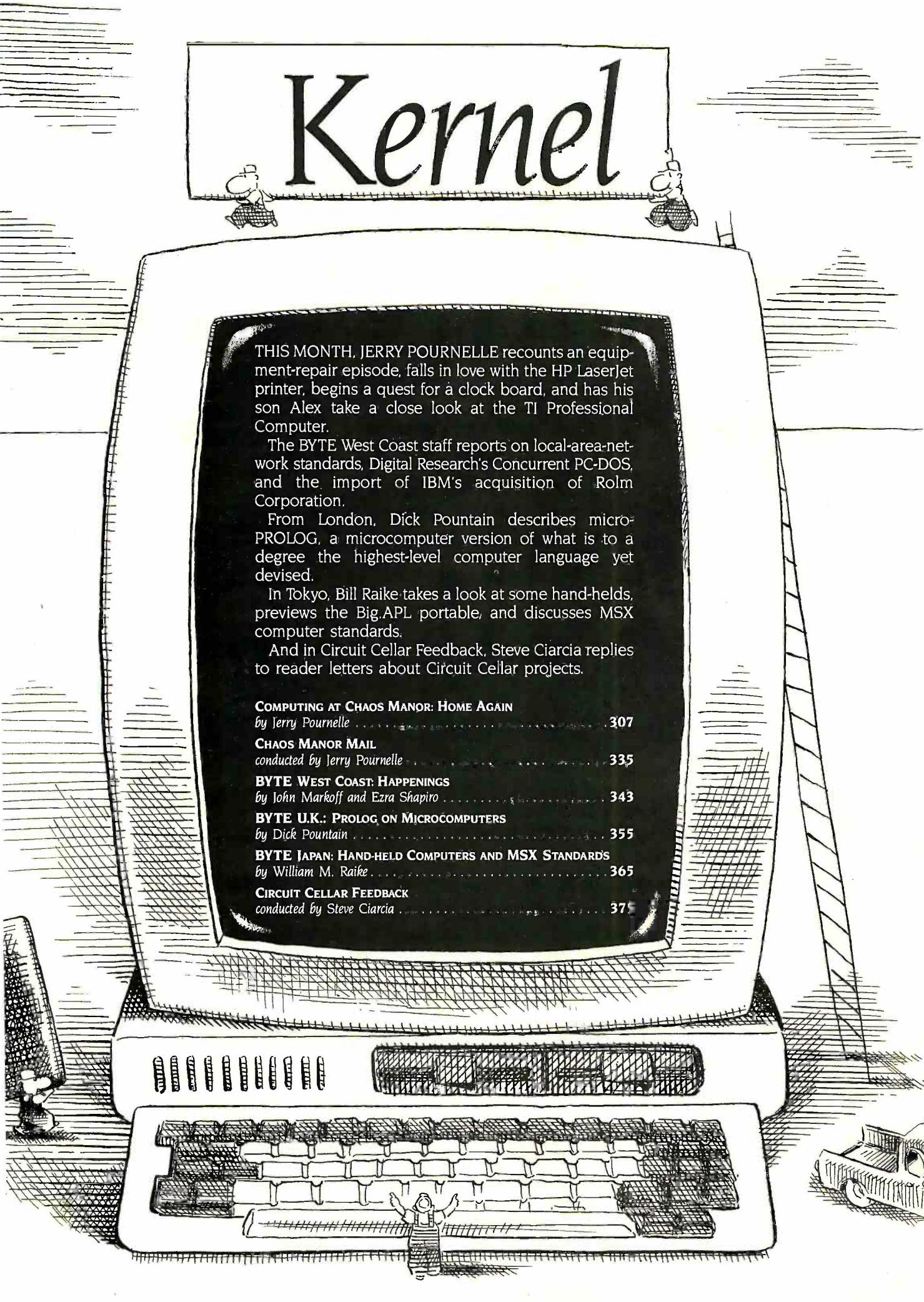
The BYTE West Coast staff reports on local-area-network standards, Digital Research's Concurrent PC-DOS, and the import of IBM's acquisition of Rolm Corporation.

From London, Dick Pountain describes microPROLOG, a microcomputer version of what is to a degree the highest-level computer language yet devised.

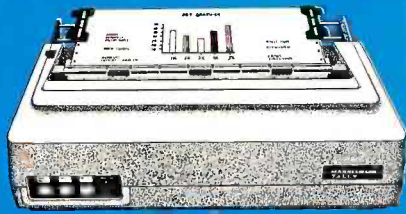
In Tokyo, Bill Raike takes a look at some hand-helds, previews the Big.APL portable, and discusses MSX computer standards.

And in Circuit Cellar Feedback, Steve Ciarcia replies to reader letters about Circuit Cellar projects.

|                                                                                              |     |
|----------------------------------------------------------------------------------------------|-----|
| <b>COMPUTING AT CHAOS MANOR: HOME AGAIN</b><br><i>by Jerry Pournelle</i> .....               | 307 |
| <b>CHAOS MANOR MAIL</b><br><i>conducted by Jerry Pournelle</i> .....                         | 335 |
| <b>BYTE WEST COAST HAPPENINGS</b><br><i>by John Markoff and Ezra Shapiro</i> .....           | 343 |
| <b>BYTE U.K.: PROLOG ON MICROCOMPUTERS</b><br><i>by Dick Pountain</i> .....                  | 355 |
| <b>BYTE JAPAN: HAND-HELD COMPUTERS AND MSX STANDARDS</b><br><i>by William M. Raike</i> ..... | 365 |
| <b>CIRCUIT CELLAR FEEDBACK</b><br><i>conducted by Steve Ciarcia</i> .....                    | 375 |



# “BUILT TO WORK & WORK & WORK & WORK”



*InfoWorld* magazine

**W**e think \$798 is a small price to pay for a printer that's engineered to work as hard as a Tally.

Nobody offers more productivity for the price. But don't take our word for it. See what leading computer magazines like *InfoWorld* have to say:

“The frame and mechanism are obviously meant for heavy-duty office use.”

That means continuous full speed printing for everything from correspondence and spreadsheets to reports with graphics. And when it comes to print quality, we couldn't have said it better than *Interface Age*:

“The text output produced in the letter quality mode is superior to all dot matrix printers in this price class.”

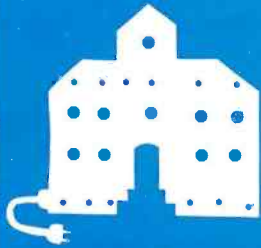
With word processing enhancements, easy-to-use versatility and so much to choose from in paper handling, the Tally performance story goes on and on. *Creative Computing* came right to the point:

“In a word, remarkable.”

The MT160 and MT180 printers. See your Tally dealer for the most convincing quote of all. Or call toll-free for information: 800-447-4700. In Illinois: 800-322-4400.

**MANNESMANN**  
**TALLY**

Circle 25 on inquiry card.



# C·O·M·P·U·T·I·N·G A·T C·H·A·O·S M·A·N·O·R

## Home Again

Repair Beware

LaserJet Printer

KoalaPad

Clock Boards

Discount Blues

Lilith Computer

Modula-2

Apple Modules

Software Essentials

TI Professional

Gulf Strike

Under Ware

BY JERRY POURNELLE

It's over. August saw: the completion of *Footfall* (by Larry Niven and Jerry Pournelle; Ballantine Del Rey Books, June 1985); the publication of *The User's Guide to Small Computers* (by Jerry Pournelle; Baen Books, 1984, and if you don't like these columns you'll hate it); the World Science Fiction Convention in Anaheim (Gordon Dickson, Guest of Honor; Jerry Pournelle, Master of Ceremonies); and, in early September, the BYTE Computer Show in San Francisco, where I was a speaker. It was mid-September before I could come up for air.

### ZORRO RISING

Zorro, our Z-100, is something between a working machine and an experimental box. We depend on him for a lot of our work. Zorro is the host for the wonderful Disk Maker I that allows us to transfer files from nearly any 5¼-inch disk format to nearly any other, and since the Z-100 can take 8-inch disk drives without modification, we can also transfer to and from 8-inch, as well as 5¼-inch, disks. On the other hand, he gets an awful lot of experimental boards, ROMs (read-only memories), memory chips, and other stuff installed in him.

Alex tried to install a new board and discovered that the machine didn't work. He'd followed all the usual safety precautions, but Zorro's keyboard wasn't sending control characters—and saw only 128K bytes of memory instead of the 192K bytes installed.

We were all worried. Of course, three Disk Maker I jobs awaited. (Faster than a speeding modem! More powerful than a copy of Transporter! Able to leap from MS-DOS to CP/M in a single bound! This is a job for Disk Maker II!)

Zorro's long been out of warranty, but as it happens we've never had any trouble with him at all, so we didn't know where to take him. Naturally, this happened just before the World Con, so we had little time to deal with the situation. A quick call to the West

Coast Zenith distributor produced a recommended repair facility, and off he went.

The news was horrible: they wanted to replace both the motherboard and the keyboard at a cost of \$500 and \$300, respectively. This didn't seem reasonable. Zorro had problems, but there hadn't been any smoke, and there was surely no visible damage. We retrieved him, paying \$20 for the diagnosis. Now the World Con was only one day away.

"Take him to a Heath store," I suggested. "In fact, why didn't we do that in the first place?"

"Because," Alex and Peter explained patiently, "they're remodeling the one in downtown L.A., and the Woodland Hills Heath place is doing double duty while that happens, and they can't promise quick action."

I could understand that, but \$800 seemed pretty steep, and besides, we wouldn't need Zorro during the World Con anyway; so off he went to the Woodland Hills Heath store.

Heath's backlog was mostly illusory. A week later Zorro was fixed. One bad chip and one broken wire in a cable. Total cost: less than \$100, including both diagnosis and repair. That's the first repair in more than a year-and-a-half of intensive use, including being carried about through the house, transported across town several times, and a half-dozen dissections for installation of new stuff. It's certainly not an unreasonable repair bill.

The moral of the story should be plain: the first place we went didn't really do repairs; they merely tested boards (and didn't do that very well, since they thought the problem was the keyboard rather than the keyboard cable). They had the facilities to replace boards, but they didn't even try to do anything else. The Heath stores were able to get in and see what was really wrong.

Pournelle's rule applies: If you don't know what you're doing, deal with people who

(continued)

*Jerry Pournelle holds a doctorate in psychology and is a science-fiction writer who also earns a comfortable living writing about computers present and future.*

do—and make sure they *do* know what they're doing.

### LASERS!

I first saw the Hewlett-Packard LaserJet printer at COMDEX in Las Vegas. The printer is based on the Canon cartridge-copier system. It has the Canon sheet feeder, connects to your system with a 9600-bps (bits per second) RS-232C serial connection, and prints eight pages a minute. It's also quiet.

I thirsted for one.

In mid-August I got a conference call: Bill Godbout, president of CompuPro, in Oakland and Steve Rose of Capacity Inc., a CompuPro Systems Center in Kahului, Hawaii.

"Good news," Dr. Godbout said. "We have the HP LaserJet working with the CompuPro 10." (The 10 is his silly name for the multiuser Shirley that has become the workhorse of Chaos Manor.)

"Better news," Steve said. "I can ship you one this week. Interested?"

"Works like a bomb," Bill Godbout said. "We want one here, but Steve's a fan of yours and wanted to offer you the first shot—"

"Stop!" said I. "How much?" They told me. I gulped. It wasn't cheap. I went to consult the checkbook. After

all, we *had* just finished *Footfall*, the acceptance payment had been authorized, and I hadn't bought any presents for Shirley and Zeke II in some time. "Done," says I.

It arrived just before World Con, of course. That's all right. Bill Godbout *still* doesn't have his. We unpacked it, and Peter took almost 10 minutes getting it hooked up to Shirley, after which it ran like a charm. It did listings and printed WordStar files just fine, and if you tell WRITE that it's a standard Teletype simpleminded printer, it does WRITE files. The only catch—you must set WRITE's sheet length to 60 lines, instead of the standard 66. For some reason, HP set the default that way.

Enter Barry Workman. "If you let me have it for a week, I'll take it to Noor Singh, and he'll do some custom software for WRITE," says Barry. "After all, you're going to the World Con, and up to San Francisco, and you'll have it back before you return, and ——" He held out a glass of Armagnac.

Two glasses later, his arguments sounded so reasonable that I let him take the printer away. I got back last night. They tell me I'll have my printer back tomorrow.

Meanwhile, they've made some discoveries.

It underlines fine. To make it do boldface, we'll need an alternate character set, which comes in a ROM cartridge. (Actually, it tries to do boldface, but it just prints the same letters twice—accurately.) There also seems to be some problem with proportional spacing of the kind WRITE uses (the WordStar method of justifying line-ends works fine for either WordStar or WRITE). The machine is said to have a whole bunch of different type fonts, but I have only one.

The paper-feed tray holds only about 80 sheets of paper, meaning that you have to reload it every 10 minutes or so.

The print-intensity control on the side doesn't do a damn thing; Canon insisted on putting it in. The LaserJet doesn't use the same cartridge as the Canon personal copiers.

But it runs like a bomb, silently printing eight pages a minute in *beautiful* black characters on any quality of paper you like.

I think I'm going to be in love.

### BASIC COMPATIBILITY FOR THE Z-I 50

Mrs. Pournelle has taken over the Z-I 50 and normally allows no one to touch it, but she saw an ad for the

(continued)

# PROFESSIONALS

From computer systems to support... Dynacomp serves Canada.\*

When you're ready to buy a computer, consider the difference professionals can make. You want full support from your dealer, and complete reliability from your computer. At Dynacomp, we offer both.

Dynacomp is Canada's 1st Full Service CompuPro System Center offering you the most cost-effective and advanced business and scientific computers available... CompuPro's System 816™ family and the multi-user CompuPro 10 PLUS™. And we

now offer UNIX™ on CompuPro, UniPlus™ + SYSTEM V for \$1495. U.S. list\*\* on the CompuPro 816/E!™

Our support includes giving you the most computer for your money. Tell us what you do, and we'll put together a complete system that meets your needs... right down to the peripherals.

Our CompuPro systems include a library of the most popular and useful software, CompuPro's full year warranty and Xerox®

on-site service with designated systems.

Call Dynacomp for the professional support you expect when you buy a computer system.

Since 1982, Full Service CompuPro System Center. 

\*Dynacomp serves all Canada and parts of Asia and the Pacific Rim. Call us for details and information on our full product line including Plexus, Macrotech and Ampro.

CompuPro System 816 and CompuPro 10 PLUS are trademarks of CompuPro. Xerox is a registered trademark of Xerox Corp. UNIX is a trademark of Bell Laboratories, Inc. UniPlus is a trademark of UniSoft Corp.

\*\*Dealer inquires welcome.

210 W. Broadway  
Vancouver, B.C. V5Y 3W2  
(604) 872-7737

**DYNACOMP**  
COMPUTER SYSTEMS LTD.

74-6535 Mill Creek Dr.  
Mississauga, Ont. L5N 2M2  
(416) 362-8358

# Not Dow Jones.

THE SOURCE INVESTOR SERVICES -- MR. WYATT: THIS IS TO CONFIRM YOUR ONLINE PURCHASE OF 500 SHARES WESTINGHOUSE AT \$25 5/8 UNIT. YOUR CONFIRMATION TIME: 10:52:25. YOUR PORTFOLIO VALUE: \$42,817.56

# Not MCI Mail.

VIA SOURCEMAIL -- DEAR BOB: I FOUND YOUR NAME IN THE SOURCE MEMBER DIRECTORY. COULD YOU PLEASE JOIN OUR WEEKLY COMPUTER CONFERENCE ON PC APPLICATIONS FOR ARCHITECTS? HOWARD -STC 301■

# Not CompuServe.

THE SOURCE/MICROSEARCH -- THIS IS THE REVIEW YOU REQUESTED ABOUT SYMPHONY SOFTWARE. TITLE: A SYMPHONIC PERFORMANCE. AUTHOR: ANDERSON, DICK. PUBLICATION: PC WORLD (JUL 1984) TEXT FOLLOWS:

# Only The Source.

The Source is the only online network that offers all the features you see on the computer screens above.

Only The Source lets you trade stocks & options online. *And* join computer conferences. *And* discover what experts say about hardware and software before you buy it.

And those are just three of the dozens of services that make The Source America's most powerful information and communications network.

But The Source does more than combine features other online services don't even offer.

Only The Source has such a wide choice of business, investment, consumer, and communications services together in *one* package.

For *one* new, low price. Just \$49.95.

And our reasonable online rates *include* tele-

communication charges in more than 1,200 communities around the nation.

No wonder experts say "There is nothing like The Source anywhere else in the world."

To join The Source, visit your nearest computer dealer. Or call The Source direct at **800-336-3366** to sign up on the spot, or for a free information kit.

Online trading provided by Spear Securities, Inc., an independent brokerage firm. The Source is a servicemark of Source Telecomputing Corporation, a subsidiary of The Reader's Digest Association, Inc. The Source services are offered in participation with Control Data Corporation. © Source Telecomputing Corporation, 1984 1616 Anderson Road, McLean, VA 22102

INFORMATION NETWORK  
**The Source**<sup>SM</sup>

The most powerful resource any personal computer can have.

# The Preferred C Compiler

"...C86 was the only compiler we tested that ran every benchmark we tried and gave the expected results... Computer Innovations C86 was the compiler that our staff programmers used both before and six months after we conducted the tests."

J. Houston, **BYTE MAGAZINE** - February 1984

**\*FAST EXECUTION** -  
of your programs.

**\*FULL & STANDARD  
IMPLEMENTATION OF C** -  
includes all the features described by  
K & R. It works with the standard  
MSDOS Linker and Assembler; many  
programs written under UNIX can  
often be compiled with no changes.

**\*8087 IN-LINE** -  
highly optimized code provides 8087  
performance about as fast as possible.

**\*POWERFUL OPTIONS** -  
include DOS2 and DOS1 support and  
interfaces; graphics interface capability;  
object code; and librarian.

**\*FULL LIBRARY WITH SOURCE** -  
6 source libraries with full source code  
the "large" and "small" models, soft-  
ware and 8087 floating point, DOS2  
and DOSALL.

**\*FULL RANGE OF SUPPORT  
PRODUCTS FROM COMPUTER  
INNOVATIONS** -  
including Halo Graphics, Phact File  
Management, Panel Screen Manage-  
ment, C Helper Utilities and our  
newest C to dBase development  
tool.

**\*HIGH RELIABILITY** -  
time proven through thousands of  
users.

**\*DIRECT TECHNICAL  
SUPPORT** -  
from 9 a.m. to 6 p.m.

Join The Professional Programmers Who Agree C86™ Is The C Compiler Of Choice

For Further Information Or To Order Call:

**800-922-0169**

Technical Support: (201) 542-5920

980 Shrewsbury Avenue  
Suite PW509  
Tinton Falls, NJ 07724

 **Computer Innovations, Inc.**

# C86™

PRICE IS SUBJECT TO CHANGE WITHOUT PRIOR NOTICE  
UNIX IS A TRADEMARK OF BELL LABS    C86 IS A TRADEMARK OF COMPUTER INNOVATIONS, INC.    MS-DOS IS A TRADEMARK OF MICROSOFT  
PC DOS IS A TRADEMARK OF INTERNATIONAL BUSINESS MACHINES

KoalaPad and wanted that. (Not surprising: the KoalaPad is great fun, easy to use, and one of the better enhancements for your machine.) We had it here at Chaos Manor. Alex was drafted into installing it on the Z-150. Here is his report on some curious phenomena.

"Through some oversight, we never received any software from Zenith for the Z-150 IBM PC clone. That hadn't bothered us; we just used our IBM PC disks. They all worked just fine—for the first six months we got along without. Then I tried to hook up the KoalaPad to it and discovered it needed BASICA.

"No problem," thought I, "I'll just get a copy from Lucy Van Pelt (the IBM)."

"The result wasn't quite as I expected: the Zenith went slightly gaga! It printed a long series of graphics characters, bells, letters, and other extraneous matter and then went dead. Really dead: the old Ctrl-Alt-Del sequence wouldn't reboot it.

"At first I blamed the KoalaPad software: 'Hmm, must be a bad disk.' But I tried to run BASICA alone and got the same result. I knew the program was all right; it had run on the IBM.

"Right then I should have remembered the problem but didn't. I called Rachel Klau, our friend at Zenith who wrote Zenith's BASICA and other Z-150 software.

"IBM BASICA won't run on the Z-150, Rachel!"

"Alex, I'm disappointed in you! What happens to the IBM if you turn it on without a disk?"

"It waits for a disk for a while, then it runs built-in BASIC."

"None of the compatibles, not even the Compaq, have—or can have legally—BASIC in ROM. IBM's BASICA calls routines in those ROMs. That's why its BASICA is shorter than ours."

"Now it came back to me. I felt a bit silly, having forgotten that IBM's ROMs include a number of BASIC routines.

"Rachel arranged to send us BASICA. The upshot is obvious—IBM-compatible still means that you must buy Zenith's BASICA; you can't use the IBM's. Note that compiled BASIC

programs, such as Cygnus's Star Fleet I and Bruce Tonkin's My Word!, seem to work just fine without the Zenith BASICA. Most interpreted BASIC programs run once you install the Zenith BASICA.

"As promised, we received both BASICA and Zenith's DOS 2.0. The KoalaPad software, when tried, booted just fine—but didn't listen to the KoalaPad. I called Koala Technologies' service department.

"The current KoalaPad software is for the IBM PC only. It doesn't say PC-compatible, nor will it run on them. That software is being developed."

I don't know what Koala's software does, but it must be pretty specific to *not* run on the IBM PC clones, especially one designed as carefully as the Z-150. Zenith went to great lengths to make the Z-150 compatible; this is the first major incompatibility we've found. More when we know more. For now, all you compatible owners beware.

**THE GREAT CLOCK-BOARD QUEST**

Mrs. Pournelle grew weary of typing in the time and date when she booted the Z-150—complaining (correctly!) that we didn't have to do that on the IBM, TI PC, or CompuPro. So off went Alex to get a time-and-date board, possibly with some memory, for the Z-150.

Upon arriving at Priority One, he discovered there was only one in stock—the STB RIO PLUS board, which we have in Lucy Van Pelt. Upon return, he plugged it in the Z-150, set the memory switches, and booted it.

The Zenith's self-test program said there was bad memory in the new block. Alex swapped for known good chips—for a programming major, he sure fixes hardware—and tried again. Same result. Called Priority One.

Mike, the showroom technician, thought the RIO PLUS board was good, but it just wouldn't work in the Zenith. Alex brought the board in, and during World Con Mike tested it. The RIO PLUS board was fine but didn't work in Mike's Z-150, either.

(continued)

# 3,000 Programmers depend on us to find, compare, evaluate products and for *solid value*.

THE PROGRAMMER'S SHOP serves serious microcomputer programmers . . . from giant institutions to small independents. *Specializing* helps us provide 100s of programming products . . . technical literature . . . specialized evaluations and more to help you find and evaluate. Other services like . . . special formats . . . rush delivery . . . payment options (POs, COD, credit cards, etc.) . . . newsletters . . . and reports *help you save time, money, and frustration and get solid value.*

**Intriguing New Products**

BRIEF™ THE PROGRAMMER'S EDITOR is "Out of the way", windows, undo, macros PCDOS \$195  
C SHARP REAL-TIME Toolkit with source is thorough, well supported. Portable, MSDOS, UNIX. \$600

DEBUG-PERISCOPE with "Reset Box", independent RAM, Symbols, more. PCDOS. \$295

HS/FORTH - fits professionals with great doc, MSDOS interface, full RAM, ASM, graphics, more. \$210

"BASICA COMPILER", also access all RAM, modules, structured. BetterBASIC, PCDOS \$195

LINT-86 provides full, UNIX-like, careful C program checks. For any MSDOS C. \$200

**Other Key Products**

C86 by CI (\$339), Lattice (\$359) from Lifeboat or Microsoft, and Williams C (\$475) are in a tight battle. Which is best for integration with Fortran? 8087? support libraries? speed? debugging?

FORTTRAN-86 from Microsoft (\$259) is improving with libraries for graphics (\$175), screen (\$265).

LISP by Integral Quality (\$155) is well rounded GC Lisp (\$465) supports syntax closer to "Common LISP." TLC LISP (\$235) is nice.

LANGUAGE INDEPENDENT products increase productivity like PLINK-86 (\$315) overlays, PROFILER-86 (\$125) analysis, BTRIEVE (\$225) ISAM, POLYLIBRARIAN (\$95).

**FEATURED PRODUCT:**

**The Instant-C™ Interpreter  
C programming three times faster**

*Instant-C™* is an optimizing interpreter for C that makes programming much faster. It eliminates the time wasted by compilers and loaders. Many repetitive tasks are automated to make programming less tedious.

- Two seconds elapsed time from completion of editing to execution.
- Symbolic debugging; single step by statement.
- Follows K & R—works with existing programs. Comprehensive library with source.
- Full-screen editor integrated with compiler; compiler errors set cursor to trouble spot.
- Compiled execution speed; 40 times faster than interpreted Basic.
- Can generate .EXE, .CMD files.
- Integrated package; nothing else needed.
- Works under PC-DOS, MS-DOS, or CP/M-86.
- Immediate execution; ideal for learning C.

**RATIONAL SYSTEMS, INC.** (617) 653-6194 *Instant-C* is \$500.

Call for a Catalog, literature on any product or a free literature "Packet" on: "AI", BASIC, C, COBOL, Debuggers, Editors, FORTH, FORTRAN, Libraries, PASCAL

**CALL TOLL FREE 800-421-8006**

**THE PROGRAMMER'S SHOP™**

*The programmer's complete source for software, services and answers*

128-B Rockland Street, Hanover, MA 02339 In Mass.: 800-442-8070 or 617-826-7531

The upshot is that we're getting a Quadram Quadboard instead. Those successfully run in the Z-150. Jean, the Priority One assistant sales manager, was extremely patient with us, but no one offered an explanation of why some boards will not work in the Z-150.

Incidentally, I'm willing to bet that when Zenith's Mark Foster reads this, he'll brood until he finds a way to Do Something; the Zenith firmware crew really work at keeping the Z-150 compatible with the PC.

This compatibility business can be tricky. My best advice is to either look for the Zenith list of tested hardware (which we didn't do, alas) or deal with places that don't mind taking stuff back if it doesn't work.

#### DISCOUNTED SERVICES . . .

On that score: Priority One sells good stuff at big discounts. The only way it can afford to do that is by cutting ser-

vice and support to the bone. That can result in some pretty unfair impositions on full-service (and full-price) computer stores, such as ComputerLand.

The people at Priority One protest that they do have a hardworking service department. I agree. This is one of the best of the by-mail discount houses. However, on their margins they *cannot* hold novices' hands.

Indeed: one ComputerLand manager tells us that perhaps 25 percent of his support requests come from people who buy boards from Priority One and then discover they don't really know how to install them.

There's another problem. A customer comes to a computer store, one that employs knowledgeable salespeople. After several hours of analysis of the client's requirements, the store recommends a system—and discovers that the customer has checked the Priority One catalog and

wants the equipment for those prices.

It won't take long for stores to go broke that way. In the old days, we complained that computer stores didn't employ knowledgeable salespeople. Some still don't. Those that have taken the trouble to hire and train good people get ripped off by customers out to save money at the store's expense.

This isn't a diatribe against Priority One or the other discount houses, nor am I trying to talk computer companies out of selling to discounters. Hobbyists, hackers, and others who know what they're doing don't need full services at full prices and ought to have lower-price sources. On the other hand, those who *don't* know what they're doing shouldn't really expect costly advice for nothing, and constant attempts to get support without paying for it is driving the full-service stores out of business.

It has got so bad that one store suggests contracts with customers: either buy the equipment at the store or pay a consultation fee. That policy has obvious problems, but I can't offhand think of anything better.

The problem is real. Suggestions are welcomed.

#### LILITH

In the midst of our hectic August, Lilith arrived. We were glad to see her, since we'd returned our Diser (and the Diser Company vanished into Chapter 11).

Lilith is the computer designed in Europe to Professor Niklaus Wirth's specifications. She has Modula-2 built into her microcode. There's a mouse, fast bit-mapped screen, great graphics, mediocre to crummy documentation, a pretty hefty software library, and a keyboard that looks an awful lot like the DEC VT-100 keyboard. There's a full review in the September BYTE on page 300.

Lilith does everything the Diser did, and more. She has a real Winchester hard disk (instead of the washing-machine Honeywell-Bull cartridge hard disk the Diser sported) and a 5¼-inch floppy disk for backup and

(continued)

## GEORGE TATE, RIP

He got started as a technician back in the early days of the micro revolution. Noor Singh, who knew him in those days, says he was always conscientious and eager to give customers more than their money's worth. George Tate was one of the first to recognize that immense fortunes could be made from microcomputers.

Before he was well into his thirties he'd started a software chain that became one of the industry's largest. Then he read my review of a program called Vulcan, decided it could be marketed, and arranged to publish it as dBASE II.

The program sold well, making Ashton-tate (there wasn't any "Ashton"; George thought a hyphenated company name sounded better, and he and his partner, Hal Lashlee, agreed that "Ashton" sounded better than "Lashlee") one of the giants of the industry. When George bought Vulcan, he was offered all rights; but he chose to leave the original author a hefty percentage of the profit to encourage him to main-

tain and expand the program. That turned out to be a wise decision.

In the old days, George, my late mad friend Dan MacLean, and I used to get into violent arguments on where this micro revolution was (or should be) taking us. We soon spilled over into discussions of his own company's policies. No matter how loud the argument, George always listened to our suggestions and was unfailingly polite. He gave copies of dBASE II to a half-dozen charities and scholars on my recommendation. After I complained about his license agreements, he rewrote them. For a while I thought George would publish Tony Pietsch's WRITE program, and I still wish they'd been able to come to some agreement.

He was only 40 years old when he died of a heart attack on August 10. Ironically, one of the papers on his desk was an employment application from Noor Singh.

We'll all miss him. George was one of the good guys.



# REST ASSURED

## THE CERMETEK SECURITY MODEM IS ON THE JOB!

**Don't lose sleep** worrying about an unattended computer. The CERMETEK SECURITY MODEM is the best guard for the job.

**Communication and Security for only \$695** is an unbeatable buy! The Security Modem offers a variety of security options to fit your specific needs. In addition to 4 levels of access security, the modem has originate (dial-out) security and will maintain an audit trail of all access attempts. Changing security options or codes requires a key.

### Four Levels of Access Security

🔒 **No Security** — an intelligent 1200/300/110 bps modem, fully compatible with the Hayes SMARTMODEM 1200™

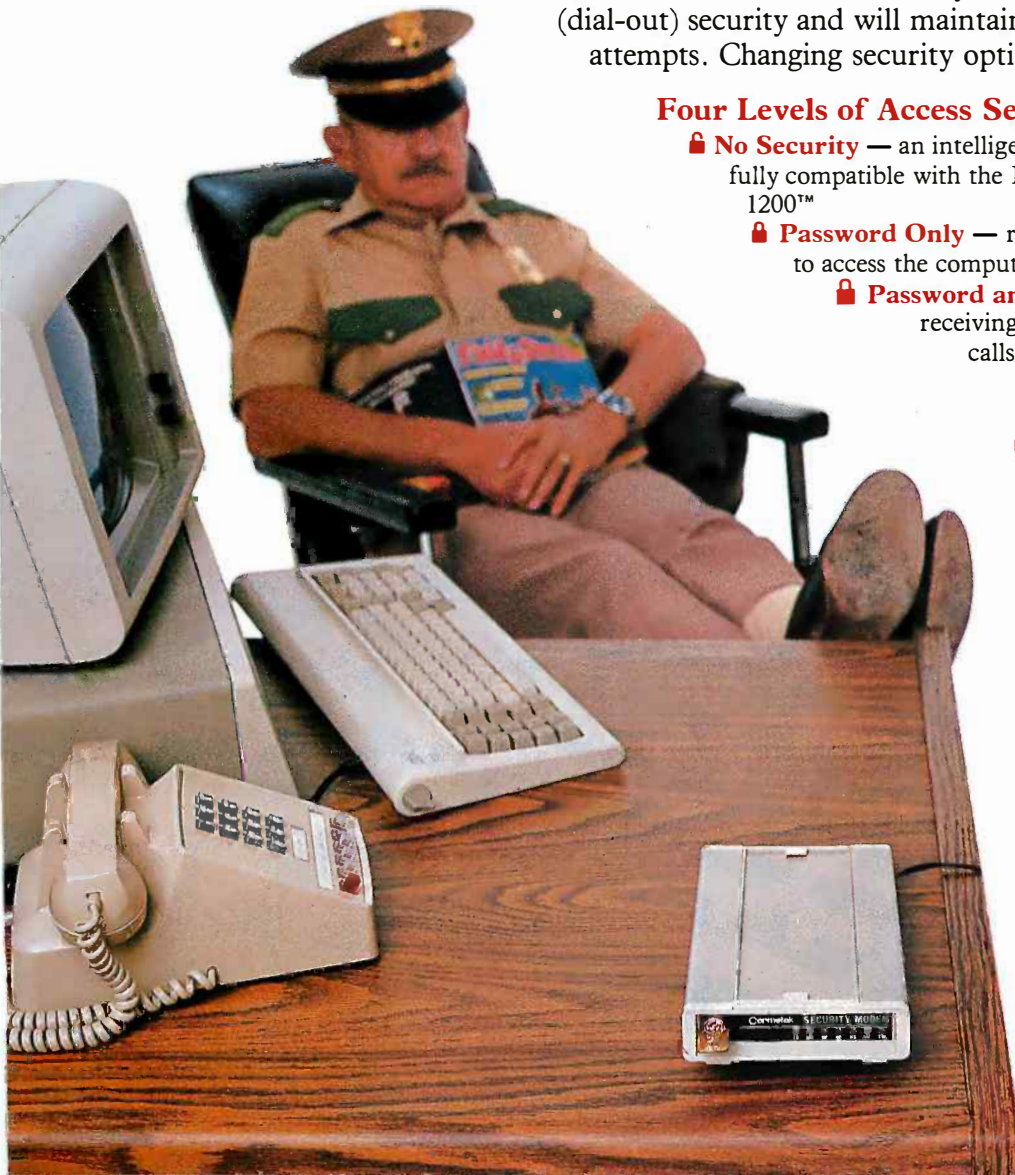
🔒 **Password Only** — requires a valid 8 digit password to access the computer

🔒 **Password and Call-Back** — After receiving a valid password, the modem calls back to the phone number linked to that password in its memory.

🔒 **Password and Call-Back on Second Security Line** — The modem can make the call-back call on a second secret phone line, preventing the interception of the call-back by a sophisticated security breaker.

### Additional Modem Features

- 2 year limited warranty
- Auto-dial, auto-answer
- synchronous as well as asynchronous
- call progress monitoring
- 41 auto-dial numbers stored, 25 for call-back numbers in security mode



*“Communication for your computer, Security for your peace of mind.”*

Take this ad to your favorite computer dealer and ask for the CERMETEK SECURITY MODEM.

SMARTMODEM 1200 is a trademark of Hayes Microcomputer Products, Inc.

Circle 57 on inquiry card.

**Cermetek**  
microelectronics

1308 Borregas Ave.  
Sunnyvale, CA 94088-3565  
(408) 752-5022

# THERE'S NOT ONE REASON WE'VE SOLD 500,000 TERMINALS.

There are a lot.

There's reliability. First we design and manufacture it into the terminal right up front. Then we pretest and burn-in every Viewpoint™ we sell and because we do this so thoroughly, our reliability record is unsurpassed in the industry.

There's a Viewpoint that will fit your particular point-of-view. We don't just approach your terminal needs from one Viewpoint. We offer many. With the Viewpoint 60+ for example, productivity is enhanced. A 7x9 character resolution and user friendly set-up

menu make the Viewpoint 60+ a pleasure to operate. Function keys are not only user programmable but allow for variable length. The Viewpoint 60+ will even support an optional second page. So you can alternate between two independent 24 line screens or configure a single 48 line page. Our other Viewpoints address your terminal needs with an emphasis on other points-of-view as well.

Then there's who we are. ADDS is a subsidiary of NCR Corporation. So the company you're buying your terminals from is just as reliable as the terminals you buy.

For functions, features, quality and reliability—more and more companies are coming around to our Viewpoint. So if you're considering a terminal purchase for your company, consider the ADDS Viewpoint. If for no other reason than our prices are also reasonable.



## IT ALL ADDS UP.

# ADDS

Applied Digital Data Systems Inc.  
A Subsidiary of NCR Corporation

100 Marcus Boulevard, Hauppauge,  
NY 11788 USA  
Tel. (516) 231-5400 • Telex 510-227-9886  
Fax (516) 231-7378



\*Viewpoint is a registered trademark of Applied Digital Data Systems Inc.

**VIEWPOINT**  
Low Cost Conversational



**VIEWPOINT+**  
Three Terminals in one



**VIEWPOINT/90**  
Fully Featured and Programmable



**VIEWPOINT COLOR**  
Color at Monochrome Prices



## CHAOS MANOR

*Our Lilith is very quiet. Her three fans just barely make any noise.*

transferring programs. It took Alex about two hours (and a phone call to Provo, Utah) to get Lilith set up; as Modula Corporation improves the documents and shipping crates (I never saw so much foam rubber and plastic worms in my life), the setup time and complexity ought to come down, but it's hardly onerous now.

Once set up, Lilith will play chess (although we can't find any documents for the chess program; the computer knows how to castle, but we can't figure out how to get the machine to let the *player* do it) and pool (the same game the Diser played). She'll also do terrific text editing, and they tell me they'll have software to let Lilith drive my HP LaserJet Real Soon Now. (She can already work with dot-matrix printers.)

Alex decided to modify an existing program, just to find out how the Modula development tools worked. He reports that there is a master program to call the editor, debugger, compiler, and the program under development; much like Turbo Pascal, this makes correcting bugs much easier.

Our Lilith has 128K bytes on four boards; you can get as much as 512K bytes for her. The boards, unfortunately, sit on a nonstandard bus designed specifically for Modula machines—you can't buy boards from anyone else. There is an extra serial port, though.

Lilith is very quiet. Her three fans just barely make any noise. That's very welcome here at Chaos Manor, where we've considered learning Navy semaphore to converse when all the computers are on at the same time.

Lilith was intended to be an idealized workstation for generating Modula-2 programs, and that's why we have her. Dr. Michael Hyson and

I are doing a book on Modula-2, and I intend to have lots of examples. From the little experimentation I've been able to do, Lilith ought to let me get the book out about twice as fast. I expect you'll hear a *lot* more about Lilith in future reports.

## MORE MODULA-2

Hurrah! Logitech now has a version of Modula-2 for the IBM PC and clones that produces stand-alone code. The code size and speed aren't much to brag about yet; Logitech is working to do optimizations. Still, they're comparable to some of the Pascal compilers on the market. (My apologies for being vague; I've barely had the compiler in the machine long enough to verify that it will, indeed, turn out stand-alone .EXE programs. A complete report when I've had a chance to do real tests.)

Another good machine for playing with Modula-2 is the Sage IV with the Volition Systems Modula-2 and ASE editor. This runs p-code only and thus is slow. You can do practical programs, but you'll wish there were a 68000 native-code compiler.

Alas, there isn't one. A story goes with that . . .

## REVOLUTION AT VOLITION?

For months, Volition Systems people reported that they would have a native-code stand-alone Modula-2 compiler for the 68000 chip Real Soon Now. Indeed, for several months it was always "next month."

Then, during August, there was a general shake-up of Volition Systems. Several people who had formerly worked there (and still owned stock) formed a coalition able to muster a majority of voting stock just before the company was supposed to go public. The result was that Joel McCormick, A. Windsor Brown, and Richard Glaves (otherwise known as Glitch) have left the company. Lawsuits are rumored. As I write this, the 68000 native-code compiler seems further away than ever.

I wish I had better news. With a Modula-2 native-code compiler, my

(continued)

# The best buy you'll ever find!

## Nashua™ Diskettes

**LIFETIME WARRANTY!**

5 1/4" SSDD **.99¢** ea. Qty. 50  
5 1/4" DSDD **\$1.09** ea. Qty. 50

(These are poly-bagged diskettes with reinforced hubs, Tyvek sleeves, and write-protect tabs.)

**SOFT SECTOR ONLY!**

Sold in multiples of 50 only. Prices good while sale quantities last.

**INTRODUCTORY SPECIAL!**

NASHUA Corporation is a half-billion dollar corporation and a recognized leader in magnetic media. You've used these diskettes before and didn't know it... since Nashua has sold primarily to software duplicators.

### SUPER SPECIAL!



Order 50 NASHUA Diskettes on this special offer and you can get an Amaray Media Mate 50 for only \$9.99 (shipping included). Nor any, a \$14.95 retail value, this is one of the best designed disk storage units we've seen. Special slots and ridges for stacking. A great buy.

With 50 NASHUA 5 1/4" Diskettes **\$9.99**

Ordered alone: **\$10.95** + \$2.00 Shpng.

**3M HEADCLEANING KITS**

Stop swearing and start cleaning. This non-abrasive cleaning kit has everything you need for 30 applications. **\$18.00** Shpng. + \$1.50



**DISKETTE 70 STORAGE: STILL A GREAT BUY**

Dust-free storage for 70 5 1/4" diskettes. Six dividers included. An excellent value. **\$11.95** Shpng. + \$3.00



**DISK CADDIES**

The original flip-up holder for 10 5 1/4" diskettes. Beige or grey only.

**\$1.65 ea.** + 20¢ Shpng.

**PRINTER RIBBONS AT BARGAIN PRICES!**

Brand new ribbons produced to manufacturer's specs.

|                  |                        |
|------------------|------------------------|
| Epson MX-70/80   | \$3.58 ea. + 25 Shpng. |
| Epson MX-100     | \$6.99 ea. + 25 Shpng. |
| Okidata Micro 83 | \$1.48 ea. + 25 Shpng. |
| Okidata Micro 84 | \$3.66 ea. + 25 Shpng. |

Shipping: 5 1/4" DISKETTES—Add \$3.00 per 100 or fewer diskettes. Other Items: Add shipping charges as shown in addition to diskette shipping charges. Payment: VISA and MASTERCARD accepted. COD orders only, add \$3.00 handling charge. Taxes: Illinois residents only, add 8% sales tax.

MINIMUM ORDER: \$35.00

FOR ORDERS ONLY:

**1-800-621-6827**

(In Illinois: 1-312-944-2788)

INFORMATION & INQUIRIES:

**1-312-944-2788 only!**

HOURS: 9AM - 5PM Central Time, Monday - Friday

WE WILL BEAT ANY NATIONALLY ADVERTISED PRICE ON THE SAME PRODUCTS AND QUANTITIES!

**DISK WORLD!, Inc.**

Suite 4806 • 30 East Huron Street • Chicago, Illinois 60611

**DISK WORLD!**

NASHUA  
Authorized Distributor  
MAGNETIC  
MEDIA

Sage IV would run like gangbusters. Sigh.

### APPLE MODULES . . .

After Lilith arrived, I called up Professor Richard Ohran of Modula Corporation. You may recall that Richard is also director of the nonprofit Modula Research Institute, which distributes much public-domain Modula-2 software; Modula Corporation sells Lilith and other Modula-2 hardware, hopefully for a profit. During our discussion, Prof. Ohran mentioned his Modula-2 package for the Apple II.

Understand: I do not yet have this package, so I can only report what Ohran told me. On the other hand, I've known him several years now and I've never been fed any hype, so I have every reason to believe him.

According to Ohran, they have developed a Modula package that in-

cludes a language card and software. The package doubles the memory and quadruples the speed of the Apple II—and works with the Apple accelerator. The package, plus an accelerator, lets an Apple with Modula-2 outperform an IBM PC. Moreover, you can develop and compile programs on Lilith, then download to the Apple.

This all sounds wonderful. I can hardly wait to test it out.

Flash: Modula Corporation also has a Macintosh compiler complete with toolbox for \$90. It looks superior to Mac Pascal.

### SUCH A DEAL . . .

Bruce Tonkin is a software wizard. He works mostly in Microsoft BASIC because of its portability; and he can do wonders. Of course, he makes copious use of pointers and indirect variables and the like, and he often uses his highly structured PBASIC pre-

compiler (it compiles to Microsoft BASIC, which can in turn be compiled with Microsoft's BASCOM compiler). His results are amazing.

For example: his My Word! word-processing program has some features not found in *any* other text editor I've ever seen. His Creator database-generation program is simple to use, runs splendidly on a variety of machines, and was, to my knowledge, the very first outside-developed application program for the Macintosh.

Alas, Bruce will do no more work with the Macintosh. Although Apple professes to be eager for Macintosh software, Bruce has been unable to get Apple to do more than look at Creator, which has never been put on Apple's list of Macsoftware. Maybe it's because Bruce is uninterested in spending the money to become a "certified developer." In a recent letter he writes, "All the little developers who made the Apple II popular are frozen out of the Mac market. How many can afford to lay down \$6000 for a Lisa on top of what they paid for a Mac, then pay Apple \$500 so they can get answers to technical questions and \$150 for a preliminary technical manual set?"

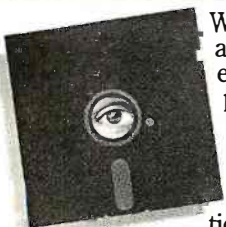
He's also annoyed that no Apple magazine seems interested in reviewing the Creator (although they will review programs that do less and cost more). Bruce thinks it's because he doesn't buy high-cost advertising; at his prices he can't afford to.

Indeed, his prices are one of his problems: many dealers refuse to carry Tonkin's T.N.T. software line because he insists that the prices be kept low, and many dealers believe they can't make any profits with such low prices. That's not as ridiculous as it may sound. Unless you're doing a very high volume of business, you need to make quite a bit on each sale.

There's another approach. Barry Workman has bundled several of Tonkin's programs into a package he calls The Software Essentials. The total price—about \$125—is high enough that Barry can advertise it, sell it through dealers, support it, and

(continued)

# Read Any Good Minds Lately?



With the Mind Prober™ you can. In just minutes you can have a scientifically accurate personality profile of anyone. This new expert systems software lets you discover the things most people are afraid to tell you. Their strengths, weaknesses, sexual interests and more. Mind Prober. Another insightful product from the Human Edge™ Software Corporation. Call 1-800-624-5227 (in California 1-800-824-7325) for more information on the location of the nearest retailer.

IBM • Apple • Macintosh • Commodore

**Mind Prober™**  
Software That Lets You Read People Like A Book.

# HIGH TECHNOLOGY AT AFFORDABLE PRICES

## Dot Matrix Printers

|                                    |            |
|------------------------------------|------------|
| Brother 2044L/Dynax DM-40          | \$ 1039.88 |
| C. Itoh Prowriter (8510)           | 359.88     |
| C. Itoh Prowriter-2, (136 col)     | 589.88     |
| C. Itoh Prowriter BPI (IBM-PC)     | 389.88     |
| C. Itoh HotDot                     | 509.88     |
| C. Itoh HotDot-2 (136 col)         | 729.88     |
| DMX-80 (Panasonic 1090)            | 259.88     |
| Epson RX/FX/LQ Series              | CALL       |
| <b>Epson/Imagewriter upgrade</b>   | CALL       |
| Inforunner Riteman                 | 309.88     |
| Mannesmann Tally Spirit-80         | 329.88     |
| Okidata Microline 92               | 419.88     |
| w/IBM graphics compatibility       | 419.88     |
| <b>w/Imagewriter compatibility</b> | 499.88     |
| Okidata Microline 93               | 679.88     |
| 93 w/IBM graphics compatibility    | 679.88     |
| Okidata Microline 84 Step II       | 769.88     |
| NEC Pinwriter w/tractor (80 col)   | 699.88     |
| NEC Pinwriter w/tractor (132 col)  | 929.88     |
| Star Micronics Gemini 10X          | 279.88     |
| Star Micronics Gemini 15X          | 399.88     |
| Star Micronics Delta 10            | 379.88     |
| Star Micronics Delta 15            | 529.88     |
| Star Micronics Radix 10/15         | 679.88     |
| Toshiba P-1351                     | CALL       |
| Toshiba P-1340                     | CALL       |
| Printer Buffers (Quadram)          | CALL       |

## Letter-Quality Printers

|                                   |           |
|-----------------------------------|-----------|
| Brother/Dynax DX-15               | \$ 399.88 |
| Brother/Dynax DX-25               | 669.88    |
| Brother/Dynax DX-35               | 939.88    |
| C. Itoh A-10 Starwriter (18 cps)  | 549.88    |
| C. Itoh F-10 Starwriter (40 cps)  | 1079.88   |
| C. Itoh F-10 Printmaster (55 cps) | 1379.88   |
| Diablo 620/630/Series 35          | CALL      |
| NEC 2010/2030 (18 cps)            | 739.88    |
| NEC 2050 for IBM-PC (18 cps)      | 759.88    |
| NEC 3510/3530 (33 cps)            | 1379.88   |
| NEC 3550 for IBM-PC (33 cps)      | 1499.88   |
| NEC 7710/7730 (55 cps)            | 1779.88   |
| Qume Sprint 11/40 (40 cps)        | 1519.88   |
| Qume LetterPro 20 (18 cps)        | 459.88    |
| Silver Reed EXP-770 (35 cps)      | 979.88    |
| Silver Reed EXP-550 (18 cps)      | 469.88    |
| Silver Reed EXP-500 (12 cps)      | 389.88    |
| Silver Reed EXP-400 (10 cps)      | 329.88    |
| Star Micronics PowerType (18 cps) | 349.88    |

## Modems

|                               |          |
|-------------------------------|----------|
| Anchor Volksmodem, 300 bd.    | \$ 69.88 |
| Anchor Mark XII, 1200 bd.     | 299.88   |
| Hayes Micromodem IIe (Apple)  | 249.88   |
| Hayes Smartmodem, 300 bd.     | CALL     |
| Hayes Smartmodem, 1200 bd.    | CALL     |
| Hayes Smartmodem 1200B (PC)   | CALL     |
| Novation AppleCat, 300 bd     | 239.99   |
| Novation AppleCat, 1200 bd    | 449.88   |
| Novation SmartCat+            |          |
| IBM-PC Internal, 1200bd       | 349.88   |
| External, w/software (MS-DOS) | 349.88   |
| USR Password, 1200 baud       | 369.88   |
| Multi Phone-Line Junction Box | 29.88    |

## Monitors

|                    |           |
|--------------------|-----------|
| Amdek 300G (green) | \$ 144.88 |
| Amdek 300A (amber) | 159.88    |

|                                                     |           |
|-----------------------------------------------------|-----------|
| Amdek 310A (TTL amber)                              | \$ 179.88 |
| Amdek Color 300 (composite)                         | CALL      |
| Amdek Color 600 (RGB)                               | CALL      |
| Princeton Graphics HX-12                            | 509.88    |
| Princeton Graphics Max-12                           | 199.88    |
| Quadram QuadChrome                                  | 529.88    |
| Roland DG-121 (green/amber)                         | 144.88    |
| Roland DG-122 (TTL output, green or amber, w/cable) | 169.88    |
| Monitor Stand (tilt/swivel)                         | 39.88     |
| Monitor Cable (NTSC composite)                      | 9.88      |

## IBM-PC Peripherals

|                                                            |          |
|------------------------------------------------------------|----------|
| 64K Memory (4164/200ns) 9/pkg                              | \$ 69.88 |
| Alloy 41 MB Hard Disk w/Tape                               | CALL     |
| Alloy PC Tape Backup                                       | CALL     |
| Curtis Monitor Stand                                       | 39.88    |
| Curtis Monitor Extention Cable                             | 39.88    |
| Curtis Keyboard Extention Cable                            | 29.88    |
| Curtis System Stand                                        | 21.88    |
| Hercules Graphics Card                                     | 379.88   |
| Hercules Color Graphics Card                               | CALL     |
| Keytronics 5151 keyboard                                   | 219.88   |
| Microsoft Mouse (parallel)                                 | 149.88   |
| Mouse Systems PC-Mouse (3.0)                               | 149.88   |
| Paradise MultiDisplay                                      | 299.88   |
| Quadram 384K Quadboards                                    | CALL     |
| Quadram Quad 512 + (64K)                                   | 239.88   |
| Quadram Quad 512 + (512K)                                  | 609.88   |
| Quadram QuadColor-1                                        | 219.88   |
| Quadram QuadColor-2                                        | 229.88   |
| QuadVue (TTL output)                                       | 259.88   |
| Quadram Parallel Card, RS-232C Card or Clock/Calendar Card | 79.88    |
| Quadram Memory Boards (64K)                                | 209.88   |
| Quadram Memory Boards (128K)                               | 269.88   |
| Quadram Memory Boards (192K)                               | 319.88   |
| Quadram QuadLink                                           | 509.88   |
| QuadLink (Columbia/Compaq)                                 | 539.88   |
| STB Graphics Plus II                                       | 359.88   |
| STB Super I/O                                              | 169.88   |
| STB Super RIO (64K)                                        | 289.88   |
| STB Super RIO Plus (64K)                                   | 309.88   |
| Tandon TM 100-2 DSDD                                       | 199.88   |
| Titan Cygnus I/O (clock/parallel)                          | 149.88   |
| Titan Cygnus I/O (clock/RS-232)                            | 169.88   |
| TG Joystick                                                | 59.88    |

## Apple Peripherals

|                                                          |           |
|----------------------------------------------------------|-----------|
| ALS CP/M Plus Card (CP/M 3.0)                            | \$ 279.88 |
| ALS Smarterm II (80 col)                                 | 139.88    |
| ALS Dispatcher (RS-232)                                  | 74.88     |
| AMT MicroDrive (half height)                             | 179.88    |
| Grappler+ Printer Card & cable                           | 109.88    |
| Buffered Grappler+ (16K)                                 | 184.88    |
| Microsoft Softcard (CP/M)                                | 244.88    |
| Microsoft Softcard IIe (CP/M, 64K, 80 col. for IIe only) | 279.88    |
| Pkasso-U Printer Card & cable                            | 129.88    |
| Printer Card & cable                                     | 79.88     |
| Quadram E-Ram (IIe, 80 col/64K)                          | 119.88    |
| Rana Elite-1 Disk Drive                                  | 219.88    |
| Rana Controller                                          | 84.88     |
| Titan/Saturn Memory Boards                               |           |
| 32K                                                      | 154.88    |
| 64K                                                      | 244.88    |
| 64K                                                      | 349.88    |

|                                               |           |
|-----------------------------------------------|-----------|
| Neptune 64k/80 col (IIe)                      | \$ 194.88 |
| TBL Cooling Fan                               | 59.88     |
| Titan Accelerator II                          | 419.88    |
| Videx VideoTerm                               | 199.88    |
| Videx VideoTerm/softswitch                    | 219.88    |
| Videx UltraTerm (80/160 column)               | 244.88    |
| Videx Enhancer II                             | 109.88    |
| Videx PSIO (parallel & RS-232 interface card) | 159.88    |

## Macintosh Peripherals

|                            |           |
|----------------------------|-----------|
| 1st Base DB                | \$ 139.88 |
| Diskettes (5-pk)           | 24.88     |
| Diskettes (10-pk)          | 43.88     |
| Bluechip Millionaire       | 44.88     |
| Daisywheel Printer Drivers | 79.88     |
| Habadox DataBase           | 139.88    |
| Hayden DaVinci Series      | CALL      |
| InfoCom Games              | CALL      |
| Kensington Starter Pak     | 69.88     |
| Kensington Diskette Holder | 29.88     |
| Kensington Modem           | 119.88    |
| Living Video Think Tank    | 99.88     |
| MacForth (Level I/II)      | 179.88    |
| Microcom MacModem          | 519.88    |
| Micron Eye (digitizer)     | CALL      |
| Microsoft BASIC            | 109.88    |
| Microsoft MultiPlan        | 139.88    |
| Miles Comp. Mac the Knife  | 29.88     |
| Monogram Dollars & Sense   | 114.88    |
| Magnum McPic               | 39.88     |
| Main Street Filer          | 139.88    |
| Megahaus MegaMerge         | 89.88     |
| Odesta Helix PDSS          | 279.88    |
| Omnis 2 (mouse ver)        | 199.88    |
| Penguin Games              | CALL      |
| PFS: File                  | 89.88     |
| PFS: Report                | 89.88     |
| ProVUE OverVue             | 199.88    |
| Sargon III                 | 39.88     |
| Soft-Life MacSlots         | 54.88     |
| Softworks C Compiler       | 319.88    |
| Telos FileVision           | 139.88    |
| T/Maker Click Art          | 39.88     |
| Tecmar MacDrive (5MB)      | CALL      |

TECHNICAL INFORMATION/SALES  
**(603) 881-9855**  
 TOLL-FREE ORDER DESK  
**(800) 343-0726**

Hours: 9:00 to 5:30 EST, Mon-Fri

- FREE UPS ground shipping on all orders over \$50 (under \$50 add \$2.50 handling)
- MasterCard, VISA, American Express, Diners Club & Carte Blanche credit cards accepted
- No surcharges on credit card orders
- Credit cards are not charged until your order is shipped from our warehouse
- CODs accepted up to \$1000 (add \$10 for COD handling). Payable with certified check, money order or cash.
- Allow 10 days for shipping from date of order
- All personal checks held 30 days for clearance
- Full manufacturer's warranty on all products sold
- Software can be returned for an exact exchange only; no credits or refunds issued
- Sorry, no APO/FPO or foreign orders



HIGH TECHNOLOGY AT AFFORDABLE PRICES  
**THE BOTTOM LINE**



MILFORD, NH 03055-0423 □ TELEPHONE (603) 881-9855

# COMPUTERS and more...

is your place to buy for SELECTION, SERVICE and SAVINGS.

We know that your needs are not the same as everyone's, so we don't treat you "just like every one else." Your needs are special. That's why **COMPUTERS and more...** is your place to buy for...



"Tomorrow's Technology at Prices You Can Afford Today"

## COMPUTERS

|                         |                             |
|-------------------------|-----------------------------|
| <b>IBM</b>              | <b>CORONA</b>               |
| 256 PC w/2.....1450     | Desktop w/2 Drives 1795     |
| PC w/10 Meg 1-32 1995   | Portable w/2 Drives 1959    |
| PC w/dual & 10 Meg 2795 | Hard Disk Models... CALL    |
| New At... On Sale!      | Multi-User System CALL      |
| Warranty Included!      |                             |
| <b>APPLE</b>            | <b>NEC</b>                  |
| Hot New IIC... CALL     | 8201 A (Portable)... 469    |
| MAC-All Models... CALL  | APC I... CALL               |
| LISA-All Models... CALL | APC II... FOR               |
| Apple IIE... CALL       | APC III... LOW              |
|                         | APC IV... PRICE             |
| <b>LEADING EDGE</b>     | <b>COMPAQ</b>               |
| PC-1... 1395            | Portable w/2 Drives On Sale |
| PC-2... 1549            | Portable w/Hard... CALL     |
| PC4... 1956             | New Models Now Shipping     |
| PC5... 2349             |                             |
| PC6... 2695             | <b>SANYO</b>                |
| Nutshell... 119         | 550... ON                   |
|                         | 555... SALE                 |
| <b>COLUMBIA</b>         | 550-2... NOW!               |
| MPC 4210... 1895        |                             |
| MPC 4220... 2079        | <b>ZENITH</b>               |
| MPC 4620... 3359        | Desktop 151-21... 1995      |
| MPC 4820... 3795        | Desktop 151-22... 2195      |
| MPC 4750... 4129        | Portable 161-21... 2099     |
| VP 2220... 2059         | Portable 161-22... 2249     |
| VP 2116... 1276         | CALL FOR PRICES ON:         |
| <b>TELEVIDEO</b>        | KAYPRO • SHARP •            |
| TPC-II... On Sale!      | COMPAQ • EAGLE •            |
| 1605 Color... CALL      | OTRONO • NOVELLE •          |
| PM/16... CALL           | NORTHSTAR • ALTOS •         |
|                         | DEC • EPSON •               |

## ACCESSORIES

|                                 |                                   |
|---------------------------------|-----------------------------------|
| <b>IBM</b>                      | <b>AST-6 PAK</b>                  |
| Hercules Color Card 199         | Quad Link... 469                  |
| Vutek CPS Cd... 229             | PC Saver... 39                    |
| Keytronic 5151 - 5151 Jr... 209 | TG Joystick... 44                 |
| Bi-Graphics I... 450            | 64K Ram Chips... CALL             |
| Bi-Graphics II... 228           | CALL FOR PRICE LIST!!             |
| Smart Cable by I.Q. 64          |                                   |
| Jr. Extender by Falcon... CALL  | <b>APPLE</b>                      |
| UltraPak by TSENG 489           | DiscWasher Cari... 199            |
| UltraRam by TSEN 139            | PrinterFace by P.P. 64            |
| Multisplay by PS... 239         | GraphicCard by P.P. 79            |
| Plantronics Color Plus 299      | Z-80 Card... 69                   |
| Orchid Blossom... 299           | Touch Pad by Koala 84             |
| Orchid PCnet... 389             | MicroSoft Access... CALL          |
| Orchid Combo... CALL            | GraphicPlus... 109                |
|                                 | Videx 80 Col w/Soft Switch... 179 |
|                                 | Wesper Full Graphics 78           |
|                                 | System Saver FAN 57               |

WE'VE EXPANDED TO A NEW LOCATION TO SERVE YOU BETTER



1 Year Warranty Available

TO ORDER: Phone orders invited using Visa, MasterCard, or bank wire transfers. Visa, MC NO SERVICE CHARGE Mail orders may send charge card number (include expiration date), cashiers check, money order, or personal check (allow 10 business days for personal or company checks to clear). Please add 3% (\$5.00 minimum) for UPS shipping, handling, and insurance. All equipment is in factory cartons with manufacturer warranty. Opened products not returnable. Restocking fee for returned merchandise. Equipment subject to price change and availability. Retail prices differ from mail order prices. Calif. residents add 6% State Tax. Company and school P.O.'s accepted on approval. IBM & Apple are registered trademarks.

\* On All Pre-paid Cash Orders In Cont. U.S.

## PRINTERS

|                           |                                         |
|---------------------------|-----------------------------------------|
| <b>JUKI</b>               | <b>TOSHIBA</b>                          |
| Juki... 389               | Toshiba P 1351 P... 1259                |
| Tractor... 109            | Toshiba P 1351 S... 1259                |
| 6300... CALL              | Toshiba P 1340 ser... 749               |
|                           | Toshiba P 1340 Par... 749               |
| <b>EPSON</b>              | <b>MANN-TALLY</b>                       |
| RX-80... 219              | Spirit... 294                           |
| FX Series... CALL         | 160-1... 539                            |
| LQ 1500... 1059           | 160-L... 619                            |
| <b>DAISYWRITER</b>        | 180-1... 769                            |
| Daisy 200... 859          | 180-L... 849                            |
| New Models... CALL        | 420-T123... 2369                        |
| <b>PANASONIC</b>          | 420-L-112... 1939                       |
| 1090... 219               | <b>CITIZEN</b>                          |
| F091... 279               | MSP-10... 394                           |
| 1092... 399               | MSP-15... 649                           |
| 1093... 589               | Ribbons, Supplies at Low Prices... CALL |
| Ribbons (with purchase) 8 |                                         |
| <b>QUADRAM</b>            | <b>STAR</b>                             |
| QuadJet... 695            | STX-80... 137                           |
| IBM Kit... 19             | Gemini 10X... 239                       |
| Apple Kit... 49           | Gemini 15X... 349                       |
|                           | Delta 10... 339                         |
| <b>NEC</b>                | Delta 15... 469                         |
| New Pinwriter 2... CALL   | Radix 10... 494                         |
| New Pinwriter 3... CALL   | Radix 15... 567                         |
| 2030-Parallel... 679      | X-War Avail. All Models                 |
| 2050-Parallel... 889      | <b>OKIDATA</b>                          |
| 3510-RS232... 1299        | MicroLine 84 P... CALL                  |
| 3515-RS232... 1299        | MicroLine 92 P... CALL                  |
| 3530-Parallel... 1279     | Pacemark 2350 P... CALL                 |
| 3550-Parallel... 1599     | Pacemark 2410 P... CALL                 |
| Extended Warranties CALL  |                                         |

FREE \* SHIPPING "MODEMS"

|                            |                          |
|----------------------------|--------------------------|
| <b>HAYES</b>               | <b>RIXON</b>             |
| II C Compatible w/Soft 259 | R 103J ASYNC... 229      |
| MicroModem IIe... 229      | PC 212A IBM Internal 429 |
| Hayes 1200B... 389         | PC 212A-WA... 429        |
| SmartModem 300-RS232 219   | w/ASYNC Port... 499      |
| SmartModem 1200-RS232 539  | R-212A-I RS232... 429    |
| ChronoGraph RS232 199      |                          |
| <b>U.S. ROBOTICS</b>       | <b>NOVATION</b>          |
| IBM PC Modem... 369        | Access 1-2-3... 399      |
| Password 300/1200... 357   | J-Cat... 99              |
| <b>VEN-TEL</b>             | 103 Smart Cat... 189     |
| 1200 Plus... 384           | 212 Auto Cat... 397      |
|                            | Apple Cat II... 229      |

## DISK DRIVES

|                         |                                         |
|-------------------------|-----------------------------------------|
| <b>FLOPPY DRIVES</b>    | <b>HARD DISK</b>                        |
| Tandom 100-2... 169     | 10 Meg Internal... 895                  |
| Slim Line Drives... 149 | QuarterMaster ON SALE!                  |
| Apple Compatible... 159 | 10 Meg External... 1095                 |
| <b>FUJI DISKETTES</b>   | 15 Meg External... CALL                 |
| SS DD... 22             | Bernoulli by Imega 2799                 |
| DS DD... 27             | <b>QUADRAM • TECMAR • CONTROLL DATA</b> |

## SOFTWARE

|                              |                               |
|------------------------------|-------------------------------|
| <b>FOR PC &amp; XT</b>       | <b>APPLE</b>                  |
| OZ by Fox & Geller... 299    | dBase III by Ash/Tate 419     |
| Quick Code... 219            | Friday by Aston-Tate 199      |
| FrameWork by... SALE!        | Bottom Line Strategist 269    |
| dBase III... 419             | C Dex Packages (ea.)... 399   |
| Friday... 199                | CPA Modules 1 thru 4          |
| Please by Hayes... CALL      | (each) 174                    |
| Lotus 1-2-3... 275           | OZ by Fox & Geller... 319     |
| Mayday by Teletek CALL       | Graphox... 197                |
| Symphony by Lotus SALE       | Sales Edge... 174             |
| Upgrades for 1-2-3 CALL      | Format IIe... 104             |
| DESQ... CALL                 | Knoware... 64                 |
| Inves Anyly by Dow Jones     | Master Type... 27             |
| Market Analyzer... 249       | Micro Pro... CALL             |
| Market Manager... 219        | Micro Soft... CALL            |
| PFS: Access... 65            | PFS: Access IIe... 49         |
| PFS: File... 89              | PFS: File II... 84            |
| PFS: Write... 89             | PFS: File IIe... 84           |
| PFS: Report... 84            | The Handlers (all)... 149     |
| Bankstreet Writer... 47      | Terapin Logo... 99            |
| EasyWriter II by IUS... 269  | VersaForm... 259              |
| Down Jones On Soft... CALL   | BPI GL... 267                 |
| Volkswriter Deluxe... 179    | Pie Writer by Hayden 97       |
| R-Base by Micro Rim... 319   | Persona Pearl... 194          |
| WordStar... ON SALE!         | Dow Jones... CALL             |
| MBSI Real World... CALL      | Lock Smith... 78              |
| T.I.M... 329                 | Zork-I, II or III (ea.)... 26 |
| VersaForm... 279             | Deadline... 33                |
| Call for Complete Price List | Flight Simulator II... 74     |
|                              | Jack Report... 74             |

## MONITORS

|                        |                         |
|------------------------|-------------------------|
| Roland DG-121-G... 139 | Quadscreen w/Card 1650  |
| Roland DG-121-A... 249 | Zenith 131... 319       |
| Roland CB-141... 319   | Zenith 135... 487       |
| Roland CC-141... 595   | Zenith 122... 109       |
| Taxan 420... 389       | Amdek 310... 159        |
| Taxan Amber... 119     | Amdek Colon IV T... 597 |
| Taxan 415... 499       | NEC JC 1215... 269      |
| TGB-80 col. IIe... 139 | NEC JC 1216... 397      |
| RGB Card IIe... 89     | Amdek 300 G... 134      |
| Quadchrome... 559      | Amdek 300 A... 144      |

## TERMINALS CALL

## SERVICE

WE OFFER EXTENDED WARRANTIES ON ALL OF OUR PRODUCTS. OUR EXPERIENCED TECHNICIANS ARE HERE FOR YOU!



# COMPUTERS and more...

8265 Commercial Dr., La Mesa, CA 92041



1-800-433-9449



For CA, HI and Alaska (619) 466-4895

NO SERVICE CHARGE FOR CREDIT CARDS NATIONAL LEASING AVAILABLE

P.O.'S ACCEPTED ON APPROVAL

## *Borland's Sidekick, Lotus 1-2-3, and the T.N.T. package turn your PC into one heck of a useful machine.*

make a profit. Bruce is happy, since the price per program is low. Of course, they both are betting that customers will also be happy.

Included in The Software Essentials are My Word! and My Word! extended (contains extended sort, global paragraph reformatting, and calculations; it's WordStar-compatible); 80-page manual plus NEW.DOC on disk; My Word!'s mail-merge utility, alias "MyMerge."

Textref: an indexing program that makes *very* complete indexes; too complete for large books but not bad for program documentation. It's a single-word indexer; for multiple levels, you have to do a bit of work by hand. Still, it does work well for a first pass, and the price is right.

The Creator and Reporter: with a newly reprinted 120-page manual. While these won't do everything that dBASE II will, they'll do a surprising amount of data management and report generation, probably as much as most users need.

Just to sweeten the deal, they've thrown in some utilities.

Compress/Expand: makes My Word! files smaller for disk storage. Much akin to the public-domain squeeze and unsqueeze utilities. I'd never use it myself, but it does seem safe and can save disk space.

Read: a typing program like MS-DOS's More. Unlike the TYPE command, the MORE command lets you move forward and backward by pages through the file.

Cheapsort: a low-price database-sorter program.

Xtrax: converts random or sequential files for mail merge, etc.

I'm told there are several other utilities, too.

All the programs will run on every

model IBM, from PCjr through PC AT. They also will run on most compatibles; the utilities should run on almost all MS-DOS computers. My Word! runs on the TI PC, Zenith Z-150, and Tandy 2000, but not the Zenith Z-100.

As an instant software package it looks hard to beat: word processor, mail merger, sorter, database handler, and utilities.

After watching Philippe Kahn demonstrate his Borland International Sidekick with Lotus 1-2-3, I came to the conclusion that Sidekick plus 1-2-3 is at least as useful as Symphony; add the Workman T.N.T. package and you can turn your PC into one heck of a useful machine.

### **BIG TEX**

We've had our TI Professional for a couple of months; alas, busy months, which haven't given me much time to play with the machine. On the other hand, just as we were about to get to Big Tex, TI sent technicians out to rebuild him from bottom to top, so I'm glad we hadn't invested a lot of time in the old model.

Although I've been busy with *Footfall* and other novelistic matters, Alex has had the summer off and was able to put in nearly a full week with the Professional.

Alex talks mostly about hardware. The TI Professional is not an IBM PC clone, and most PC software won't run on it. That's the bad news. The good news is that dozens of the best programs, including Lotus 1-2-3, dBASE II, EasyWriter, BASIC, WordStar, and many others, have been specially rewritten for the TI, and many take advantage of the machine's special features. Programs adapted for Big Tex work very well indeed.

Now to Alex's notes.

### **THE TI'S HARDWARE**

"Being the inquisitive type, I took the TI apart to look at its construction. I was impressed. Two screws hold on the top panel, at the upper corners of the rear panel. This is much better than the five that are inconveniently placed on the IBM PC. Once open, the TI is better looking, too. There's a

spacer bar along the left-hand side of the cabinet so that the boards won't twist (which does happen on the IBM PC). The power supply is much larger than the IBM's, large enough to run all our boards, the Winchester, and one floppy-disk drive. (I'm told by TI engineers that it's not quite large enough to run another floppy-disk drive, but an even heavier supply is in development.)

"There is a whole lot of room under the Winchester and floppy-disk drives. There's actually enough that some enterprising individual could stick a half-height hard disk under the floppy-disk drive. (The speaker is under the Winchester drive, but of course that could be moved.) This, by the way, isn't so unusual: the Zenith Z-150 has much the same arrangement—intentionally designed that way.

"The machine had six boards in it: RS-232C board, memory-expansion board, TI's graphics board with three planes of memory, speech-command board, 300/1200-bps modem, and Winchester disk controller. The first two boards plugged into two separate connectors that are in a row, so the TI PC can be said to have "five-and-a-half" slots. The floppy-disk controller, parallel-port connector, 8088, and 128K bytes of memory are built into the motherboard of the TI PC. The modem board is built for TI by Racal-Vadic, an old minicomputer modem firm that now sells PC modems. All the other boards are built by TI (more on that in a moment).

"Most of the boards are thicker than normal. The modem board has a transformer that sticks out. If you add color to the TI PC, the extra graphics memory is put on a piggyback board—otherwise you have but one color. The speech board is two boards thick, but it has extremely large connectors that make it effectively three boards thick. I expect that new versions of these boards will be much smaller and draw less current."

### **INCOMPATIBILITY**

"The TI's bus, though it looks exactly like the IBM PC's, isn't compatible. TI

*(continued)*

# Multi-function RS-232 Transfer Switches

MFJ-1240  
\$ 79 95

Choice of  
8 models



Multi-function RS-232 transfer switches let you switch your computer among printers, modems, terminals, any RS-232 peripherals; monitor data/line failure, protect data lines from surges, and use as null modem for less cost than a switch alone.

Switches 10 lines (2, 3, 4, 5, 6, 8, 11, 15, 17, 20). LED data/line indicators monitor lines 2, 3, 4, 5, 6, 8, 20. Metal oxide varistors protect data lines 2, 3 from voltage spikes and surges. Push button reverses transmit-receive lines (2, 3). PC board eliminates wiring, crosstalk, line interference. Connects any one input to any one output.

| Model    | Price    | In | Out | Model    | Price    | In | Out |
|----------|----------|----|-----|----------|----------|----|-----|
| MFJ-1240 | \$79.95  | 1  | 2   | MFJ-1244 | \$139.95 | 3  | 3   |
| MFJ-1241 | \$99.95  | 2  | 2   | MFJ-1245 | \$169.95 | 3  | 5   |
| MFJ-1242 | \$119.95 | 2  | 3   | MFJ-1246 | \$199.95 | 5  | 5   |
| MFJ-1243 | \$119.95 | 1  | 4   | MFJ-1247 | \$99.95  | 1  | 2   |

switches 20 lines

## AC Power Centers

MFJ-1108  
\$ 99 95

MFJ-1108, \$99.95. Add convenience, prevent data loss, head bounce, equipment damage. **Relay** latches power off during power transients. **Multi-filters** isolate equipment, eliminate interaction, noise, hash. **MOVs** suppress spikes, surges. 3 isolated, switched socketpairs. One unswitched for clock, etc. Lighted power, reset switch. Pop-out fuse. 3 wire, 6 ft. cord. 15A, 125V, 1875 watts. Aluminum case. Black. 18x23/4x2 in. **MFJ-1107**, \$79.95. Like 1108 less relay. 8 sockets, 2 unswitched. **MFJ-1109**, \$129.95. Like 1107 but intelligent. Switch on device plugged into control socket and everything else turns on. Others available.



## Acoustic/Direct Coupled Modem



Use with any  
phone anywhere

MFJ-1233  
\$ 129 95

MFJ-1233 Acoustic/Direct Coupled 300 baud modem. Versatile. Use with virtually any phone, anywhere. Use battery or 110 VAC. **Direct connect mode:** Plug between handset and base. Use with single or multi-line phones. **Acoustic coupled mode:** Use with phones without modular plugs. Quality muffs give good acoustic coupling, isolates external noise for reliable data transfer. Originate/answer. Self test. Carrier detect, ON LEDs. RS-232, TTL compatible. Reliable single chip modem. Crystal controlled. Aluminum cabinet. 9x1 1/2x4 in. Other models available.

Order from MFJ and try it. If not delighted, return within 30 days for refund (less shipping). **One year unconditional guarantee.** Order yours today. Call toll free 800-647-1800. Charge VISA, MC. Or mail check, money order. Add \$4.00 each for shipping and handling.

CALL TOLL FREE . . . 800-647-1800

Call 601-323-5869 in MS, outside continental USA.

**MFJ ENTERPRISES  
INCORPORATED**

921 Louisville Road, Starkville, MS 39759

*In a world of  
me-too machinery, the  
TI Professional is  
obviously different and  
thus more salable.*

decided to move the bus lines around so that IBM cards wouldn't work in the Professional. This seemed to me like a pretty bad idea when I first heard about it—after all, TI had lost big on the TI-99/4A with much the same approach. But there was some logic to the decision, as I discovered later.

"If the Professional had had IBM-compatible slots, everyone would have thought it was another IBM PC clone. Customers would have rioted if they knew that boards could plug in but wouldn't work exactly as in the IBM. One of the main selling points of the TI PC is its high-resolution graphics; if TI had made the slots compatible, it would have had to make the graphics compatible (and therefore much lower resolution).

"While you can argue that compatibility isn't quite that cut and dried, you must admit that it was a smart move. In a world of me-too machinery, the TI PC is obviously different and therefore more salable. This, without going overboard in the other direction, as with the Victor 9000, Apple III, or NEC micros.

"This incompatibility meant that TI could include a much better display than the IBM's. Screen resolution is 720 by 300 pixels, with no display modes that I can find. The higher resolution, better character set, and larger screen make the display better than the IBM PC's if you compare color to color. Compared to the IBM monochrome, it's a toss-up, which is a compliment to the TI's color display."

[In any event, the TI has the only color display (under \$10,000 anyway) I know of that you could use day after day for word processing. All the other color systems are too fuzzy and will

give you (or at least me) eyestrain after a few hours. . . J.E.P.]

### THE TI BOARD CRUNCH

"When we first got Big Tex, he had all six expansion connectors filled (see above); it's pretty tight in there. When Bill Cmela came out from TI, he replaced the two boards in a row (that's the memory and RS-232C boards, if you're keeping count) with a Persyst Time Spectrum board. The Time Spectrum board has a light-pen adapter, battery-supplied real-time clock, an RS-232C port, and space for up to 448K bytes of memory—which brings the TI PC up to 512K bytes. The light-pen adapter has the same connector as the monitor, so I labeled them both to circumvent confusion. The Time Spectrum board comes with software to automatically set the TI PC's time at start-up plus printspooling and RAM-disk software. The clock was accurate to within a few minutes when I tested the board.

"The Time Spectrum board supplants the RS-232C and memory boards (the short ones in a row) plugging into *both* sockets, so it looks like two different boards to the TI. Unfortunately, Bill had to remove the modem board so that he could fit in the Persyst board—since the Time Spectrum board, with all its memory, is two boards hooked together.

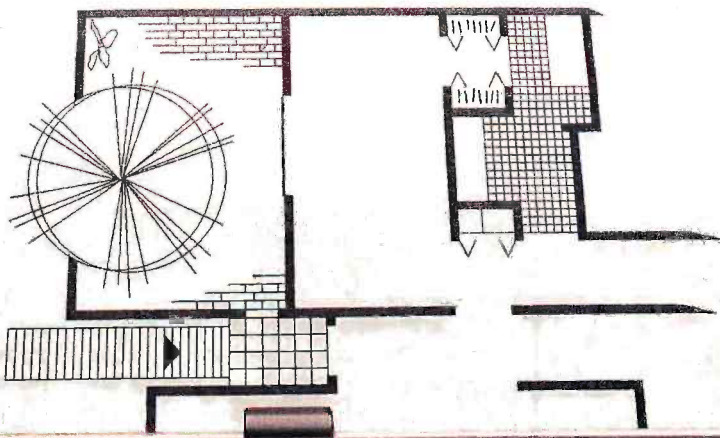
"We were certain we wanted all five boards (which were around nine boards thick) installed, so it became a game of Chinese checkers, figuring out which boards would fit in which slots. One of the engineers at TI said that he didn't think you could physically fit all the boards into the box, but if you could, the power supply wouldn't complain. I saw a challenge, so I played with various configurations. Then the speech board wouldn't listen, so Bill had to come out again anyway. Between the two of us, we discovered a way to fit all of them in."

### ALL THE BOARDS DO FIT!

"People who don't own a TI PC are invited to skip this section; those who do will be happy to know that you can

(continued)





## The first 3-in-One printer with a good head for graphics. The Toshiba P1351.

The Toshiba P1351 is the ultimate 3-in-One printer. Other printers try to approach our level of graphics sophistication. Other dot matrix printers can come close to us on speed. And there are even a couple of printers with a 24-pin dot matrix print head similar to ours. But our combination of graphics, speed and letter quality makes the Toshiba P1351 stand alone.

**Intelligence with an eye for detail.** The Toshiba P1351 comes with one of the most advanced print heads in the industry. A unique high-density 24-pin dot matrix print head that produces amazingly sharp 180 x 180 dot-per-square inch, fully dot-addressable graphics. So you get unbeatable high-resolution charts, graphs and illustrations no one can duplicate. And it's supported on popular graphics software like Lotus 1-2-3.<sup>™</sup>

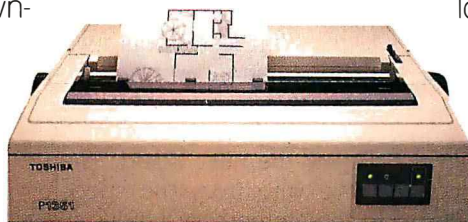
**Intelligence that's unlimited.** The Toshiba P1351 does more than give you access to three resident typefaces for word processing. It also gives you the ability to download an unlimited variety from a growing library of IBM-compatible software typefaces. They're all stored on floppy disk. And you get programming access to five typefaces at any time.

**Intelligence that's letter-perfect.** Our unique print head gives you letter-quality results from any typeface you choose. And with Qume SPRINT 5<sup>™</sup> emulation, the Toshiba P1351 can give you those results from almost every popular word processing program. Of course, it's fully IBM-compatible. And there's even an optional forms tractor or sheet feeder for paper handling versatility.

**Intelligence and speed.** You won't have to sacrifice speed for letter-quality printing. Because the Toshiba P1351 gives you the best of both. Sharp, clean letter copy at 100 cps. And even faster draft copy at 192 cps.

**Intelligent and dependable.** The Toshiba P1351 3-in-One<sup>™</sup> printer is also engineered and built with a very intelligent attitude toward dependability. And optional third party 24-hour service is also available. That's why, over the past four years, more than 200,000 intelligent buyers have depended on Toshiba 24-pin printers.

So make the intelligent move. To the Toshiba P1351, the first 3-in-One printer with a good head for graphics. And everything else. For more information, call 1-800-457-7777, Operator 32.



Lotus and 1-2-3 are trademarks of Lotus Development Corporation. SPRINT 5 is a trademark of Qume Corporation.

In Touch with Tomorrow

# TOSHIBA

TOSHIBA AMERICA, INC., Information Systems Division

# ADVANCED AMERICAN MEMORIES

## COMPUTER SYSTEMS



|                               |       |        |
|-------------------------------|-------|--------|
| IBM PC 64K, 1 DRIVE           | ..... | \$1395 |
| IBM PC 64K, 2 DRIVE           | ..... | \$1575 |
| IBM PC XT, 1 DRIVE            | ..... | CALL!  |
| IBM AT                        | ..... | CALL!  |
| COMPAQ 128K, 1 DRIVE          | ..... | CALL!  |
| COMPAQ 128K, 2 DRIVE          | ..... | CALL!  |
| TAVA PC 128K, Complete System | ...   | \$1595 |
| SANYO 555-2                   | ..... | CALL!  |
| SANYO 550-2                   | ..... | CALL!  |
| APPLE IIC                     | ..... | CALL!  |
| MacINTOSH                     | ..... | CALL!  |

## DISK DRIVES



|                                          |       |       |
|------------------------------------------|-------|-------|
| TEAC 55B, 360 KB 1/2 HT                  | ..... | \$123 |
| PANASONIC (MATSUSHITA)<br>360 KB, 1/2 HT | ..... | \$118 |
| SANYO 360 KB, 1/2 HT                     | ..... | \$118 |
| IBM PC-AT, 1.2 M6, DUAL SPEED,<br>1/2 HT | ..... | CALL! |
| TOSHIBA 360 KB, 1/2 HT                   | ..... | \$145 |
| MITSUBISHI QUAD DENSITY<br>1/2 HT        | ..... | \$149 |
| TANDON TM 100-2                          | ..... | \$169 |
| A.M.I. Iic                               | ..... | \$175 |
| A.M.I. Iie                               | ..... | \$175 |
| IBM COMPATIBLE SS/DD                     | ..... | \$90  |
| TRS 80 COMPATIBLE SS/DD                  | ..... | \$90  |
| 10 Mb HARD DISK<br>W/CONTROLLER          | ..... | \$799 |

## IBM COMPATIBLE PRODUCTS/ACCESSORIES



COMPUTER PERIPHERALS, INC.  
(ADD ON CARDS)

|                              |       |          |
|------------------------------|-------|----------|
| 7-PACK (S,P,C, 0-384K)       | ..... | \$209.95 |
| MULTI-PACK (S, P, C, 0-256K) | ...   | \$179.95 |
| PCM-1 (0-256K)               | ..... | \$129.95 |
| PCM-2 (0-384K/512K)          | ..... | \$162.50 |
| 64K UPGRADE IBM              | ..... | \$39.50  |
| LOCKING DISK FILE (90 CAP.)  | ..    | \$23.95  |

# ADVANCED MEMORIES

187 W. Orangethorpe  
Building 1, Unit C  
Placentia, CA 92670

**(714) 528-4300**



CA RESIDENTS  
ADD 6.5% SALES TAX



Availability and prices subject to change without notice.  
Not responsible for typographical errors.

## CHAOS MANOR

fit all of those thick boards in your PC.

"Unplug the computer and take off its top. Take out the screw that holds down the Winchester controller board—that's the one nearest the floppy-disk drives with two cables on it. You'll need longer cables for this board. The cables needed are 34-pin card-edge socket to 2-row female pin connector and 20-pin with the same connectors. If in doubt, take the old cables with you when you get them made up. I had them made about a foot longer than the current ones. They were about \$30, which is far less than an expansion chassis for the TI. You can get them made at most specialty computer supply stores. Radio Shack stores stock only cables for Radio Shack computers. (Make sure you notice the orientation of the connectors when you remove them; the new ones *must* be connected the same way. Also note what connectors are used; there are extras on the Winchester board. I don't know what would happen if you connected something backward or to the wrong socket, but I wouldn't want to find out.)

"Once you've got your new cables, here's how to fit all the boards in: first, make sure the power cord is unplugged. (You did that anyway, right?) The Time Spectrum (or memory) board goes in the first slot (as seen from the front of the computer). Next goes the graphics board, which you probably haven't touched. Next, route the Winchester cables between the power supply and drives, past the first slot where the Winchester board used to sit, between the card sockets and card guides. (The card guides sit up near the front of the cabinet and keep the cards from twisting.) Connect the cables to the Winchester board with the same orientation as when you took the board out. Give the cables a quarter-twist *gently*, so they won't be in the way of the next board. Then connect the wire from the speech board to the motherboard. If it's still connected, leave it alone. If the jumper has come loose, the speech-board hardware manual tells how to reconnect it. Now insert the speech board, taking care that the Winchester

cables are out of harm's way—not between the cards and their card guides, nor between the socket and card edge, nor where the speech board will sit. Be very gentle with all the boards. You may have to pull the Winchester board out partially to seat the speech board. Some gentle persuasion of both boards and their cables may be in order. Don't force anything. All the boards must sit in their connectors, the card-edge guides, and their sockets or they (the cards) will twist. This is a no-no.

"Once these two boards are in place, make sure the Winchester cables aren't pinched and that no boards are touching. Then plug in the computer, turn it on, and boot up the diagnostic disk. Test the computer and the speech board. If all is working, you can put the modem board (or whatever's left over) in the last slot, put all the hold-down screws back in the boards, check for boards touching again, and put the cover back on. You've just saved yourself a lot of money."

## HARD-DISK SYSTEM

"Our TI has the optional 10-megabyte hard disk; as with the PC XT, the drive itself sits in the right-hand slot. The TI will accept hard disks from 5 to 30 megabytes. The hard-disk formatting program lists 10 different models.

"The only problem with that program is it's slow! It took 20 minutes to format and error-check our 10-megabyte drive. I'm glad you have to do it only once.

"I couldn't find a program to partition the hard disk for operating systems other than MS-DOS. I know that the UCSD p-System, CP/M-86, and Concurrent CP/M-86 are available for the TI, though.

"The hard-disk controller itself is an add-on board. Unlike the IBM, the TI's floppy-disk controller is on the motherboard, along with a parallel (Centronics) printer port. That means one more free slot.

"TI's hardware approach contrasts well with IBM's and Zenith's. IBM builds the keyboard interface, some

(continued)



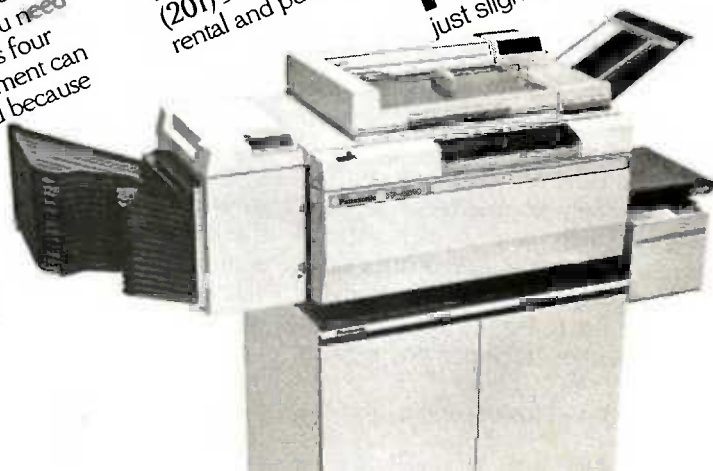
# If you're running out of ways to tell your boss the copier broke again, it's time for a Panasonic.

If a broken copier causes your boss so much pain you'd like to put him out of his misery, tell him about the new Panasonic high-speed copier, the FP-4520. It has advanced electronics specially designed to help prevent breakdowns. This Panasonic will give you fast relief when you need copies quick. It can make 45 copies per minute. Its four modes of reduction and three modes of enlargement can make changing copy sizes a lot less painful. And because

Circle 301 on inquiry card.

the FP-4520 can grow into a complete system, with sorter, ADF, and large capacity paper cassette, it can solve almost any copying headache. So, before a broken copier gives your boss a migraine, tell him it's time for a Panasonic. If you're afraid to talk to your boss, talk to us. Just call Panasonic at 1-800-526-0354. In New Jersey, call (201) 384-0275. And ask about PANAP,™ our national rental and purchase program for major accounts.

**Panasonic**  
just slightly ahead of our time.



memory, a cassette interface, processor, and boot ROMs into the PC motherboard. TI adds a floppy-disk interface, diagnostic LEDs (light-emitting diodes), and the parallel port. Zenith's motherboard is more like an S-100 bus: nothing but power and data signals. All the functions, from processor through keyboard interface, are on add-on boards. On the one hand, the basic machine price can be kept low (as with IBM and TI). On the other hand, expansion is much easier—as with the Zenith."

### TI HARDWARE PLANS

"TI's own mouse is being approved by the Federal Communications Commission, but some third-party mice will work. Someone makes an expansion chassis for the TI, a product we'll probably need soon. Of course, Corvus makes an Omninet board for the TI, and several other local-area-network boards are available.

### THE TI DIAGNOSTICS

"Most computers come with a diagnostics or troubleshooting disk, but I've never seen a microcomputer with such good ones. Three LEDs are on the motherboard; these light up when the computer is too sick to boot. You can figure out what's wrong by reading the hardware manual. The computer gives itself a short self-test before starting up. Unlike the IBM PC, the memory test is tolerable even with 512K bytes in it. You may remember we disabled this test in the IBM PC because it took so long; we don't feel the need in the TI.

"The diagnostics disk is very good. I learned this by doing: I checked out the speech board before using it and discovered it wasn't listening to the headset. Yet it passed all 10 internal tests and it spoke, so I knew it was otherwise okay. A quick board swap later and all was well.

"These tests are so thorough that the extremely knowledgeable could fix moderately bad problems themselves. As it is, the diagnostics disk, plus operations manual, is enough for the beginner to isolate most faults. It insults neither beginner nor expert,

which is a rarity among manuals. This goes for the software and other manuals, too. Many companies could benefit from manuals this good.

"A few complaints: there is no physical Reset button. Like the IBM PC, Ctrl-Alt-Del will reset the machine if it's listening to the keyboard. If a program crashes or turns off the interrupt that listens to the keyboard, this won't work. You must turn off the power, wait 20 seconds, and then turn it back on. That's extremely bad for both boards and the hard disk. The TI PC shares this deficiency with most IBM PC clones.

"Also: the cursor blinks about once a second, which is distracting. [Alex charitably calls it distracting. I call it maddening. . . .]E.P.] I know this can be disabled because the speech program does so. I will have to plumb through the manuals for how to turn this off. Also, the Caps Lock on the keyboard (which has an LED, bless TI) goes on whenever you reboot. It must have been designed by an uppercase typist. A little program to set these would be extremely nice, especially if it would reset them between programs.

"On the hard disk: the model we have has no way to retract the hard-disk head. Later models have a landing zone. Also, I would really like a physical write-protect switch on it, just like on larger drives.

"The hard disk does make PC-DOS and MS-DOS easier to use. I set up separate directories for programs like WordStar, BASIC, and modem software, with path commands to search them. With buffers set to 30, the hard disk really moves. The TI would be a great development computer."

### THE SPEECH HARDWARE

"With the full name of the Speech Command System, this is a rarity. It's both a talker and a listener. You can dictate, dial and answer the phone, give voice commands to programs, use a voice password to lock out unwanted guests, set up appointment schedules, set alarms, and give yourself audio reminders. The board's vocabulary (on input or output) isn't

good enough to actually transcribe your audio ramblings, but it is good enough for everything else. It's quite a board—I'm disappointed that it hasn't been accorded the publicity it deserves. [Editor's note: *The Speech Command System* was reviewed in June, page 341.]

"A word on I/O: the board comes with a microphone/headset that works well; a phone can also be used through the board. If neither suit you, you can use any good dynamic 600-ohm microphone with a ¼-inch plug. I'm using a Radio Shack cardioid microphone, catalog number 33-992B. You'll also want a good microphone stand; effective range is only about 3 inches. (There may be a way to adjust sensitivity of the input; I'm still learning.) With the external microphone, the board talks back through either the TI PC's own speaker or any 8-ohm external one.

"The speech system isn't perfect. Its quality could stand improving. Voices played back are discontinuous and somewhat garbled—less so with the external microphone than the headset. Both are a bit too noisy. Yet the board is still a great start.

"Voice data is recorded at 2400 bps. With data compression (speech is mostly silence) and a little better circuitry, I'll bet that TI could improve the voice quality considerably.

"You can change the speed of playback, much as with dictation recorders. Unlike them, however, the replayed voice tends to break up at high or low speeds—much like the discontinuity at regular speed.

"The Speech Command System requires a great deal of memory to run, both RAM and disk. The speech program itself is 161K bytes. A bit of arithmetic shows that floppies are quickly used up at 2400 bps with serious dictation. A hard disk is certainly in order for more than 15 minutes of dictation at a time."

### PHONE-SYSTEM SOFTWARE

"The speech program itself is broken into major selections: phone dialer, phone answerer, dictation system, and

(continued)

# computers of New York wholesale

# 315-676-3004

Box 150 Brewerton, N.Y. 13029

Circle 91 on inquiry card.

*We pay UPS shipping charges  
on prepaid orders.*

### —PRINTERS—

|               |        |
|---------------|--------|
| <b>ANADEX</b> |        |
| DP-9501B      | \$1049 |
| DP-9620B      | 1099   |
| DP-9625B      | 1199   |
| DP-6500       | 2299   |

|                          |       |
|--------------------------|-------|
| <b>TEXAS INSTRUMENTS</b> |       |
| TI855 w/Tract.           | \$849 |
| TI 810RO Package         | Call  |

|                      |       |
|----------------------|-------|
| <b>C. ITOH</b>       |       |
| Prowriter 8510A Par. | \$315 |
| Prowriter 8510A Ser. | 415   |
| Prowriter II Par.    | 499   |
| Prowriter II Ser.    | 549   |

|              |       |
|--------------|-------|
| <b>EPSON</b> |       |
| RX-80FT      | \$299 |
| FX-100       | 599   |

|                       |       |
|-----------------------|-------|
| <b>STAR MICRONICS</b> |       |
| Gemini 10X            | \$259 |
| Gemini 15X            | 389   |
| Radix 15              | Call  |

|                         |       |
|-------------------------|-------|
| <b>MANNESMAN TALLEY</b> |       |
| MT-160 I                | \$529 |
| MT-160 L                | 579   |
| MT-180 L                | 829   |

|               |       |
|---------------|-------|
| <b>DIABLO</b> |       |
| 620 RO 25 CPS | \$879 |
| 630 RO 40 CPS | 1705  |

|                    |      |
|--------------------|------|
| <b>OKIDATA</b>     |      |
| ML-82A             | Call |
| ML-83A             | Call |
| ML-92 Par.         | Call |
| ML-92 Ser.         | Call |
| ML 92SA (APPLE)    | Call |
| ML-93 Par.         | Call |
| Pacemark 2350 Par. | Call |

|                  |       |
|------------------|-------|
| <b>PANASONIC</b> |       |
| KX-P1090         | \$279 |
| KX-P1091         | 329   |

|                        |       |
|------------------------|-------|
| <b>NEC NEWNEC 2050</b> | 979   |
| IBM 2050               | \$479 |
| 3510                   | 1219  |
| 3550                   | 1499  |
| 8023                   | 279   |

|             |       |
|-------------|-------|
| <b>JUKI</b> |       |
| Daisywheel  | \$459 |

|              |        |
|--------------|--------|
| <b>QUME</b>  |        |
| Sprint 11/40 | \$1299 |
| Sprint 11/55 | 1499   |
| Sprint 11/90 | Call   |

|                           |       |
|---------------------------|-------|
| <b>RITEMAN Inforunner</b> | \$299 |
|---------------------------|-------|

Advertised prices reflect a cash discount on prepaid orders only. Most items are in stock for immediate delivery in factory sealed cartons with full factory warranties.

### —MONITORS—

|                   |     |
|-------------------|-----|
| <b>AMDEK</b>      |     |
| 300 G (12" green) | 135 |
| 300 A (12" amber) | 145 |
| 310 A (IBM PC)    | 165 |
| 600               | 449 |

|                   |      |
|-------------------|------|
| <b>BMC</b>        |      |
| 12 AU (12" green) | \$79 |

|                     |       |
|---------------------|-------|
| <b>NEC</b>          |       |
| JB-1201 (12" green) | \$155 |
| JB-1205 (12" amber) | 155   |
| JC-1212 (12" color) | 339   |
| JC-1216 (12" RGB)   | 439   |

|                      |       |
|----------------------|-------|
| <b>PANASONIC</b>     |       |
| 12" Green Monochrome | \$169 |
| 12" Amber Monochrome | 179   |
| 13" RGB              | 379   |

|                  |     |
|------------------|-----|
| <b>PRINCETON</b> |     |
| SR-12            | 625 |
| Scan Doubler     | 205 |

|                   |       |
|-------------------|-------|
| <b>SAKATA</b>     |       |
| SG-1000 12" Green | \$105 |
| SG-1001 12" Color | 269   |
| SG-200 12" RGB    | 539   |

|                     |       |
|---------------------|-------|
| <b>TAXAN</b>        |       |
| KG 12N (12" green)  | \$129 |
| 210 (13" color)     | 299   |
| 400 (13" RGB color) | 299   |
| 410 (13" RGB color) | 379   |

|                   |       |
|-------------------|-------|
| <b>ZENITH</b>     |       |
| Z-122 (12" amber) | \$139 |
| Z-123 (12" green) | 109   |

### —HARD DISKS—

|                      |        |
|----------------------|--------|
| <b>CORVUS</b>        |        |
| 20Mg. (IBM or Apple) | \$3315 |

|                               |      |
|-------------------------------|------|
| <b>TALLGRASS TECHNOLOGIES</b> |      |
| 20MB Hardfile Disk for IBM-PC | 2695 |

|                            |      |
|----------------------------|------|
| <b>Greatakes</b>           | Call |
| <b>Teamate</b>             | Call |
| <b>Turbo-10 1/2 height</b> | Call |

### —DISKETTES—

|               |         |
|---------------|---------|
| <b>Maxell</b> |         |
| 5 1/4" MD1    | \$22.95 |
| 5 1/4" MD2    | 32.95   |

|                  |         |
|------------------|---------|
| <b>3M/Scotch</b> |         |
| 5 1/4" SSDD      | \$21.95 |
| 5 1/4" DSDD      | 30.95   |

|                              |         |
|------------------------------|---------|
| <b>Educator</b>              |         |
| Lifetime Warranty            |         |
| 5 1/4" SSDD                  | \$16.95 |
| 5 1/4" DSDD                  | 21.95   |
| Flip 'n' File/holds 50 Disks | 17.95   |

### —BOARDS—

|                              |      |
|------------------------------|------|
| <b>IBM PC BOARDS</b>         |      |
| AST Sixpak plus 64k          | 299  |
| AST Megaplus 256k            | 569  |
| Microsoft 256k RAM Board     | 299  |
| Plantronics Color + Board    | 399  |
| Quadram New Quadboard        | Call |
| Quadram Quadlink Board       | Call |
| Tecmar 1st MATE Board        | 229  |
| Tecmar Graphics Master Board | 569  |
| PC Peacock Graphics Board    | 299  |
| 64k Chip Kit (9 Chips)       | Call |

### —SYSTEMS—

|                 |      |
|-----------------|------|
| <b>ALTOS</b>    | Call |
| <b>COLUMBIA</b> |      |
| VP Portable     | Call |
| MPC 1600-1      | Call |
| MPC 1600-4      | Call |
| <b>CROMEMCO</b> | Call |
| <b>IBM</b>      | Call |

## SOFTWARE

*Discount Prices on  
Most Popular  
Manufacturers!*

|                                  |        |
|----------------------------------|--------|
| <b>MORROW</b>                    |        |
| NEW Pivot                        | Call   |
| 2 drives, 256K, Modem, LCD       |        |
| MD-3                             | \$1927 |
| 2 drives, Prnt., MDT-70 Terminal |        |

|                               |      |
|-------------------------------|------|
| <b>NEC</b>                    |      |
| PC-8201 Portable              | Call |
| PC-8800 Small Business System | 1669 |
| PC-8800 16-Bit System         | 1999 |
| PC-8800 System w/8-in. Drives | 2299 |

|                  |      |
|------------------|------|
| <b>NORTHSTAR</b> |      |
| Advantage        | Call |

|              |        |
|--------------|--------|
| <b>SANYO</b> |        |
| MBC 550-2    | Call   |
| MBC 555-1    | \$1139 |
| MBC 555-2    | Call   |

|                            |        |
|----------------------------|--------|
| <b>APPLE</b>               |        |
| Apple II-C w/1 drive, 228K | \$1035 |

|                  |      |
|------------------|------|
| <b>TELEVIDEO</b> |      |
| Tele-PC          | Call |
| Tele-XT          | Call |
| TPC-II Portable  | Call |

|                    |        |
|--------------------|--------|
| <b>ZENITH</b>      |        |
| 151-22 w/2 Drives  | \$2495 |
| 151-22 w/Hard Disk | 3995   |
| 161-22 Portable    | Call   |

### —TERMINALS—

|                                  |       |
|----------------------------------|-------|
| <b>ESPRIT SYSTEMS</b>            |       |
| Esprit                           | \$485 |
| Esprit III (Detachable Keyboard) | 649   |

|                                    |       |
|------------------------------------|-------|
| <b>New!</b>                        |       |
| <b>Televideo Personal Terminal</b> |       |
| Personal Terminal                  | \$399 |
| Personal Terminal                  | 529   |
| w/300 band modem                   |       |
| Personal Terminal                  | 849   |
| w/1200bandmodem                    |       |

|                  |       |
|------------------|-------|
| <b>TELEVIDEO</b> |       |
| 910              | \$439 |
| 914              | 579   |
| 924              | 695   |
| 925              | 699   |
| 950              | 865   |
| 970/50           | 949   |

|                 |       |
|-----------------|-------|
| <b>QUME</b>     |       |
| 102 Gr. or Amb. | \$549 |
| 108 Gr. or Amb. | 719   |

|             |      |
|-------------|------|
| <b>WYSE</b> |      |
| 50          | 549  |
| 300 Color   | 1089 |

|               |       |
|---------------|-------|
| <b>ZENITH</b> |       |
| Z-29          | \$629 |
| ZT-10         | Call  |
| ZT-11         | Call  |

### —MODEMS—

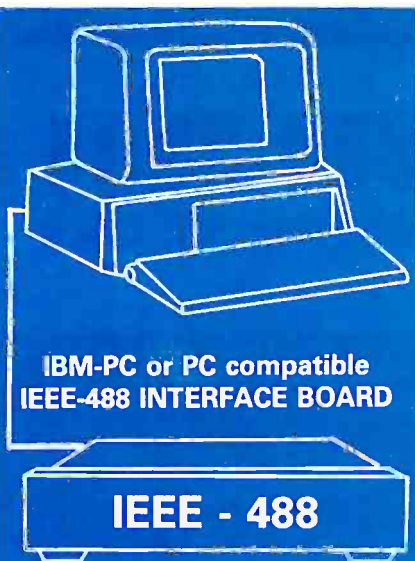
|                  |       |
|------------------|-------|
| <b>HAYES</b>     |       |
| Smartmodem 300   | \$189 |
| Smartmodem 1200  | 479   |
| Smartmodem 1200B | 429   |
| Micromodem II-E  | 219   |

|                   |       |
|-------------------|-------|
| <b>NOVATION</b>   |       |
| D-Cat             | \$149 |
| J-Cat             | 99    |
| Apple Cat II      | 249   |
| 103 Smart Cat     | 179   |
| Smart Cat+        | 339   |
| 103/212 Smart Cat | 399   |
| 212 Auto Cat      | 549   |
| Access 1-2-3      | 399   |

|                  |     |
|------------------|-----|
| <b>SIGNALMAN</b> |     |
| Mk XII           | 279 |
| Mk VII           | 129 |
| Volksmodem       | 59  |
| Mk II L          | 75  |

|                       |       |
|-----------------------|-------|
| <b>U.S. ROBOTICS</b>  |       |
| 300 Baud Password     | \$149 |
| 1200 Baud Password    | 339   |
| PC 1200 Baud Modem    | 329   |
| S 100 1200 Baud Modem | 329   |

N.Y. residents, add appropriate sales tax. We accept VISA and Master Card. Personal and company checks, allow 2 weeks to clear. C.O.D.'s require a 25% deposit. All prices and offers may be withdrawn without notice.



## VERSATILE

- Implements the entire IEEE-488(GP-IB, HP-IB) standard with high-level commands and standard mnemonics.
- Resident firmware routines support interpreted and compiled BASIC, Pascal, C, and other languages.
- Supports Lotus 123 and most wordprocessing programs.
- One board drives any combination of 15 IEEE-488 peripherals.
- Emulates most Hewlett-Packard controller functions and graphics language statements with single line BASIC statements.
- Supports Tektronix® Standard Codes and Formats.
- Small size - fits the PC/XT short slot.

## FAST

- Burst DMA > 800KB/sec
- Continuous DMA > 300KB/sec

## PROFESSIONAL

- Clear, concise documentation includes a complete tutorial and source code for interactive bus control, bus diagnostics, graphics plotting, and many other applications.
- **\$395 complete.** There are no extra software charges.



CAPITAL EQUIPMENT CORP.

10 Evergreen Avenue  
Burlington, MA. 01803  
(617) 273-1818

IBM is a trademark of International Business Machines Corp.  
Lotus 123 is a trademark of Lotus Development

## CHAOS MANOR

transparent keyboard software. I'll talk about each of these in a moment.

"This is one nice hunk of software. In fact, it almost has too many options. Let me explain.

"A problem that software developers must face is a user's experience. Unless he's going to restrict the software's flexibility (people will feel insulted), he must explain all of them. The more options, the more likely a newcomer will give up because it's too hard to learn. Yet people like me who want everything controllable will snub inflexible software. With the speech board's obvious target being the busy executive, I wonder if TI hasn't erred by putting too many features in the program. Of course, the gadget-mad person will love it and be patient enough to read about all its features. I'd love to hear how long it took other people to figure out this system.

"That out of the way, I can say that TI's programmers have paid very close attention to detail. All of their programs use the function, arrow, and editing keys right where you'd expect them. Escape gets you out of one menu into the previous one. The editing keys even work in MS-DOS: using Ins and Del, you can insert or delete a character within a command. The line under consideration changes color to remind you you're working on it. The same function key does the same thing through all of the voice-command routines. The menus are all tree-oriented, but there aren't more than two levels to the bottoms. The menu items do what they say they will—without much jargon.

"Like it? I may go hoarse praising its good points. It quietly does what it says it will, with accurate sample screens in the manual."

### PHONE DIALER

"I haven't experimented with the phone dialer much. The software looks good and does dial the phone. You can set it up to dial someone and play a prerecorded message. Once you run 'PCSpeech smartphone,' you can use the TI keypad, the phone, or your on-line list of numbers to dial

out. There's also a way to continue working on the computer when you're put on hold. You can take notes on the computer while phoning, too."

### APPOINTMENT SYSTEM

"Nicely done. You can set the alarm to remind you to leave or expect someone. You can set up 'day at a glance' appointment lists days in advance. I don't think you can set daily or weekly appointments, except one at a time. Nonetheless, the overworked man without a secretary might find this essential."

### THE PHONE SLAVE

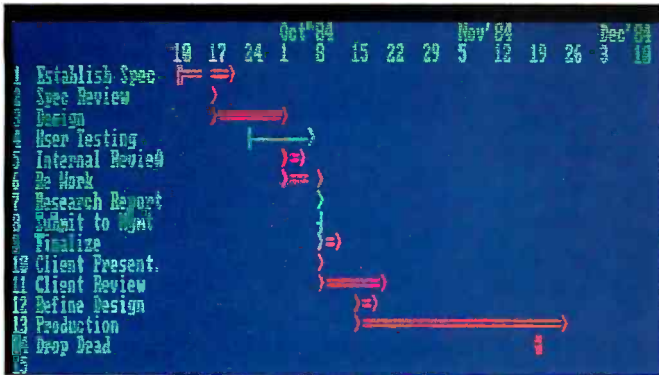
"I've now played with the answering-machine function for about an hour. (The biggest problem was my plugging the phone into the modem instead of the speech board!) It's easy to learn; everything is menu-driven and consistent. You record your phone greetings (up to five) and can then set the machine to answer with one of these. You can also replay messages from any Touch-Tone phone. For privacy, you can set up a four-digit password. Once you've convinced the computer that you're entitled, it will let you play back, delete, and skip over messages. It differentiates between old and new messages—and remembers when they came in. There was serious attention paid to detail in this program.

"Complaints: speech quality (again). The recorded messages tend to distort. The TI's voice itself is very clear, though. Other complaints: the machine takes several rings to answer the phone, even set to answer on the zeroth ring, and it takes several seconds to hang up after you hang up. But these are probably features: almost no one is actually ready to talk until the second ring, and you wouldn't want to hang up too early on anyone. There is no provision for remote voice command—you must use touch tones—nor can the many commands be listed over the phone. You'd have to carry the supplied reference card. You can't record new messages, switch messages, etc.,

(continued)

# Now there's no excuse to drop dead.

Producing a brochure. Introducing a new product. Moving your entire company across town. Every project has a start date, a completion date, and a date beyond which you absolutely, positively cannot go. The drop dead date. Blow that date and you've got positively, absolutely no excuses.



Better to arm yourself with Microsoft® Project, the new software tool for business managers and their IBM® PCs. Microsoft Project tells you which activities are essential to keeping your schedule. And which you can let slide.

## Microsoft Project keeps you on a healthy track.

What a spreadsheet does for financial planning, Microsoft Project does for start-to-completion scheduling. Give it your best to worst "what-if" scenarios. It tells you what must be accomplished. By whom. By when. At what cost.

When management needs detailed

status or budget reports, it prints them out. In text and bar charts. And it can also send budgeting information to programs like Multiplan®, Microsoft Chart, or Lotus™ 1-2-3™.

## Get Microsoft Project. No excuses.

Microsoft Project is easy to use. Especially if you're familiar with electronic spreadsheets. It saves your company time, work, money. Makes you an on-time, on-budget manager. Not to mention it's from Microsoft. We're the people who designed the MS™ DOS operating system that tells the IBM **MICROSOFT** PC how to think. The High Performance Software. And our BASIC is the language spoken by nine out of ten microcomputers worldwide.

For the name of your nearest Microsoft dealer, please call 800-426-9400. In Washington State, Alaska and Hawaii 206-828-8088.

Should you decide you can face another drop dead date without Microsoft Project, tell us where to send the flowers.

A hand is shown holding a large, three-dimensional block letter logo for the word "MICROSOFT". The letters are dark and have a metallic or plastic appearance. The hand is positioned at the bottom right, with fingers gripping the base of the letters.

remotely. August 15, 12:05 a.m. is replayed as "zero eight one five at zero zero zero five"—the speech board's vocabulary should include the months, the numbers from 1 through 20, and a.m./p.m.

"Don't get me wrong; I like this product. TI could have left the phone-answering option off, with its atten-

dant circuitry, but didn't. I'm glad; it's as good as some mechanical answering machines and doesn't limit the caller to a 15-second "HellothisisDave I'mtryingtoeachyou bye!"

**THOUGHTS FOR IMPROVEMENT**  
 "The speech program should display the length (in bytes and seconds) of

each piece of dictation. I don't like its green display (everything else is white on black), but that's minor.

"Playing with this board prompted many ideas. For instance, how about a software overlay that plays back dictation while in another program? That way, I could replay my meanderings and type them in with WordStar at the same time. A really smart program could find the space between words, play back one word at a time, and watch for the space bar to be pressed. You could listen to a word at a time and never have to fiddle with a foot control as with a regular dictating machine. Of course, it'd also have to wait for you when you made corrections. Hmm, maybe it could watch for the arrow and editing keys. When it saw one, it could wait for you. Then you'd signal start-up with something like Alt-Space. Oh, and it should repeat the word if you don't type anything for a while or press a Replay key. "Listening, TI?"

**THE MODEM**

"The modem and speech software are somewhat integrated but leave room for improvement. The modem itself seems to work well. You can hook your phone through the modem and speech boards and still use the instrument. An integrated speech/modem board would be the next logical step.

"Another integration I'd like to see is using the network software (e.g., Omninet) to send voice messages from TI to TI."

**TI SOFTWARE**

"We also received some TI-specific software. The WordStar uses all the special keys, including all 12 function keys. Other niceties: Shift-right-arrow moves by word, Shift-up-arrow by screen, etc. This is very intuitive for most people and much easier to remember than control keys.

"The MBASIC seems pretty standard. I haven't experimented with it.

"Emulate, a supplied utility, makes the TI much more like an IBM PC. You can run My Word! with it installed. It's not perfect—StarFleet Battles (com-

(continued)

**ITEMS DISCUSSED**

**DISK MAKER I**.....\$1500  
 New Generation Systems Inc.  
 2153 Golf Course Dr.  
 Reston, VA 22091  
 (800) 368-3359

**GULF STRIKE**.....\$30  
 Victory Games  
 43 West 33rd St.  
 New York, NY 10001  
 (212) 563-2630

**KOALAPAD**.....\$125  
 Koala Technologies Corp.  
 3100 Patrick Henry Dr.  
 Santa Clara, CA 95052-8100  
 (800) 562-2327

**LASERJET PRINTER**.....\$3495  
 Hewlett-Packard  
 19447 Pruneridge Ave.  
 Cupertino, CA 95014  
 (800) 367-4772

**LILITH**.....\$8000  
**MODULA-2 (for Macintosh)**.....\$90  
 Modula Corporation  
 950 North University Ave.  
 Provo, UT 84604  
 (801) 377-3598

**MODULA-2**.....\$595  
 Volition Systems  
 POB 1236  
 Del Mar, CA 92014  
 (619) 481-2286

**MODULA-2 (for the IBM)**.....\$495  
 Logitech Inc.  
 165 University Ave.  
 Palo Alto, CA 94301  
 (415) 326-3885

**QUADBOARD**.....\$345-\$795  
 Quadram  
 4355 International Blvd.  
 Norcross, GA 30093  
 (404) 923-6666

**RIO PLUS II Clock MODULE**..\$395  
 STB Systems Inc.  
 601 North Glenville  
 Richardson, TX 75081  
 (214) 234-8750

**SAGE IV**.....\$7300  
 Stride Micro  
 4905 Energy Way  
 Reno, NV 89502  
 (702) 322-6868

**THE SOFTWARE ESSENTIALS**...\$125  
**T.N.T. SOFTWARE**.....\$25-\$50  
 Workman and Associates  
 112 Marion Ave.  
 Pasadena, CA 91106  
 (818) 796-4401

**TI PROFESSIONAL**.....from \$2495  
 Texas Instruments  
 POB 402430  
 Department DCA232BY  
 Dallas, TX 75240  
 (800) 527-3500

**TIME SPECTRUM**.....\$395-\$1270  
 Persyst Products  
 Personal Systems Technology  
 17862 Fitch  
 Irvine, CA 92714  
 (714) 662-5600

**UNDER WARE**.....\$20  
 Diversions Inc.  
 1550 Winding Way  
 Belmont, CA 94002  
 (415) 591-0660

**Z-100 COMPUTER**.....\$2899  
**Z-150 COMPUTER**.....from \$2199  
 Zenith Data Systems  
 1000 Milwaukee Ave.  
 Glenview, IL 60025  
 (312) 391-8865



# The most BASIC.

Microsoft® BASIC is the language spoken by nine out of ten microcomputers worldwide. It's the language with the most programs written for it.

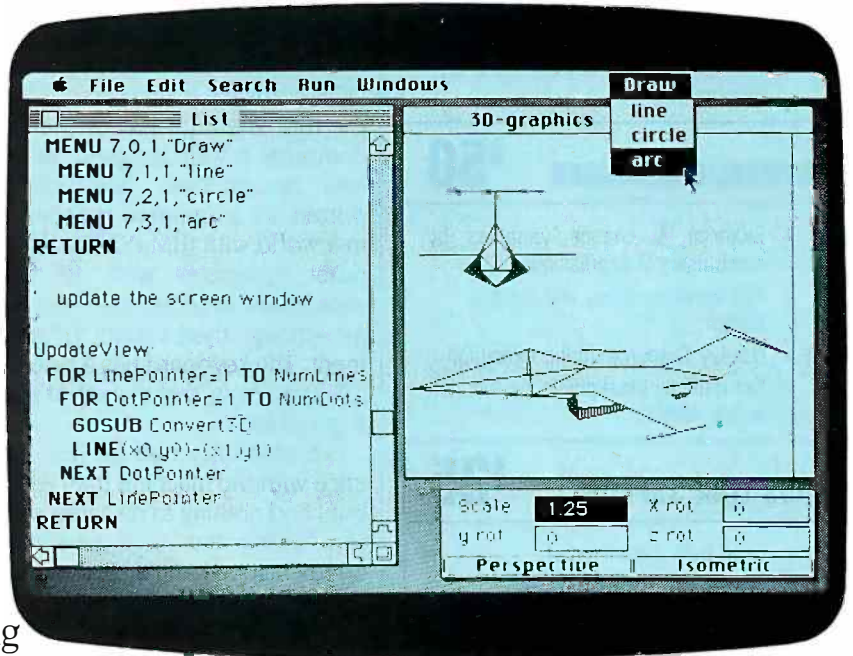
So if you want to access the power of your Macintosh™, only one language makes the most sense. Mac's first language, Microsoft BASIC.

Not only is it the industry standard, it's the most advanced BASIC for Macintosh. It lets you add mouse commands. Graphics. Windows. Change type fonts and styles. Customize menus. Incorporate music and sound effects. Write your own dialog boxes. Basically, it lets you take advantage of everything that makes Mac 'Mac.'

It makes editing programs as easy as cutting and pasting and pointing and clicking. Debugging is easier

than ever with the advanced trace command.

It's no wonder Microsoft is the most logical choice for the Macintosh.



# MICROSOFT

**MICROSOFT**® We've  
The High Performance Software written more  
Macintosh programs than any other  
software company. Including Mac's  
spreadsheet, Multiplan.®

So if you want to get the most out of your Macintosh, call (800) 426-9400 for the name of your nearest Microsoft dealer. In Washington State, Alaska, Hawaii and Canada, call (206) 828-8088.

Microsoft and Multiplan are registered trademarks of Microsoft Corporation. Macintosh is a trademark licensed to Apple Computer, Inc.

# DeSmet C

8086/8088  
Development  
Package

**\$109**

## FULL DEVELOPMENT PACKAGE

- Full K&R C Compiler
- Assembler, Linker & Librarian
- Full-Screen Editor
- Execution Profiler
- Complete **STDIO** Library (>120 Func)

## Automatic DOS 1.X/2.X SUPPORT

## BOTH 8087 AND S/W FLOATING POINT OVERLAYS

## OUTSTANDING PERFORMANCE

- First and Second in AUG '83 BYTE benchmarks

## SYMBOLIC DEBUGGER **\$50**

- Examine & change variables by name using C expressions
- Flip between debug and display screen
- Display C source during execution
- Set multiple breakpoints by function or line number

## DOS LINK SUPPORT **\$35**

- Uses DOS .OBJ Format
- LINKs with DOS ASM
- Uses Lattice® naming conventions

Check:  Dev. Pkg (109)  
 Debugger (50)  
 DOS Link Supt. (35)

SHIP TO: \_\_\_\_\_

\_\_\_\_\_ ZIP \_\_\_\_\_

**CWARE**  
CORPORATION

P.O. BOX C  
Sunnyvale, CA 94087  
(408) 720-9696

All orders shipped UPS surface on IBM format disks. Shipping included in price. California residents add sales tax. Canada shipping add \$5, elsewhere add \$15. Checks must be on US Bank and in US Dollars. Call 9 a.m. - 1 p.m. to CHARGE by VISA/MC/AMEX.

## CHAOS MANOR

piled IBM PC BASIC) still won't run. Emulate doesn't seem to affect the operation of TI-specific programs, so I run it at boot-up.

"IUS's EasyWriter II is also supplied and runs, but I didn't experiment much with it.

"The major defect of all the supplied software is the same: none of it supports PC-DOS and MS-DOS pathnames. You can change drives but not directories."

## THE LAST ROUNDUP

"The TI Professional deserves better than it has gotten. A lot of people own and use it: enough that most MS-DOS software is first announced for the IBM, then quickly for the TI. The computer is well designed, well built, well documented, and well supported. It's a dream to maintain. Even in a world with IBM PC ATs, this computer competes well. Its speech equipment is more than just a gadget—though there's room for improvement. The keyboard has a nice touch.

"If you're in the market, it's worth a good look."

I've obviously had far less experience with the machine than Alex has, but I find nothing to disagree with. I'm also hoping that TI will get a machine up to Philippe Kahn at Borland so that he can get Sidekick running for it.

## WINDING UP

The game of the month is Victory Games' Gulf Strike, a simulation of action in the Persian Gulf. We have the Atari disk version. It's strategy rather than arcade, though you use the joystick to select, move, and attack. The computer sets up the dozens of pieces so you don't have to—a major complaint about board games. Gulf Strike is for two people or the computer will play one side.

I think I might become fond of Avalon-Hill's implementation of Diplomacy for computers (A-H and Victory Games are sister firms located in Baltimore and New York, respectively); but the game can be played *only* on a machine with color, and it needs a lot of memory. However, you can even play solitaire, and if there are

missing players, the computer can act for them. I've mixed emotions here; there was something satisfying about writing orders on little slips of paper and chunking them onto the board, and I don't get quite the same feeling from typing them in. Ah, well. If you don't have a gamesmaster, the A-H computerized version of Diplomacy can save a lot of quarrels.

There is no book of the month. What with everything else, I didn't read any computer books (other than my own).

Meanwhile, I'm piling up data for my big article on the future of BASIC (I'm beginning to believe it has a great future); starting my Modula-2 book; and encouraging Alex to work on an introductory-level Pascal book keyed to Borland's Turbo Pascal.

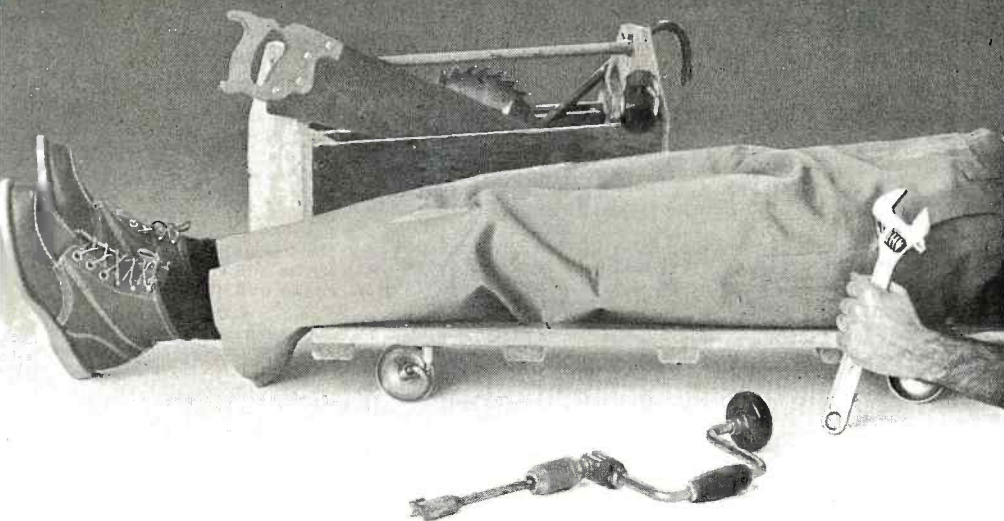
I'm also hoping to do some real work on my accounting program and minimum database, adding lots of help files and getting it running on the IBM PC. I'll be working with several BASIC dialects; doing practical programming like that is the best way to get a basis for comparison.

I have an interesting-looking program called Expert-Ease that claims to generate expert systems. I've much interest in expert systems. At the BYTE Show I was shown another such program, too, so when I get it I'll be able to compare them.

Also at the BYTE Show, Diversions Inc. gave me a special ribbon for my Macintosh Imagewriter printer. You make up any MacPaint image, then flip it left to right, You install this ribbon (it's called, appropriately, Under Ware) and insert a sheet of bond paper, print your MacPaint file, and out comes an iron-on suitable for transfer to a T-shirt. The possibilities stagger the imagination . . . ■

Jerry Pournelle welcomes readers' comments and opinions. Send a self-addressed, stamped envelope to Jerry Pournelle, do BYTE Publications, POB 372, Hancock, NH 03449. Please put your address on the letter as well as on the envelope. Due to the high volume of letters, Jerry cannot guarantee a personal reply.

# WE TURN YOUR PC INTO A GRAPHICS TERMINAL WITH VTERM/4010



The original VT100 terminal emulator for the IBM PC has something new under the hood: Tektronix 4010/4014 emulation. Now you can use one powerful, well-built software package for mainframe graphics, terminal emulation and file transfer.

VTERM/4010 gives you all of the features of VTERM II, plus Tektronix graphics. It can run mainframe graphics applications from SAS, ISSCO, Tektronix (PLOT 10), Precision Visuals, and many other similar packages. And VTERM/4010 will save pictures on disk, or draw them on Hewlett-Packard and IBM plotters.

But that's not all. As thousands of users know, the VTERM communications line comes standard with these exceptional features:

- Complete VT100, VT101 and VT102 emulation.
- Full throughput to 9600 baud.
- A highly reliable error-free file transfer with CRC checking, including complete host software for several host operating systems.

- XMODEM file transfer also supported.
- An ASCII file transfer system with a wide variety of options that allow exchanges with most host systems using only standard host utilities.
- Optional 132 column display using a special display adapter available from Coefficient.
- Autodialing, on line help, and a unique softkey command system that lets you automate many communications functions.
- Easy-to-use setup screens always accessible with a single keystroke.
- Multiple setup files.
- A "hot-key," that lets you switch instantly back and forth between DOS and VTERM without ever losing your terminal screen or communications link.

Get the picture? VTERM II gives you DEC terminal emulation, file transfer and lots more. VTERM/4010 gives you all that plus Tektronix graphics.

Call Coefficient or your local dealer today.

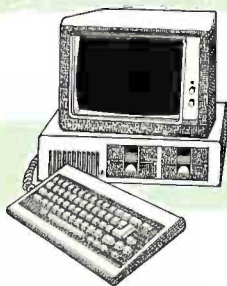
Coefficient Systems Corporation (212) 777-6707 611 Broadway, New York, N.Y. 10012

# IT ALL ADDS UP...

## IBM SYSTEMS

Starting as low as

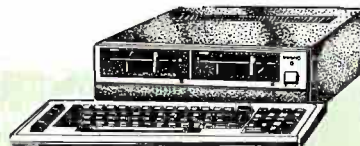
# \$1399



## ZENITH

data systems

## SANYO



### PC COMPATIBLES

| ZENITH                   | SANYO                   |
|--------------------------|-------------------------|
| PC-180 Desktop.....CALL  | MCB 850.....\$699.00    |
| PC-180 Portable.....CALL | MBC 85 0-2.....\$749.00 |
| <b>COLUMBIA</b>          |                         |
| Desktops.....CALL        | MBC 888.....\$949.00    |
| Portables.....CALL       | MBC 888-2.....\$1099.00 |

## APPLE

| APPLE IIe STARTER PACK                  | APPLE IIe.....CALL |
|-----------------------------------------|--------------------|
| 64K Apple IIe, Disk Drive & Controller, | APPLE IIc.....CALL |
| 80 Column Card, Monitor II & DOS 3.3    | MACINTOSH.....CALL |
| .....CALL                               |                    |

| NEC PRINTERS                           | LOTUS                                   |                                  |  |
|----------------------------------------|-----------------------------------------|----------------------------------|--|
| NEC 2050.....\$749.00                  | Symphony.....\$499.00                   |                                  |  |
| NEC 3550.....\$1449.00                 | 1-2-3.....\$319.00                      |                                  |  |
| NEC 8850.....\$1799.00                 |                                         |                                  |  |
| <b>HAYES</b>                           |                                         |                                  |  |
| <b>MAI</b>                             |                                         |                                  |  |
| 5 1/4" 320K Floppy.....\$189.00        | Please (Data Base).....\$269.00         |                                  |  |
| <b>VISICORP</b>                        |                                         |                                  |  |
| VisiCalc IV.....\$159.00               | General Ledger, Payroll, Inventory,     |                                  |  |
| VisiWord +.....\$249.00                | Accounts Payable/Receivable.....CALL    |                                  |  |
| Optical Mouse.....\$189.99             | WordStar Professional Pack.....\$299.00 |                                  |  |
| <b>IDEA Associates</b>                 |                                         |                                  |  |
| <b>MICROPRO</b>                        |                                         |                                  |  |
| 5MB to 45MB Hard drives with           | <b>MICROMIM</b>                         |                                  |  |
| removable Cartridge back up            | R:Base 4000.....\$279.00                |                                  |  |
| as low as.....\$1399.00                | <b>MULTIMATE INT.</b>                   |                                  |  |
| <b>AST RESEARCH</b>                    |                                         | Multi Mate.....\$289.00          |  |
| Six Pak Plus.....from.....\$249.00     | <b>MICROSTUF</b>                        |                                  |  |
| Combo Plus II.....from.....\$279.00    | Crosstalk.....\$105.00                  |                                  |  |
| Mega Plus.....from.....\$299.00        | <b>MICROSOFT</b>                        |                                  |  |
| I/O Plus.....from.....\$139.00         | MultiPlan.....\$139.00                  |                                  |  |
| <b>QUADRAM</b>                         |                                         | <b>ASHTON-TATE</b>               |  |
| New Quadboard...as low as.....\$249.00 | Framework.....\$399.00                  |                                  |  |
| Quadlink 64K.....\$479.00              | dBASE II.....upgrade.....\$149.00       |                                  |  |
| Quadboard II...as low as.....\$249.00  | dBASE II.....\$299.00                   |                                  |  |
| Quad 512 Plus...as low as.....\$259.00 | dBASE III.....\$399.00                  |                                  |  |
| Quadcolor I.....\$209.00               | Friday!.....\$179.00                    |                                  |  |
| Chronograph.....\$89.99                | <b>IUS</b>                              |                                  |  |
| Parallel Interface Board.....\$89.99   | EasyWriter II.....\$249.00              |                                  |  |
| 64K RAM Chips Kit.....\$49.99          | EasySpeller.....\$119.00                |                                  |  |
| <b>PARADISE</b>                        |                                         | EasyFiler.....\$229.00           |  |
| Multi-Display Card.....\$339.00        | <b>CONTINENTAL SOFTWARE</b>             |                                  |  |
| Modular Graphics Card.....\$319.00     | 1st Class Mail/Form Letter.....\$79.99  |                                  |  |
| <b>SPI</b>                             |                                         | Home Accounting Plus.....\$88.99 |  |
| Open Access.....\$339.00               | <b>PROFESSIONAL SOFTWARE</b>            |                                  |  |
| <b>HARVARD</b>                         |                                         | PC Plus/The Boss.....\$269.00    |  |
| Harvard Project Manager.....\$229.00   | <b>SYNAPSE</b>                          |                                  |  |
| <b>PFPS</b>                            |                                         | File Manager.....\$59.99         |  |
| <b>IBM/APPLE</b>                       |                                         | <b>FOX &amp; GELLER</b>          |  |
| Write.....\$89.99                      | dGraph.....\$139.00                     |                                  |  |
| Graph.....\$79.99                      | Quick Calc.....\$139.00                 |                                  |  |
| Report.....\$79.99                     | dUtil.....\$49.99                       |                                  |  |
| File.....\$89.99                       | Grafox.....\$139.00                     |                                  |  |
| Plan.....\$89.99                       | <b>ALPHA SOFTWARE</b>                   |                                  |  |
| <b>ELECTRONIC ARTS</b>                 |                                         | Electronic Desk.....\$229.00     |  |
| Get Organized.....\$139.00             | <b>BORLAND</b>                          |                                  |  |
|                                        | Turbo Pascal.....\$49.00                |                                  |  |

### MONITORS

| AMDEK                                    | SAKATA                             |                              |  |
|------------------------------------------|------------------------------------|------------------------------|--|
| 300 Green.....\$129.00                   | SC-100 Color.....\$249.00          |                              |  |
| 300 Amber.....\$149.00                   | SG-1000 Green.....\$129.00         |                              |  |
| 310 Amber IBM Plug.....\$169.00          | SA-1000 Amber.....\$139.00         |                              |  |
| Color 300/audio.....\$259.00             | <b>TAXAN</b>                       |                              |  |
| Color 500 Composite/RGB/VCR.....\$389.00 | 100 12" Green.....\$125.00         |                              |  |
| Color 600 Hires(640 x 240).....\$439.00  | 121 IBM Green.....\$149.00         |                              |  |
| Color 700 Hires(720 x 240).....\$499.00  | 100 12" Amber.....\$135.00         |                              |  |
| Color 710 Long Phosphor.....\$579.00     | 122 IBM Amber.....\$159.00         |                              |  |
| <b>BMC</b>                               |                                    | 210 Color RGB.....\$269.00   |  |
| 1201 Plus (12" Green Hi-Res).....\$89.99 | 400 Med-Res RGB.....\$319.00       |                              |  |
| 9191 Plus.....\$249.00                   | 415 Hi-Res RGB.....\$459.00        |                              |  |
| 9191U.....\$229.00                       | 420 Hi-Res RGB (IBM).....\$469.00  |                              |  |
| <b>GORILLA</b>                           |                                    | <b>USI</b>                   |  |
| 12" Green.....\$89.99                    | Pi 1, 9" Green.....\$99.99         |                              |  |
| 12" Amber.....\$89.99                    | Pi 2, 12" Green.....\$119.99       |                              |  |
| <b>NEC</b>                               |                                    | Pi 3, 12" Amber.....\$129.99 |  |
| JB 1206 Green.....\$109.00               | Pi 4, 9" Amber.....\$119.99        |                              |  |
| JB 1201 Green.....\$139.99               | 1400 Color.....\$249.99            |                              |  |
| JB 1205 Amber.....\$149.99               | <b>QUADRAM</b>                     |                              |  |
| JB 1215 Color.....\$259.00               | Quadchrome 8400 Color.....\$489.00 |                              |  |
| JC 1216 RGB.....\$399.00                 | <b>ZENITH</b>                      |                              |  |
| JC 1460 Color.....\$359.00               | ZVM 122 Amber.....\$89.99          |                              |  |
| <b>PRINCETON GRAPHICS</b>                |                                    | ZVM 123 Green.....\$84.99    |  |
| MAX-12 Amber.....\$199.00                | ZVM 124-IBM Amber.....\$149.00     |                              |  |
| HX-12 RGB.....\$489.00                   | ZVM 135-RGB/Color.....\$459.00     |                              |  |
| SR-12 RGB.....\$629.00                   |                                    |                              |  |

### MODEMS

| ANCHOR                                    | NOVATION                           |                           |
|-------------------------------------------|------------------------------------|---------------------------|
| Volkmodem.....\$59.99                     | J-Cat.....\$99.99                  |                           |
| Mark II Serial.....\$79.99                | Cat.....\$139.00                   |                           |
| Mark VII (Auto Ans/Auto Dial).....\$99.99 | Smart Cat 103.....\$179.00         |                           |
| Mark XII (1200 Baud).....\$259.99         | Smart Cat 103/212.....\$399.00     |                           |
| Mark TRS-80.....\$99.99                   | AutoCat.....\$219.00               |                           |
| 9 Volt Power Supply.....\$9.99            | 212 AutoCat.....\$549.00           |                           |
| <b>HAYES</b>                              |                                    | Apple Cat II.....\$249.00 |
| Smartmodem 300.....\$199.00               | 212 Apple Cat.....\$449.00         |                           |
| Smartmodem 1200.....\$489.00              | Apple Cat 212 Upgrade.....\$259.00 |                           |
| Smartmodem 1200B.....\$419.00             | Smart Cat Plus.....\$339.00        |                           |
| Micromodem IIe.....\$269.00               | <b>ZENITH</b>                      |                           |
| Micromodem 100.....\$299.00               | ZT-1.....\$339.00                  |                           |
| Smart Com II.....\$75.99                  | ZT-10.....\$309.00                 |                           |
| Chronograph.....\$199.00                  | ZT-11.....\$369.00                 |                           |

# COMPUTER MAIL ORDER

west

canada

east

**800-648-3311**  
In NV call (702)588-5654  
Order Status Number: 588-5654  
P.O.Box 6689, Dept. 100  
Statenline, NV 89449

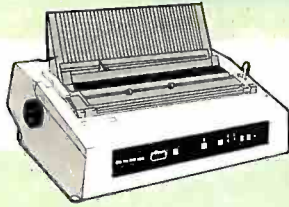
Ontario/Quebec **800-268-3974**  
Other Provinces **800-268-4559**  
In Toronto call (416) 828-0866  
Telex: 06-218960

2505 Dunwin Drive, Unit 3B, Dept. 100  
Mississauga, Ontario, Canada L5L1T1

**800-233-8950**  
In PA call (717)327-9575  
Order Status Number: 327-9576  
Customer Service Number: 327-1450  
477 E. 3rd St., Dept. 100, Williamsport, PA 17701

Open purchase orders accepted with net 30 days terms, subject to credit approval. Next day shipping on all stock items. No risk, no deposit on C.O.D. orders and no waiting period for certified checks or money orders. Add 3% (minimum \$5) shipping and handling on all orders. Larger shipments may require additional charges. NV and PA residents add sales tax. All items subject to availability and price change. Call today for our catalog.

# ...THE BEST PRICES



## HOME COMPUTERS



### PRINTERS

|                                |             |                                |           |
|--------------------------------|-------------|--------------------------------|-----------|
| <b>AXIOM</b>                   |             | <b>MANNESMAN TALLY</b>         |           |
| AT-100 Atari Interface Printer | \$199.00    | 160L.....                      | \$589.00  |
| AT-550 Atari Bidirectional     | \$259.00    | 180L.....                      | \$749.00  |
| GP-100 Parallel Interface      | \$189.00    | Spirit 80.....                 | \$259.00  |
| GP-700 Atari Color Printer     | \$489.00    | <b>NEC</b>                     |           |
| GP-550 Parallel Printer        | \$269.00    | 2010/18/30.....                | \$749.00  |
| <b>BMC</b>                     |             | 3510/15/30.....                | \$1369.00 |
| 401 Letter Quality             | \$589.00    | 7710/15/30.....                | \$1799.00 |
| BX-80 Dot Matrix               | \$239.00    | 8027.....                      | \$389.00  |
| BX-100 Dot Matrix              | \$259.00    | <b>OKIDATA</b>                 |           |
| <b>C.I.TOH</b>                 |             | 82, 83, 84, 92, 93, 2350, 2410 | CALL      |
| Gorilla Banana                 | \$149.00    | <b>OLYMPIA</b>                 |           |
| Prowriter 8510P                | \$339.00    | Compact 2.....                 | \$469.00  |
| Prowriter 1550P                | \$579.00    | Compact R.....                 | \$499.00  |
| A10 (18 cps) Son of Starwriter | \$569.00    | ESW 3000.....                  | \$1399.00 |
| Hot Dot Matrix.....            | CALL        | Needlepoint Dot Matrix.....    | \$329.00  |
| F10-40 Starwriter.....         | \$949.00    | <b>SMITH CORONA</b>            |           |
| F10-55 Printmaster.....        | \$1249.00   | TP-1000.....                   | \$449.00  |
| <b>COMREX</b>                  |             | Tractor Feed.....              | \$119.00  |
| ComWriterII Letter Quality     | \$449.00    | <b>SILVER REED</b>             |           |
| <b>DIABLO</b>                  |             | 500 Letter Quality.....        | \$379.00  |
| 620 Letter Quality.....        | \$749.00    | 550 Letter Quality.....        | \$469.00  |
| 630 API Letter Quality.....    | \$1549.00   | 770 Letter Quality.....        | \$869.00  |
| <b>DAISY WRITER</b>            |             | <b>STAR</b>                    |           |
| 2000.....                      | \$949.00    | Gemini 10X.....                | \$259.00  |
| <b>EPSON</b>                   |             | Gemini 15X.....                | \$379.00  |
| RX-80, RX-80FT, RX-100.....    | CALL        | Radix 10.....                  | \$549.00  |
| FX-80, FX-100.....             | NEW CALL    | Radix 15.....                  | \$649.00  |
| LQ 1500.....                   | LOW CALL    | Powertype.....                 | \$329.00  |
| JX-80 Color.....               | PRICES CALL | <b>TOSHIBA</b>                 |           |
| <b>JUKI</b>                    |             | 1340.....                      | \$799.00  |
| 6100.....                      | \$469.00    | 1351.....                      | \$1369.00 |

## CALL WHILE SUPPLIES LAST 600XL, 800XL, 1200XL

|                                  |          |                                   |          |
|----------------------------------|----------|-----------------------------------|----------|
| 850 Interface.....               | \$109.00 | CX30Paddles.....                  | \$11.99  |
| 1010 Recorder.....               | \$54.99  | CX40 Joystick.....                | \$7.99   |
| 1020 Color Printer.....          | \$79.99  | 4011 Star Raiders.....            | \$12.99  |
| 1025 Dot Matrix Printer.....     | \$199.99 | 4022 Pac Man.....                 | \$16.99  |
| 1027 Letter Quality Printer..... | \$269.99 | 4025 Defender.....                | \$32.99  |
| 1030 Direct Connect Modem.....   | \$59.99  | 8026 Dig Dug.....                 | \$32.99  |
| 1050 Disk Drive.....             | \$229.99 | 8031 Donkey Kong.....             | \$32.99  |
|                                  |          | 8034 Pole Position.....           | \$32.99  |
|                                  |          | 8040 Donkey Kong Jr.....          | \$32.99  |
|                                  |          | 8043 Ms Pacman.....               | \$32.99  |
|                                  |          | 8044 Joust.....                   | \$32.99  |
|                                  |          | 8045 Pengo.....                   | \$16.99  |
|                                  |          | 8052 Moon Patrol.....             | \$32.99  |
|                                  |          | 4003 Assembler.....               | \$54.99  |
|                                  |          | 8126 Microsoft Basic I or II..... | \$64.99  |
|                                  |          | 488 Communicator II.....          | \$119.99 |
|                                  |          |                                   |          |
| <b>MEMORY BOARDS</b>             |          | <b>DISK DRIVES</b>                |          |
| Axlon 32K.....                   | \$44.99  | Indus GT Drive.....               | \$279.00 |
| Axlon 48K.....                   | \$69.99  | Rana 1000.....                    | \$299.00 |
| Axlon 128K.....                  | \$269.99 | Trak AT-D2.....                   | \$389.00 |
| Microbits 64K (600).....         | \$109.00 | Trak AT-D4.....                   | \$539.00 |
|                                  |          |                                   |          |
| <b>SWP</b>                       |          | <b>MODEMS</b>                     |          |
| ATR-8000-16K Z80 CP/M.....       | \$379.00 | Micro Bits MB-1100.....           | \$129.99 |
| ATR-8000-64K Z80 CF/M.....       | \$499.00 | <b>INTERFACES</b>                 |          |
|                                  |          |                                   |          |
| <b>BITS</b>                      |          |                                   |          |
| Full View 80.....                | \$239.00 |                                   |          |

### INTERFACES

|                              |          |                             |          |
|------------------------------|----------|-----------------------------|----------|
| <b>PRACTICAL PERIPHERALS</b> |          | <b>ORANGE MICRO</b>         |          |
| Graphcard.....               | \$84.99  | Grappler CD (C64).....      | \$99.00  |
| Serial Card.....             | \$109.00 | Grappler + (Apple).....     | \$119.00 |
| Microbuffer II+.....         | \$179.00 | Grappler 16K + (Apple)..... | \$189.00 |
| Microbuffer 32K.....         | \$199.00 |                             |          |

We carry interfaces and cables for most computers on the market today. Call to determine your requirements.



|                                |           |                                  |                 |
|--------------------------------|-----------|----------------------------------|-----------------|
| CBM 8032.....                  | \$639.00  | 8X-64 Portable.....              | \$799.00        |
| CBM 8096.....                  | \$869.00  | <b>CBM 64.....</b>               | <b>\$199.00</b> |
| CBM 9000.....                  | \$999.00  | C1541 Disk Drive.....            | \$249.00        |
| B128-80.....                   | \$769.00  | C1530 Datasette.....             | \$69.99         |
| 8032 to 9000 Upgrade.....      | \$499.00  | C1520 Color Printer/Plotter..... | \$129.00        |
| 2031 LP Disk Drive.....        | \$299.00  | M-801 Dot Matrix Printer.....    | \$219.00        |
| 8050 Disk Drive.....           | \$999.00  | C1526 Dot Matrix/Serial.....     | \$299.00        |
| 8250 Disk Drive.....           | \$1249.00 | C1702 Color Monitor.....         | \$259.00        |
| 4023 Printer.....              | \$329.00  | C1600 VIC Modem.....             | \$59.99         |
| 8023 Printer.....              | \$589.00  | C1650 Auto Modem.....            | \$89.99         |
| 6400 Printer.....              | \$1449.00 | Simons Basic.....                | \$29.99         |
| Z-RAM.....                     | \$369.00  | MCS 801 Color Printer.....       | \$499.00        |
| Silicon Office.....            | \$499.00  | DPS 1101 Daisy Printer.....      | \$459.00        |
| The Manager.....               | \$199.00  | <b>PPS</b>                       |                 |
| VisiCalc.....                  | \$159.00  | File (64).....                   | \$59.99         |
|                                |           | <b>PRECISION SOFTWARE</b>        |                 |
| <b>BATTERIES INCLUDED</b>      |           |                                  |                 |
| PaperClip w/Spell Pack.....    | \$84.99   | <b>PROFESSIONAL SOFTWARE</b>     |                 |
| The Consultant DBMS.....       | \$69.99   | Word Pro 2 Plus.....             | \$159.00        |
| Bus Card II.....               | \$149.00  | Word Pro 3 Plus.....             | \$189.00        |
| 80 Col Display.....            | \$149.00  | Word Pro 4 Plus/5 Plus each..... | \$239.00        |
| <b>DISK DRIVES</b>             |           | Info Pro.....                    | \$179.00        |
| MSD SD1.....                   | \$349.00  | Administrator.....               | \$399.00        |
| MSD SD2.....                   | \$599.00  | Power.....                       | \$69.99         |
| Indus GT.....                  | \$289.00  | Word Pro 64 Plus.....            | \$59.99         |
| <b>PERSONAL PERIPHERALS</b>    |           |                                  |                 |
| Super Sketch Graphics Pad..... | \$39.99   |                                  |                 |



|                               |          |
|-------------------------------|----------|
| 41CV.....                     | \$189.99 |
| 41CX.....                     | \$249.99 |
| HP 71B.....                   | \$419.99 |
| HP 11C.....                   | \$62.99  |
| HP 12C.....                   | \$92.99  |
| HP 15C.....                   | \$92.99  |
| HP 16C.....                   | \$92.99  |
| HP 75D.....                   | \$999.99 |
| HPIL Module.....              | \$98.99  |
| HPIL Cassette or Printer..... | \$359.99 |
| Card Reader.....              | \$143.99 |
| Extended Function Module..... | \$63.99  |
| Time Module.....              | \$63.99  |

We stock the full line of HP calculator products

|                                    |          |
|------------------------------------|----------|
| <b>NEC</b>                         |          |
| PC-8201 Portable Computer          | \$439.00 |
| PC-8231 Disk Drive.....            | \$619.00 |
| PC-8221A Thermal Printers.....     | \$149.00 |
| PC-8281A Data Recorder.....        | \$99.99  |
| PC-8201-06 8K RAM Chips.....       | \$105.00 |
| PC-8206A 32K RAM Cartridge.....    | \$329.00 |
| <b>SHARP</b>                       |          |
| PC-1380.....                       | \$189.99 |
| PC-1261.....                       | \$189.99 |
| PC-1260.....                       | \$109.99 |
| PC-1800A.....                      | \$168.99 |
| PC-1280A.....                      | \$88.99  |
| CE-125 Printer/Cassette.....       | \$128.99 |
| CE-150 Color Printer Cassette..... | \$171.99 |
| CE-151 4K RAM.....                 | \$29.99  |
| CE-155 8K RAM.....                 | \$49.99  |
| CE-161 16K RAM.....                | \$134.99 |
| CE-600 ROM Library ea.....         | \$29.99  |

### KOALA

|                  |         |                     |         |
|------------------|---------|---------------------|---------|
| Atari (ROM)..... | \$79.99 | IBM.....            | \$99.99 |
| C-64.....        | \$79.99 | Apple/Franklin..... | \$85.99 |

# COMPUTER MAIL ORDER

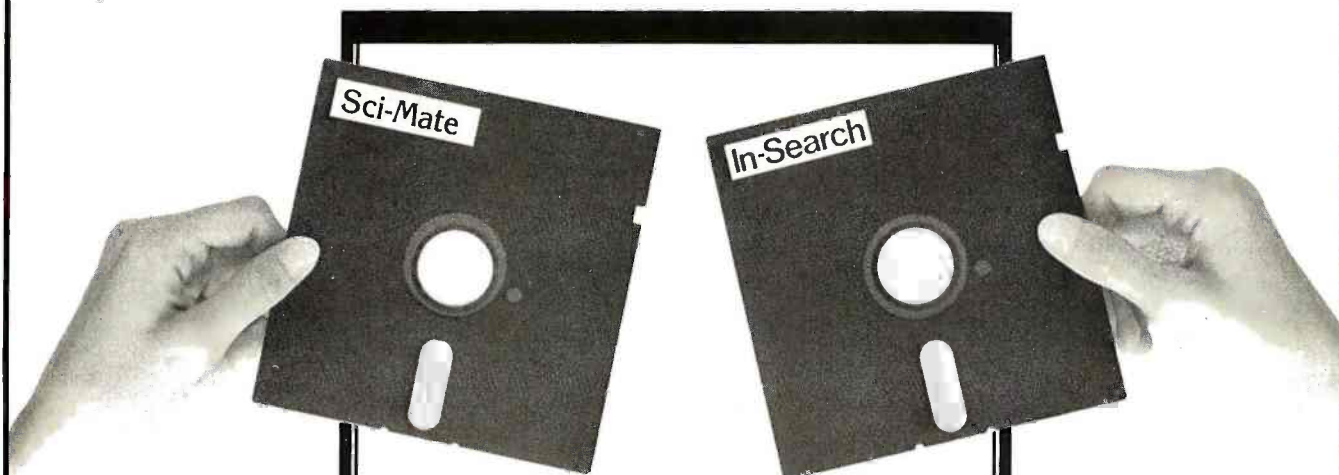
**west**  
**800-648-3311**  
 In NV call (702)588-5654  
 Order Status Number: 588-5654  
 P.O.Box 6689, **Dept.100**  
 Stateline, NV 89449

**canada**  
**Ontario/Quebec 800-268-3974**  
**Other Provinces 800-268-4559**  
 In Toronto call (416) 828-0866  
 Telex: 06-218960  
 2505 Dunwin Drive, Unit 3B, **Dept.100**  
 Mississauga, Ontario, Canada L5L1T1

**east**  
**800-233-8950**  
 In PA call (717)327-9575  
 Order Status Number: 327-9576  
 Customer Service Number: 327-1450  
 477E 3rd St., **Dept.100**, Williamsport, PA 17701

CANADIAN ORDERS: All prices are subject to shipping, tax and currency fluctuations. Call for exact pricing in Canada. INTERNATIONAL ORDERS: All orders placed with U.S. offices for delivery outside the Continental United States must be pre-paid by certified check only. Include 3% (minimum \$5) shipping and handling. EDUCATIONAL DISCOUNTS: Additional discounts are available to qualified Educational Institutions. APO & FPO: Add 3% (minimum \$5) shipping and handling.

# Sci-Mate™ Out-Searches In-Search™



ISI®'s Sci-Mate Searcher enables you to access *any* system in *up to 3* search modes. In-Search enables you to access *one* host system in *one* search mode.

If you need help with Sci-Mate, *the call is on us*. If you need help with In-Search, *you pay for the call*.

For details on Sci-Mate and information on ordering a demo disk, call us toll-free at 800-523-4092 (in Pennsylvania, call collect 215-386-0100, ext. 1418).

Then *you* decide which software out-searches which.

*The Sci-Mate Searcher . . . for powerful, flexible, and easy access to online databases.*

isi®

Institute for Scientific Information®  
Sci-Mate Customer Services

3501 Market Street, Philadelphia, PA 19104 U.S.A., Telephone: 800-523-4092, Cable: SCINFO, Telex: 84-5305  
European Office: 132 High Street, Uxbridge, Middlesex UB8 1DP, United Kingdom, Phone: 44-895-70016, Telex: 933693 UK ISI

©1984 ISI 283-3557

## DEFINITE DISAGREEMENTS

Dear Jerry,

The bias you've shown lately (perhaps always) against so-called "user-friendly computers and computer interfaces" seems to have at bottom an intense desire for all present personal computers to have an almost Marxist efficiency and no room for creativity. Being one of the elite reviewers with unlimited access to freebies, I guess you can afford to support any expensive computer (especially if it runs Pascal or UNIX). But do be honest: who pays for all this stuff you review and seem to have an endless affair with? The people with the big bucks, of course!

Have you taken a look lately at who buys the fancy equipment you so eagerly espouse (especially when CompuPro or Sage bend over backward to make sure your demos are always up to snuff and hang the cost in office visits)? Surely you don't think most people with incomes under \$20,000 can afford the cream of the crop or would want to buy it for what? Small business, you say, is where it's at. Well, if business is the only useful purpose for a personal computer, then I wouldn't have it. Workaholics can have all the multi-user business computers they want. They won't find happiness in a personal computer. UNIX on a micro, even at 10 MHz and with a 20-megabyte hard disk, is painfully slow and klutzy at word-processing and accounting programs when accessed simultaneously by several users.

Obviously, you have no use for innovators such as Apple or Osborne. Their systems have the clear stigma of being popular computers, alas. Bugs are easy to spot in new systems under \$3000. If only more people could afford a classy AT&T computer, but then again AT&T isn't making another Lisa. (This is debatable, as the starting price of Lisa I was \$10,000, and the available software was about the same then—not very much.) For about a third of what an AT&T development system costs, a Lisa 2/10 can run UNIX and a host of other software, including MacWorks.

I would be careful about referring to dedicated Macintosh users as Mactribesmen or other Macnasties. They might decide you were unfunny and quite bor-

ing (as the genre goes—enough is enough). A sage such as Pournelle should stick to sci-fi writing instead of out-of-date computer reviews.

There is enough merit to MBASIC to resist the likes of any BASIC hater as yourself. BASIC may not be structured like Pascal, but it's a lot less tiring to look at than "PROCEDURE, BEGIN, END;" ad nauseam. An English-like language would be better than BASIC, but so far natural languages have shown no popularity and ergo no large users group has evolved. FORTH is still a lot harder to master than BASIC.

Perhaps you would care to elaborate on MBASIC's bugs, if any exist in the Macintosh version. I haven't seen any, short of a few omissions from the version Radio Shack uses. MSX BASIC, as used by David Ahl, runs exactly as shown in recent issues of *Creative Computing*, when converted to Mac's MBASIC. The only difference is one of scaling. The high resolution of the Mac screen must be mapped to take advantage of BASIC's graphics commands.

It is going to take a lot more ingenuity to discover truly useful tasks for a personal computer to accomplish to be an actual friend and not an expensive sideline or sounding board. Bellyache as you will about present deficiencies, the real challenge is still *magic*. If you can do something you only dreamed about on past computers, the Mac dream will have become worth the song. Print this as it is if you dare.

TERRY W. GINTZ  
Berkeley, CA

*Like, wow, man, whose column have you been reading? Surely not mine.*

*I have never had an "office visit" from Sage, which, incidentally, is a company started literally in a garage by Rod Coleman and a couple of friends on a shoestring; it's hardly "big business." As to Tony Pietsch's visits: eight years ago I borrowed \$12,000 in order to get enough to have Tony, then a graduate student, build Ezekial, my friend who happened to be a Z80 computer.*

*Perpetual maintenance wasn't in the contract, but Tony takes pride in his work and likes to see his creations run; one*

*reason why he doesn't install computers any longer. Now he comes here mostly out of friendship; certainly not for any big bucks.*

*2. I have never advocated multiuser systems. Pournelle's rule is "One user, at least one processor." That's one reason I like the CompuPro 10: it has five processor chips for four users, and each user has his own block of memory. I thoroughly agree that the multiuser UNIX systems I've had access to have been too slow for me to write with.*

*3. I wrote one of the first favorable reviews of the Osborne. Well before the machine came out I did an unpublished critique of the Osborne I for Dr. Osborne. I believe Adam greatly and beneficially changed this field. Incidentally, the Osborne I cost more, in constant dollars, than the Sage II costs now; and Osborne Computer Company had far more financing and was much larger than Sage.*

*4. Alas, a usable Macintosh is not a system for under \$3000. Anyway, I've said enough on that subject. I like innovations; but am I not obligated to tell the truth as I see it?*

*5. I am sure some people find my writing dull. Fortunately, most don't. And if I don't get my novel done pretty quick, you'll get your wish: my publishers will insist that I stick to science fiction (most SF writers do not much care for the cutesy sci-fi label).*

*6. You must surely be the only person in the universe who believes me a "BASIC hater." I've been enough through that war. Certainly "FORTH is still a lot harder to master than BASIC"; who ever doubted it? FORTH enthusiasts say it's worth the extra effort. They may be right; alas, I've never taken the time to master FORTH.*

*7. The version of Microsoft BASIC we had is not the version you get now; and the new 2.0 Microsoft BASIC for the Mac has lots of nifty new features.*

*8. I believe that most programs in future will be written by users, just as most books are written by readers. A professional writer is someone who can make a living at writing—and writing is*

(continued)

definitely not a full-time occupation. I believe that will soon be true of programming. When the user can think of something to make the machine do, and cause the machine to do it, we'll start getting the programs you want.

9. "Dare"? I don't know if the editorial people in New Hampshire will print your letter or not, but if not, it won't be from fear of you by either them or me. Contentious letters that generate long replies don't often get published simply on grounds of space; and you are so thoroughly misinformed about me that I wonder if you have read anything other than a few random paragraphs from a single column. Stay well.—Jerry

### NOT A TOY

Dear Jerry,

Before I get to the fire and sword, I have to say that an open, say-it-the-way-you-feel-it article makes a terrific escape from BYTE's usual earthy technical submissions. Your column is the best there is for opinion.

I just hate it when circumstance makes you look foolish. I have no doubt that your July Macintosh attack would have been toned down if you had written about it in July. The Mag Lag between submission and print date must be at least three months. As an example, I was shocked to find out from you that Microsoft was pulling Macintosh Multiplan out of distribution. Only later did I realize that you were talking about the conversion from version 1.1 to 1.2. Your single disk-copy-swapping problem has been eliminated from two fronts. There is now a utility to copy an entire disk in only four swaps, and the Finder's standard copying capabilities have been sped up tremendously. Mag Lag might not be a problem if technology were not changing monthly. How about dating your column each time you write it?

I should say that I was pleased to note that you are more fond of Macintosh than you might realize yourself. After reading your scathing review, I suddenly noticed in your other columns what computers you were comparing Mac to. You say that the \$15,000 Lilit has better graphics. Well, I should hope so, and the same goes for AT&T's \$10,000 (bare-bones) 3B2/300. You even made mention of a Japanese color-drawing program similar to MacPaint. Why all the comparisons if you don't regard Mac as a serious machine?

I think the descriptor I hated the most was "toy." Your definition of toy must be incredible praise, but most regard it as an

insult. You say that Mac was fun to play with, but it was slow and that there is no software for it. I have to admit that disk access is terribly slow, but the 512K-byte upgrade (which your column ignored) will let it be a real computer. The "lack of software" problem is more of a "wait for software" problem. What exists now and what's coming are fantastic! Toy is only appropriate in the sense that Macintosh is fun! You undoubtedly enjoy your computers, but you have never called even your earliest 8080 computer a toy. I have seen a 6-year-old girl go to town on MacPaint, and her technophobic mother fell in love with MacWrite, and they had never seen a computer before. Now that hackers can find all the crazy computer designs they could ever want, real live human beings can get their benefit from computer technology.

I'll stick up for my Mac because you're too far away in the past to hear it talk. With an effective 6-MHz clocked 68000 and optimized ROMs, Macintosh is a tough cookie to beat. Lots of available software is not a matter of "maybe" but "when." Macintosh may be a slow starter, but it has what no small computer that exists today has: potential. In that respect, Macintosh is just about to break the ribbon.

KEITH NEMITZ  
Flagstaff, AZ

*Well, there is a matter of cost-effectiveness here. A full-up Mac with a second drive and the 512K-byte memory upgrade is not going to be cheap; indeed, I think you can buy a Sage II with the TPI color-graphics board and the Modula-2 operating system (complete with mouse) for about the same price. Of course, the Sage with Modula-2 won't have so very much software when it first comes out; but given Modula-2, that certainly will be a matter of "when," not "if."*

*I wish Apple and the Macintosh well, and if you've detected in my columns a willingness—yea, even a desire—to be fond of it, you're right. I just wish the implementation were up to the expectations.—Jerry*

### MACPRAISE

Dear Jerry,

In your July column, you miss what I consider essential about the Mac: good-bye commands and syntax; hello icons!

I can understand that you were impressed by AT&T's display, but after getting acquainted with the Mac's presentation of what computing should be like, I

hope to never have to go back to an operating system, no matter how full of utilities and packages, where the burden is on me to remember what to say at the appropriate moment and how. In this respect, I think UNIX is particularly weak: for all its power and its bright ingredients, it is a messy system, with more than 400 commands with cryptic names like "troff" instead of "print," directories inside directories, complex punctuation in command lines, and redundancy of function.

With nothing but Apple's introductory software and a single disk drive, my roommate and I have been using our Macintosh not as a toy but as a workhorse, for everything that used to be done on a typewriter: homework, term papers, a journal article—even a set design, using MacPaint! In fact, the prime application I have in mind for it is to write my doctoral dissertation in biomathematics (no consortium deal: list price!), and even though the final document will run into at least a couple of hundred pages, I foresee no problem in editing and printing the whole thing: I wouldn't write it in a single block no matter how much memory I had.

None of this requires "yet another" compiler-compiler, line-oriented editor, or what have you. If I were given a system with half a dozen text editors, like UNIX, I would try them all and end up using one, so why should I pay for the redundancy? My hunch is that UNIX will prove difficult to sell to the office and the individual. It would have been great a year or two ago, but it came out too late.

FRANCISCO JOSÉ OYARZUN  
Los Angeles, CA

*You're certainly not alone in your views of UNIX. On the other hand, real UNIX has some wonderful utilities, like sorting, indexing, and table of contents generators, hidden in among all the cryptic yacc and yaloe nonsense.*

*On Mondays and Wednesdays I think UNIX will sweep the world. On Tuesdays and Thursdays I agree with you. It's midnight Monday just at the moment . . . —Jerry*

### PROPRIETARY OPERATING SYSTEMS

Dear Jerry,

I have written an entire database system for the local Chamber of Commerce, but it is, alas, in Pascal. The reason: the machine they bought was the luxurious Corvus Concept. As you know, it is an

(continued)



# CONDOR

## Data Management Software

Condor's  
IBM™ PC -  
compatible  
**Relational Data-  
base Management**

is the effective way to manage your office automation needs, such as personnel management, inventory control, billing, manufacturing systems, educational, and other office, school or home needs.

With Condor you get the power and flexibility of a fully relational database system complete with a "Step-by-Step" MENU system to guide the new user. On-line help is integrated into the Menu system. A complete REPORT WRITER is also included, that even the newcomers in our field recommend.

With Condor, setting up a new database of information, is as simple as typing on a blank sheet of paper . . . typically, it takes a minute, maybe two. You are then ready to enter your data into the database you just created, again just like typing on a sheet of paper.

Then, you can SORT, SELECT, COMPUTE, POST, or PRINT your information in almost any way that you desire. Plus, you can easily pass information from Condor to your word processor's mail-merge, or pass spreadsheet information into Condor. It's all very easy, and also very English.

Begin with Condor jr. (\$195), the advanced file manager. Upgrade later as your business and your data grow, to Condor3 (\$650-or less the \$195 if you bought Condor jr.), the fully relational data management system. It's the same system that hardware manufacturers like DEC, Sony, Zenith, and Hewlett-Packard have selected to market with their personal computers. There are well over 100,000 satisfied users. To find out how condor data management software can make your business easy to handle, see your personal computer dealer, or call 1-800-221-8479 (In Michigan call 0-313-769-3992 collect) for your nearest dealer. He'll prove our point. That Condor is the data management software powerful enough to be useful to business, yet simple enough for business to use.

IBM is the registered trademark of International Business Machines Corp.

 **condor**

2051 South State Street Ann Arbor, MI 48104 313-769-3988

Circle 92 on inquiry card.

# Own your own computer supply business.

## DISK WORLD! will show you how.

You probably know who DISK WORLD! is: our ads are scattered throughout this and every other major computer magazine.

We're one of the largest computer supply marketers in the country.

### And we want you!

But, no matter how much we advertise, we still can't reach every computer user...but you can.

We're looking for people who want to run their own part- or full-time computer supply business.

### You'll have our help.

You won't be alone.

You'll have the accumulated experience, buying power and merchandising skills of DISK WORLD! working with you. (And, if you don't think that's important, just remember this: eighteen months ago DISK WORLD! didn't exist...and now we're one of the largest distributors in the nation.)

### \$24.95 gets you started.

We'll send you a complete business plan that tells you everything you need to know.

It'll cost you \$24.95 + \$3.00 shipping.

But it's risk-free. Read it for fifteen (15) days and if you decide this isn't for you, send it back. We'll refund your money.

If it is for you, you'll know what to do next.

### DISK WORLD!

Suite 4806  
30 East Huron Street  
Chicago, Illinois 60611

YES, I'm interested in the details of the DISK WORLD! independent resellers program. Please send me my manual.

I understand that if I don't like it, I can return it within 15 days for a full refund.

My check or money order for \$27.95 is enclosed.

Charge my VISA or MASTERCARD # \_\_\_\_\_

Exp. \_\_\_\_/\_\_\_\_.

Signature: \_\_\_\_\_

PLEASE PRINT LEGIBLY!

Name: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

Phone: (\_\_\_\_) \_\_\_\_\_ - \_\_\_\_\_

## CHAOS MANOR MAIL

elegant machine but not well supported by outside software. I found that all the database systems that were installed under its proprietary operating system were severely lacking in the facilities that I need to develop my system. I realized that despite its many shortcomings and bugs, I had been spoiled by dBASE II and expected other systems to offer the same facilities. I wouldn't settle for less for my client, so I went to a high-level, standard language.

The dangers of proprietary operating systems—yes, they fit the machine and make it shine, but there's not enough competition to inspire really good software. After all, it is this competition for the mass market that made micros succeed despite their price/performance ratio being less than mainframes. I don't care how good that ratio is, if the machine can't be made to do exactly what the user wants without hiring a staff of programmers, the one with the software wins.

BEN SMITH  
Smith Design  
POB 80582  
Fairbanks, AK 99708

*My father once owned radio station KFRB in Fairbanks, but I've been there only once; it was cold with lots of snow.*

*Proprietary operating systems can help improve the breed, but companies that go that route often regret it. I can't help thinking that the Corvus would be a much more popular machine if it ran CP/M-68000. It sure is pretty.*

*Is your database likely to be for sale? I should imagine other Corvus owners would be interested.—Jerry*

### APPLE STRATEGY

Dear Jerry,

I am writing in regard to your comments in recent months concerning the Macintosh. The recent change in the title of your column is, perhaps, symbolic of changes in the microcomputer industry. You are no longer a typical "user" but in fact an expert by today's standards. This change is also typified by the Macintosh. It is aimed at people who don't have the background that the industry has taken for granted in the past, a background shared by you and me. This means that everyone can use computers to some extent, but it also means that machines will not in the future be pushed to the limits of what the physical hardware can do. The usefulness of this machine to us "expert users" will not be negligible in the case of the success of

Apple's gamble. However, its usefulness to the "real users" is not going to be vastly improved by that success either.

I can't say that I agree or disagree with your comments overall. Perhaps I could best say that I agree with your analysis but disagree with your opinions. I think Apple is, indeed, trying to put together a success story by the method of self-fulfilling prophecy. I agree that it is a skillful advertising technique that has allowed Apple to market a machine that is for all present intents and purposes useless to sophisticated users. However, I don't necessarily think that, as you implied, this is a bad thing.

While somewhat unfair to initial customers, especially somewhat sophisticated ones, the cart-before-the-horse technique is a calculated gamble that, if successful, will put equipment and software in the hands of the public that not only could not have been purchased for the price otherwise but wouldn't have been available at all. The important point is not whether Macintosh owners are getting their money's worth. Rather, it is a question of whether they will get their money's worth.

If Apple wins this gamble on the Macintosh's success, then there presumably is no problem. While I don't feel that ends justify means, it seems that the means are justified in this case by the fact that nobody can really lose (except Apple, and that is somewhat unlikely). Certainly it seems at this fairly early point that the Mac will in fact take off, in which case owners of the machine are way ahead. And if not, they still have a machine that will be useful for the purposes for which they purchased it (read: MacWrite and MacPaint).

LOWELL GILBERT  
Troy, NY

*I find little to disagree with. I, too, want the Macintosh to succeed.*

*On the other hand: given the price and the limits, what we have is a machine that is easy to learn and not so easy to use. Perhaps the naive user will not know this and thus be satisfied. I rather hope so. What I fear, though, is that after a few weeks the Macintosh owner will regret buying a computer, so that the whole computer movement is set back.*

*All this will be moot if we get programs—and in particular, languages—for the Mac in the near future. The languages are not for "the rest of us," but so that semipro hackers, like me, can quickly turn out software for the machine. I know*

## CHAOS MANOR MAIL

you're supposed to be able to use a Lisa to write for the Mac, but I greatly prefer to develop software on the machine it's intended for.

I'm told that Philippe Kahn has decided to do Turbo Pascal for the Mac. I sure hope so; that will do wonders for the little beast. Meanwhile, I write letters, complete with fried egg, with mine; but I find the CompuPro and the IBM PC more useful for day-to-day work.

Incidentally: I don't think I'm an expert at all. I still use these machines. One thing I use them for is to write programs. I find programming easier—but more tedious—than writing books, and as programming languages get more powerful, programming gets easier. That's not expertise, just experience.—Jerry ■

### USERS GROUP CORNER

I have newsletters from

PC/BLUE USER'S GROUP  
AMATEUR COMPUTER CLUB  
OF NEW YORK

POB 106 Church Street Station  
New York, NY 10008

They have 60 volumes of PC public-domain software.

COMPUPRO USER'S GROUP  
POB 2146

Woodbridge, VA 22193  
Lots of dialogue on BIOS questions, including the new HMX BIOS.

FIRST ATTACHE USER GROUP (FAUG)  
1827 Haight St., Rm. 16  
San Francisco, CA 94117-2791

Much ado about using the Attache.

MORROW OWNER'S REVIEW  
POB 5487

Berkeley, CA 94705  
Actually published by Morrow, but contents are like a users group bulletin.

CB NEWS  
SOFTWARE MAGIC  
3823 Ocean View Blvd., Suite 401  
Montrose, CA 91020

Actually a newsletter for CB-80 users; independent of Digital Research. Highly recommended for anyone using Compiling CBASIC.

# WAREHOUSE

## DATA PRODUCTS

(Formerly Warehouse Software)

Call for programs not listed

Technical & Other Information (602) 246-2222

TOLL-FREE ORDER LINE 1-(800) 421-3135

### Seasons Greetings

In appreciation for a successful year we are giving a program diskette for the IBM PC to all our customers who make a purchase of \$100 or more. There are programs to print labels, balance your checkbook, select printer type fonts, do loan depreciation plus 50 others.

#### DATA BASE MANAGEMENT SYSTEMS

|                          |       |
|--------------------------|-------|
| Fox and Geller Quickcode | \$145 |
| Knowledgeman             | \$265 |
| Condor III               | \$315 |
| NWA Statpak              | \$285 |
| Tim IV                   | \$249 |
| Infostar                 | \$249 |
| FRIDAY                   | \$159 |
| Personal Pearl           | \$215 |
| PFS File                 | \$79  |
| RBase 4000               | \$265 |
| CLOUT                    | \$114 |

#### WORD PROCESSING

|                                                           |       |
|-----------------------------------------------------------|-------|
| Wordstar, Mail Merge, Correct Star, Star Index for IBM PC | \$259 |
| Wordstar for IBM PC                                       | \$185 |
| Leading Edge Word Processor with Merge                    | \$85  |
| Mail Merge or Correct Star                                | Call  |
| Microsoft Word With Mouse                                 | \$284 |
| Word Perfect                                              | \$225 |
| Volkswriter for the IBM PC                                | \$110 |
| Volkswriter DeLuxe                                        | \$154 |
| Random House Spell Checker                                | \$36  |
| PFS Write                                                 | \$78  |
| Multimate                                                 | \$235 |
| Peachtext 5000                                            | \$185 |

#### SPREADSHEETS

|                     |       |
|---------------------|-------|
| Calcstar            | \$99  |
| Supercalc II        | \$145 |
| Supercalc III       | \$160 |
| Microsoft Multiplan | \$119 |
| !TK Solver          | \$259 |
| Lotus 123           | \$294 |
| Symphony            | \$415 |

#### ACCOUNTING

TCS, equivalent of Peachtree - Specially augmented by Warehouse Software. Customized for your IBM PC Terminal and Printer - GL, AR, PA, AP, CP/M-80, CP/M-86 for PC XT, DOS 1.1, 2.0. Each Module . . . \$65 - For All Four \$249

|                              |       |
|------------------------------|-------|
| CYMA                         | Call  |
| Dollars & Sense              | \$95  |
| MBSI Accounting (Real World) | \$350 |

#### TRANSFER PROGRAMS

|                      |      |
|----------------------|------|
| Hayes Smartcom       | \$85 |
| Move-it              | \$70 |
| Microstuff Crosstalk | \$95 |

#### BEST PRICE IN U.S. FOR IBM PC OR CLONES

Multifunction Board - Includes Async Adapter, Parallel Adapter, Clock with battery back-up and Software, 64K memory expandable to 384K. 1 year warranty \$239

#### LANGUAGES

|                             |       |
|-----------------------------|-------|
| Lifeboat Lattice C Compiler | \$295 |
| Microsoft C Compiler        | \$315 |
| Microsoft Pascal Compiler   | \$215 |
| Microsoft Basic Compiler    | \$235 |
| Microsoft Basic Language    | \$225 |
| CP/M-86 for IBM PC          | \$37  |
| Concurrent CP/M 86          | \$160 |

#### FOR PC DOS

|                            |       |
|----------------------------|-------|
| PC Paint                   | \$105 |
| Norton Utilities           | \$48  |
| Copy II PC                 | \$24  |
| Prokey V3.0                | \$79  |
| Harvard Project Manager    | \$225 |
| Microsoft Flight Simulator | \$32  |

#### HARDWARE

|                                              |        |
|----------------------------------------------|--------|
| ABC Printer Switch                           | \$85   |
| Hayes 1200 Modem                             | \$475  |
| Hayes 1200b Modem for IBM PC                 | \$409  |
| 64K RAM Chips (9) 150NSEC                    | \$41   |
| Anchor Signalman 1200 baud Modem             | \$235  |
| CDC 360K Disk Drives                         | \$199  |
| 10 MB Int. hard drive for the PC             | \$850  |
| 30 MB External Hard Drive for IBM PC         | \$1795 |
| 10 MB Datamac external hard drive for IBM PC | \$995  |
| Princeton RGB monitor                        | \$459  |
| Taxan RGB Vision 425                         | \$425  |

#### COMPUTERS

Leading edge IBM PC Compatible - 2 D/S D/D Drives - 256K Ram Monitor, Software \$1395

|                               |        |
|-------------------------------|--------|
| Corona Computer               | Call   |
| Televideo Portable & Software | \$1795 |

#### BOARDS FOR THE IBM PC OR LOOKALIKES

|                                 |       |
|---------------------------------|-------|
| Color Board with Par. Port      | \$199 |
| AST Six Pack                    | \$264 |
| 384K Board with 256K installed  | \$320 |
| Maynard Sandstar Controller     | \$195 |
| STB Graphics II Board           | \$335 |
| Tecmar Graphics Master          | \$495 |
| New Quadram Multifunction Board | Call  |

#### PRINTERS

|                                                     |       |
|-----------------------------------------------------|-------|
| Dot Matrix Printers includes \$50 Print Set Program | Call  |
| Gemini 10X                                          | \$245 |
| Gemini 15X                                          | \$345 |
| Okidata 82A, 83A, 93P                               | Call  |
| Okidata 92P                                         | \$379 |
| Okidata 84P                                         | \$675 |
| Juki 6100                                           | \$399 |
| Call on all Epson Models Daisywriter 2000           | \$795 |
| Silver-Reed                                         | Call  |
| Diablo 620                                          | Call  |
| Diablo 630                                          | Call  |
| NEC 3550                                            | Call  |

TERMS: Prices include 3% cash discount. Add 3% for charge orders. Shipping on most items \$3.00. AZ orders +6% Sales Tax. Prices subject to change.

TOLL-FREE ORDER LINE 1-(800)-421-3135

### WAREHOUSE DATA PRODUCTS

2701 West Glendale Ave., Suite 6  
Phoenix, AZ 85021



# Super assemblers plus the world's largest selection of cross assemblers!

## **Z-80 Macroassembler \$49.50**

**Power for larger programs!** This 2500AD macroassembler includes:

- Zilog Z-80 Macroassembler (with the same powerful features as all our assemblers)
- powerful linker that will link up to 128 files. Com files may start at any address
- Intel 8080 to Zilog Z-80 Source Code Converter (to convert all your Intel source to Zilog Syntax in one simple step)
- COM to Hex Converter (to convert your object files to Hex for PROM creation, etc.)
- 52 page User Manual

## **8086/88 Assembler with Translator \$99.50**

**Available for MSDOS, PC DOS, or CPM/86!** This fully relocatable macro-assembler will assemble and link code for MSDOS (PC DOS) AND CPM/86 on either a CPM/86 or MSDOS machine. This package also includes:

- An 8080 to 8086 source code translator (no limit on program size to translate)
- A Z-80 to 8086 translator
- 64 page user manual
- 4 linkers included:
  - MSDOS produces .EXE file
  - CPM/86 produces .CMD file
  - Pure object code generation
  - Object code and address information only

Linker features:

- Links up to 128 files
- Submit mode invocation
- Code, Data Stack and extra segments
- Handles complex overlays
- Written in assembly language for fast assemblies.

## **Z-8000 Cross Development Package \$199.50**

**Instant Z-8000 Software!** This package allows development and conversion of software for the Z8001, 8002, 8003 and 8004 based machines on a Z-80, Z-8000 or 8086 machine. This powerful package includes:

- a Z-80/8080 to Z-8000 Assembly Language Source Code Translator
- Z-8000 Macro Cross Assembler and Linker

The Translators provide Z-8000 source code from Intel 8080 or Zilog Z-80 source code. The Z-8000 source code used by these packages are the unique 2500AD syntax using Zilog mnemonics, designed to make the transition from Z-80 code writing to Z-8000 easy.

## **All 2500 AD Assemblers and Cross Assemblers support the following features:**

**Relocatable Code** — the packages include a versatile Linker that will link up to 128 files together, or just be used for external reference resolution. Supports separate Code and Data space. The Linker allows Submit Mode or Command Invocation.

**Large File Handling Capacity** — the Assembler will process files as large as the disk storage device. All buffers including the symbol table buffer overflow to disk.

**Powerful Macro Section** — handles string comparisons during parameter substitutions. Recursion and nesting limited only by the amount of disk storage available.

**Conditional Assembly** — allows up to 248 levels of nesting.

**Assembly Time Calculator** — will perform calculations with up to 16 pending operands, using 16 or 32 Bit arithmetic (32 Bit only for 16 Bit products). The algebraic hierarchy may be changed through the use of parentheses.

**Include files supported— Listing Control** — allows listing of sections on the program with convenient assembly error detection overrides, along with assembly run time commands that may be used to dynamically change the listing mode during assembly.

**Hex File Converter, included** — for those who have special requirements, and need to generate object code in this format.

**Cross reference table generated—**

**Plain English Error Messages—**

System requirements for all programs: Z-80 CP/M 2.2 System with 54k TPA and at least a 96 column printer is recommended. Or 8086/88 256k CP/M-86 or MSDOS (PC DOS).

## **Cross Assembler Special Features**

**Z-8** — User defined registers names, standard Zilog and Z-80 style support. Tec Hex output option.

**8748** — standard Intel and Z-80 style syntax supported.

**8051** — 512 User defined register or addressable bit names.

**6800 Family** — absolute or relocatable modes, all addressing modes supported. Motorola syntax compatible. Intel Hex or S-Record format output.

**6502** — Standard syntax or Z-80 type syntax supported, all addressing modes supported.

## 8086 and Z-8000 XASM includes Source Code Translators

|                             | Z-80<br>CP/M® | ZILOG<br>SYSTEM 8000<br>UNIX | IBM P.C.<br>8086/88<br>MSDOS | IBM P.C.<br>8086/88<br>CP/M 86 | OLIVETTI<br>M-20<br>PCOS |
|-----------------------------|---------------|------------------------------|------------------------------|--------------------------------|--------------------------|
| 8086/88 ASM                 |               |                              | \$ 99.50                     | \$ 99.50                       |                          |
| 8086/88 XASM                | \$199.50      | \$750.00                     |                              |                                | \$199.50                 |
| 80186 XASM <i>new</i>       | 199.50        | 750.00                       | 199.50                       | 199.50                         | 199.50                   |
| 16000(all) XASM <i>new</i>  | 199.50        | 750.00                       | 199.50                       | 199.50                         | 199.50                   |
| 68000,08,10 XASM <i>new</i> | 199.50        | 750.00                       | 199.50                       | 199.50                         | 199.50                   |
| Z-8000™ ASM                 |               | 750.00                       |                              |                                | 299.50                   |
| Z-8000 XASM                 | 199.50        |                              | 199.50                       | 199.50                         |                          |
| Z-80 ASM                    | 49.50         |                              |                              |                                |                          |
| Z-80 XASM                   |               | 500.00                       | 99.50                        | 99.50                          | 99.50                    |
| Z-8 XASM                    | 99.50         | 500.00                       | 99.50                        | 99.50                          | 99.50                    |
| 6301(CMOS) <i>new</i>       | 99.50         | 500.00                       | 99.50                        | 99.50                          | 99.50                    |
| 6500/11 XASM <i>new</i>     | 99.50         | 500.00                       | 99.50                        | 99.50                          | 99.50                    |
| 6502 XASM                   | 99.50         | 500.00                       | 99.50                        | 99.50                          | 99.50                    |
| 65CO2(CMOS) XASM            | 99.50         | 500.00                       | 99.50                        | 99.50                          | 99.50                    |
| 6800,2,8 XASM               | 99.50         | 500.00                       | 99.50                        | 99.50                          | 99.50                    |
| 6801,03 XASM                | 99.50         | 500.00                       | 99.50                        | 99.50                          | 99.50                    |
| 6804 XASM <i>new</i>        | 99.50         | 500.00                       | 99.50                        | 99.50                          | 99.50                    |
| 6805 XASM                   | 99.50         | 500.00                       | 99.50                        | 99.50                          | 99.50                    |
| 6809 XASM                   | 99.50         | 500.00                       | 99.50                        | 99.50                          | 99.50                    |
| 8748 XASM                   | 99.50         | 500.00                       | 99.50                        | 99.50                          | 99.50                    |
| 8051 XASM                   | 99.50         | 500.00                       | 99.50                        | 99.50                          | 99.50                    |
| 8080 XASM                   | 99.50         | 500.00                       | 99.50                        | 99.50                          | 99.50                    |
| 8085 XASM                   | 99.50         | 500.00                       | 99.50                        | 99.50                          | 99.50                    |
| 8096 XASM <i>new</i>        | 199.50        | 750.00                       | 199.50                       | 199.50                         | 199.50                   |
| 1802 XASM                   | 99.50         | 500.00                       | 99.50                        | 99.50                          | 99.50                    |
| F8/3870 XASM                | 99.50         | 500.00                       | 99.50                        | 99.50                          | 99.50                    |
| COPS400 XASM                | 99.50         | 500.00                       | 99.50                        | 99.50                          | 99.50                    |
| NEC7500 XASM                | 99.50         | 500.00                       | 99.50                        | 99.50                          | 99.50                    |
| NSC800                      | 99.50         | 500.00                       | 99.50                        | 99.50                          | 99.50                    |

**Subtotal**    \$ \_\_\_\_\_    \$ \_\_\_\_\_    \$ \_\_\_\_\_    \$ \_\_\_\_\_    \$ \_\_\_\_\_

Name \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Phone \_\_\_\_\_ Ext. \_\_\_\_\_

Make and model of computer system \_\_\_\_\_

C.O.D. (2500AD pays C.O.D. charges)

VISA or MasterCard #, Exp. Date (mo./yr.) \_\_\_\_\_

Signature \_\_\_\_\_

**TO ORDER.** Simply circle the product or products you want in the price columns above, enter the subtotal at the bottom of that column and add up your total order. Don't forget shipping/handling.

**Total \$** \_\_\_\_\_

**Check one:**

8" Single Density

5 1/4" Osborne

IBM P.C.

Cartridge Tape

Apple (Softcard)

Kaypro DSDD

other formats available, please call!

shipping/handling

(\$6.50 per unit,

\$20.00 per unit for

Int'l. airmail) \$ \_\_\_\_\_

**Total Order \$** \_\_\_\_\_

CP/M is a registered trademark of Digital Research, Inc.

214

# 2500AD SOFTWARE INC.

P.O. Box 4957, Englewood, CO 80155, (303) 790-2588 TELEX 752659/AD

OVER 2000 SOFTWARE TITLES IN STOCK

# SAVE ON THESE IN-STOCK PRINTERS

## MANNESMANN TALLY

|           |          |
|-----------|----------|
| SPiRiT 80 | \$269.00 |
| MTL-160L  | \$549.00 |
| MTL-180L  | \$749.00 |

## JUKI

|             |       |
|-------------|-------|
| Juki 6100   | \$389 |
| Tractor kit | \$119 |

## Epson

|         |                     |
|---------|---------------------|
| RX80    | \$239               |
| RX80FT  | \$279               |
| RX100   | \$379               |
| FX80    | \$389               |
| FX100   | \$559               |
| JX80    | \$529               |
| LQ1500P | includes Kit \$1089 |
| LQ1500S | \$1149              |

## Citoh

|                |        |
|----------------|--------|
| Prowiter 8510A | \$309  |
| 8510BC2        | \$429  |
| 8510BP1        | \$349  |
| 8510SP         | \$449  |
| 8510SR         | \$499  |
| 8510SCP        | \$519  |
| 8510SCR        | \$569  |
| 1550P          | \$499  |
| 1550BCD        | \$589  |
| A10-20P        | \$469  |
| F104OPU or RDU | \$899  |
| F1055PU or RDU | \$1199 |

## PANASONIC

|      |        |
|------|--------|
| 1090 | \$229  |
| 1091 | \$289  |
| 1092 | \$439  |
| 1093 | \$CALL |

## BLUE CHIPS

|             |           |
|-------------|-----------|
| M12010      | \$279.00  |
| M12010 C-64 | \$279.00  |
| D4015       | \$1399.00 |

## OKIDATA

|     |       |
|-----|-------|
| 80  | \$159 |
| 82A | \$299 |
| 83A | \$549 |
| 84  | \$669 |
| 92  | \$369 |
| 93  | \$579 |

## LEGEND

|      |          |
|------|----------|
| 880  | \$259.00 |
| 1000 | \$279.00 |
| 1200 | CALL     |
| 1500 | CALL     |
| 1081 | CALL     |

PRINTER INTERFACING Available



NEC

|          |          |
|----------|----------|
| NEC 8025 | \$699.00 |
| NEC 8027 | \$359.00 |

## STAR MICRONICS

|             |        |
|-------------|--------|
| Gemini 10x  | \$239  |
| Gemini 15x  | \$355  |
| Delta 10    | \$339  |
| Delta 15    | \$449  |
| Radix 10    | \$499  |
| Radix 15    | \$589  |
| Powertype   | \$319  |
| Sweet p 100 | \$CALL |
| STX 80      | \$CALL |

**GEMINI 10X**  
\$239

## CARDCO

|                                    |          |
|------------------------------------|----------|
| LQ1                                | \$449.00 |
| LQ3                                | \$339.00 |
| PRINTER INTERFACE                  | \$39.75  |
| PRINTER INTERFACE W/ FULL GRAPHICS | \$65.75  |

# Lycy Computer Marketing & Consultants

8  
0  
0  
-  
2  
3  
3  
-  
8  
7  
6  
0

## Microprose

|             |         |
|-------------|---------|
| Solo Flight | \$22.75 |
| NATO        | \$22.75 |
| Spitfire    | \$22.95 |

## Leading Edge

|               |      |
|---------------|------|
| PC Compatible | Call |
|---------------|------|

## ZENITH

|       |      |
|-------|------|
| Z-150 | CALL |
|-------|------|

## COLUMBIA DATA

|      |      |
|------|------|
| 1600 | CALL |
|------|------|

## TELEVIDEO

|        |      |
|--------|------|
| TS1605 | CALL |
|--------|------|

## MONITORS

## NEC

|               |          |
|---------------|----------|
| JB 1260 Green | \$ 99.00 |
| JB 1201 Green | \$145.00 |
| JB 1205 Amber | \$145.00 |
| JC 1215 Color | \$255.00 |
| JC 1216 RGB   | \$399.00 |
| JC 460 Color  | \$349.00 |

## SAKATA

|                 |          |
|-----------------|----------|
| SC-100 Color    | \$229.00 |
| STSI Tilt Stand | \$ 35.00 |
| SG 1000 Green   | \$ 99.00 |
| SA 1000 Amber   | \$109.00 |

## AMDEK

|               |          |
|---------------|----------|
| 300 Green     | \$139.00 |
| 300 Amber     | \$149.00 |
| 310 Amber-IBM | \$159.00 |
| Color I Plus  | \$259.00 |
| Color 4T-IBM  | \$589.00 |

## IBM-PC COMPATIBLE

## CORONA

|                     |        |
|---------------------|--------|
| PPC22G              |        |
| Portable 256K-Green | \$1995 |
| PPCXTA              |        |
| Portable 256K-10Meg | \$3295 |
| COR128K 128K RAM    | \$ 159 |



## TAXAN

|                   |          |
|-------------------|----------|
| 210 Color RGB     | \$259.00 |
| 100 Green         | \$115.00 |
| 105 Amber         | \$125.00 |
| 400 Color RGB     | \$295.00 |
| 410 Color RGB     | \$349.00 |
| 420 Color RGB-IBM | \$459.00 |
| 121 Green-IBM     | \$145.00 |
| 122 Amber-IBM     | \$149.00 |

## ZENITH

|                     |          |
|---------------------|----------|
| ZVM122A Amber       | \$ 95.00 |
| ZVM123G Green       | \$ 85.00 |
| ZVM124 Amber-IBM    | \$129.00 |
| ZVM131 Color        | \$275.00 |
| ZVM133 RGB          | \$389.00 |
| ZVM135 Composite    | \$449.00 |
| ZVM136 HI RES Color | \$589.00 |

## GORILLA

|           |          |
|-----------|----------|
| 12" Green | \$ 82.00 |
| 12" Amber | \$ 89.00 |

## NEC

|                             |        |
|-----------------------------|--------|
| PC8201 Portable             | \$429  |
| NECB1 64K Computer System   | \$1049 |
| NECB2 128 K Computer System | \$1299 |
| PC8221 Thermal Printer      | \$ 139 |
| PC8201 8K RAM Chip          | \$ 99  |
| PC820632K RAMCart           | \$ 299 |
| PC300 Modem                 | \$ 65  |
| PC8801 MSDOS 16 Bit Card    | \$ 339 |

## MAXELL

|             |         |
|-------------|---------|
| 5 1/4" MD-1 | \$19.95 |
| 5 1/4" MD-2 | \$24.99 |

## MODEMS

## MICROBITS

|         |          |
|---------|----------|
| MPP1000 | \$109.00 |
|---------|----------|

## NOVATION

|                         |          |
|-------------------------|----------|
| J-Cat                   | \$89.00  |
| Cat                     | \$129.00 |
| Smart Cat 103/          | \$169.00 |
| Smart Cat 103/212       | \$389.00 |
| AutoCat                 | \$209.00 |
| 212 Auto Cat            | \$539.00 |
| Apple Cat II            | \$239.00 |
| 212 Apple Cat           | \$439.00 |
| Apple Cat 212 (Upgrade) | \$249.00 |
| Smart Cat Plus          | \$359.00 |

## DRIVES

### MSD

|           |          |
|-----------|----------|
| SD1 DRIVE | \$309.00 |
| SD2 DRIVE | \$499.00 |

### INDUS

|           |          |
|-----------|----------|
| ATARI     | \$279.00 |
| COMMODORE | CALL     |

### ELEPHANT

|             |         |
|-------------|---------|
| 5 1/4" SSSD | \$15.99 |
| 5 1/4" SSDD | \$17.99 |
| 5 1/4" DSDD | \$22.99 |

### SKC

|          |         |
|----------|---------|
| SKC-SSSD | \$14.75 |
| SKC-SSDD | \$17.75 |
| SKC-DSDD | \$21.75 |

MITEY MO ..... 69.95

## Hayes

|                  |          |
|------------------|----------|
| Smartmodem 300   | \$199.00 |
| Smartmodem 1200  | \$469.00 |
| Smartmodem 1200b | \$399.00 |
| Micromodem IIe   | \$249.00 |
| Micromodem 100   | \$289.00 |
| Chronograph      | \$179.00 |

## ANCHOR

|                          |          |
|--------------------------|----------|
| Volkmodem                | \$55.99  |
| Mark VII (auto ans/dial) | \$95.99  |
| Mark VII (1200 band)     | \$259.00 |

# TOLL FREE 1-800-233-8760

Circle 238 on inquiry card.



TO ORDER



CALL TOLL FREE

**800-233-8760**

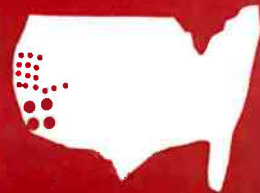
Customer Service 1-717-327-1825 Jersey Shore, PA 1774C

or send order to

Lycy Computer  
P O Box 5088

## POLICY

In-stock items shipped within 24 hours of order. Personal checks require four weeks clearance before shipping. No deposit on C. O. D. orders. Free shipping on prepaid cash orders within the continental U.S. PA residents add sales tax. All products subject to availability and price change. Advertised prices show 4% discount offered for cash. add 4% for Master Card or Visa. DEALER INQUIRIES INVITED.



# Happenings

## IBM and networks, Concurrent PC-DOS, and other developments

BY JOHN MARKOFF  
AND EZRA SHAPIRO

**I**t's certainly been a busy season for IBM—a network cabling standard, price cuts on the PC, a new keyboard for PCjr, the introduction of the AT, a network from Sytek, a carload of new software in all areas, and finally the announcement of the acquisition of Rolm, the innovative telecommunications company. If you take these developments one by one, they're all interesting, but not riveting. If you add them up, however, it becomes rather easy to launch into wild speculation on the fate of the personal computer industry. Immediately following the Rolm news, the grapevine has been awash with just such speculation, and a fair amount of gossip that verges on conspiracy theory.

The items about Sytek and Rolm products that appear later in this month's column were originally written with no knowledge of IBM's plans to move into communications in a major way. We saw the Rolm story as a fascinating new direction but certainly not an overwhelming trend, and we wondered parenthetically whether IBM's 23 percent stake in Rolm was a signal to AT&T that IBM was going to invade that corporate giant's territory, just as AT&T's foray into computers had been a challenge to IBM. As we write this, the details of IBM's Rolm takeover arrangements have been made public, but full stockholder (and legal) approval is still pending. While IBM's intentions have become clearer, the final outcome still is unsettled as of this writing. (Such are the problems of dealing with breaking news stories on the deadline schedule of a monthly magazine such as BYTE.)

Are the Rolm computer products, the Cedar and the Juniper, now to be seen as IBM products? Will they bear the blue IBM logo? Will the BIOS ROM, developed to be "PC-compatible" by Rolm engineers, be replaced with the true IBM chip? Will there be other changes to either IBM or Rolm microcomputers? We don't know yet, but we do know that the show is going to be worth watching.

—Ezra Shapiro, BYTE West Coast Bureau Chief

### COMMUNICATIONS INTEGRATION

Rolm Corporation will be announcing a couple of new products intended to round out its line of office communications equipment, both of which integrate sophisticated telephone features with data-processing power for individual users in the form of IBM PC-compatible computing. Though the two devices must be used in conjunction with Rolm's CBX computerized switchboard system and as such are in no way single-user machines, they do indicate one of the important directions in which the microcomputer revolution is spreading.

The high-end product, called the Cedar, is a full system in itself. Like the mythical centaur, a creature that was half man and half horse, the Cedar is a blend of two existing technologies; it's both computer and telephone. Physically, the device is a compact workstation with a footprint somewhat smaller than that of the IBM PC. The base of the unit houses two 360K-byte disk drives and the system's electronic guts. Rising from the top on the right side is an angled mono-

chrome monitor (a 9-inch diagonal green-phosphor display that operates in both text and graphics modes, much like the Compaq computer); on the left, there's a standard telephone handset. A detachable keyboard tucks into an opening under the drives.

The computer portion of the product is an IBM clone, running an 8088 microprocessor with 512K bytes of RAM (random-access read/write memory) standard. The telephone part is Rolm's high-tech telephone that can handle from one to four separate lines on one twisted-pair cable. Since the telephonic part of the system is digital for both data and voice, the unit has no need of an internal modem. (Any conversion of digital to analog signals takes place at the CBX level to interface with the outside world; within a Rolm system, all transmission is digital.)

The Cedar comes with a package of personal communications software that loads over the operating system and remains resident in 128K bytes of RAM. The software

(continued)

BYTE West Coast is prepared monthly by BYTE's editors and staff in San Francisco and Palo Alto. Correspondence should be addressed to BYTE West Coast, BYTE Magazine, 425 Battery St., San Francisco, CA 94111.



*IBM's decision to go with a medium-speed broadband LAN came as something of a surprise.*

business environment, the solution is accomplished without the rat's nest of wiring that usually accompanies this much functionality.

**THE IBM LAN**

Now that IBM has spoken, the real question about the company's decision to offer a local-area network (LAN) configuration for its personal computer line is: Will the microcomputer industry be any closer to a standard in the LAN world?

IBM's decision to go with a medium-speed broadband local-area network came as something of a surprise to industry analysts who had been expecting a network that was more closely modeled after the "token ring" topology that had been discussed in recent IBM technical papers. However, IBM claims that there will a gateway between this net and any future network that they might offer.

In its search for its local-area network, IBM turned to an established broadband LAN manufacturer, Sytek Inc., of Mountain View, California. Sytek is located in a corner of Silicon Valley that has been affectionately dubbed "Coaxial Corridor" because, in addition to Sytek, Ethernet manufacturer 3Com and several other network companies are all based within easy cabling distance of each other.

Sytek has been marketing its own network, a product called LocalNet/20, that is used by both large corporate and government installations and by a number of college campuses as well. In the Sytek system, each user is connected to a broadband cable through a network interface device. Each of these devices has its own microcomputer and a broadband modem that converts digital data to an analog frequency-modulated form for transmission across the network. LocalNet uses frequency division multiplexing to define as many as 120 separate channels that can share each network.

Sytek also has been working on an ongoing cable television project called MetroNet in conjunction with the Gerald Division of General Instru-

(continued)

handles various telephone management functions, such as true electronic mail (both transmission and storage) with an on-screen alert, data sharing through the CBX, softkey control of telephone functions such as auto and repeat dialing, maintenance of a personal phone directory, and so on. Obviously, since the unit can control more than one line with no additional cabling, simultaneous voice and data transmission is easy. Product pricing is roughly equivalent to the sum of the component parts (computer, memory, software, phone) at \$4995 for one unit, down to \$4245 in quantities over 100.

The second product, the Juniper, is a stand-alone add-on to an existing IBM PC or compatible that links an existing computer to the CBX system and gives it all the features of the Cedar. It's a smaller box that looks much like a telephone; it connects to a card that plugs into an expansion slot in the computer. All the software previously mentioned comes with the package, and all the integration of the CBX system is made available to the workstation. It costs \$1495 for one, down to \$1360 in quantity.

The products represent a thorough solution to the problems of personal computing in a business installation. Users have all the advantages of individual desktop processing with full privacy, yet can use the telecommunications aspects of the system to share data with remote microcomputers, file servers or other storage devices, and even company mainframes. Though not a true local-area network, the system makes use of the features of the CBX to provide a more-than-adequate surrogate. In addition, the units provide full telephone capabilities.

Not only do the Rolm products make a lot of sense for a multiuser

Votrax, Inc. isn't just talking when we say you could win \$1,000. We mean it. All you have to do is come up with the best application idea for the Votrax Type 'N Talk (TNT) or the Votrax Personal Speech System (PSS) text-to-speech synthesizers.

Send your best idea to Votrax, postmarked no later than 1/31/85, one idea per entry, and enter as often as you like. The most original idea wins \$1,000.

Second Prize: the Votrax PSS.

Third Prize: the Votrax TNT.



PSS

Votrax, Inc. enables your computer to talk with either the TNT or the PSS. Both have an unlimited vocabulary. Both are adaptable to most personal computers.

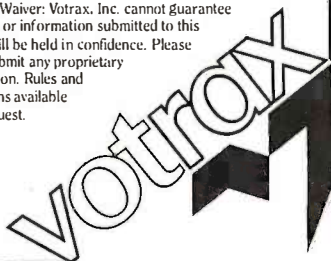
Suggested retail price is \$189 for the TNT, \$395 for the PSS. Call 313-583-9884 today to hear an actual voice demonstration of the PSS over the phone.

For more information on Votrax voice synthesizers, or to enter the Votrax Talking Computer Competition, write to:

**TALKING COMPUTER COMPETITION**  
**Votrax, Inc.**

1394 Rankin, Dept. 23B  
Troy, Michigan 48083  
1-800-521-1350  
313-588-0341 (in Michigan)

Notice of Waiver: Votrax, Inc. cannot guarantee that ideas or information submitted to this contest will be held in confidence. Please do not submit any proprietary information. Rules and regulations available upon request.





# OUR WORKSTATION DATA ACQUISITION SYSTEM HAS TOMORROW'S SOLUTIONS BUILT IN.

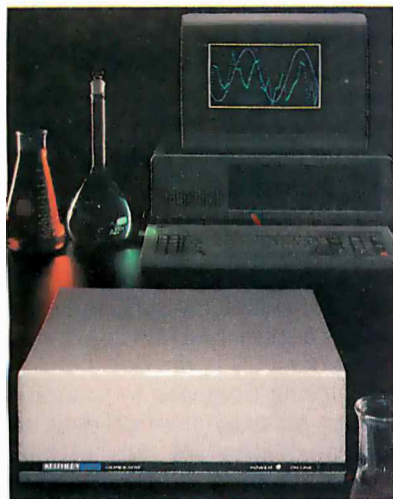
**A**s you conduct your search for the ideal data acquisition system, we think you'll find a number of capable systems, all from fine makers.

But we also think you'll find this: there is really only one system likely to meet, and perhaps exceed, your own personal standards for accuracy, flexibility, performance and power. And do so for a bottom line investment that is truly easy to justify.

That system is the Keithley DAS Series 500 for the IBM PC and Apple II families of micro-computers.

To begin with, even a basic Series 500 configuration, like the one shown in the chart, comes out of its carton with enough power and capacity for most lab and test bench applications. So you needn't trade up to more expensive options to get basic capabilities.

And because the Series 500 is completely modular, you can start out with just the capacity you need. Then choose from our comprehensive library of plug-in function cards to instantly reconfigure your system for the most demanding applications—with up to 272 channels of discrete analog input, 50



**Keithley DAS Series 500  
Measurement and Control System.**

|                                   | Keithley<br>DAS<br>Series 500 | ISAAC<br>91A           | ISAAC<br>2000          | MACSYM<br>200          | HP<br>3497A             |
|-----------------------------------|-------------------------------|------------------------|------------------------|------------------------|-------------------------|
| System Base                       | \$4800 <sup>(1)</sup>         | \$3950                 | \$4100                 | \$3660                 | \$2990                  |
| <b>Analog Input</b>               |                               |                        |                        |                        |                         |
| 16 Channels                       | Yes                           | Yes                    | +\$600                 | +\$362 <sup>(2)</sup>  | +\$2104 <sup>(3)</sup>  |
| Instrumentation Amplifier         | Yes                           | +\$800                 | +\$800                 | Yes                    | Yes                     |
| ± 0.035% Absolute System Accuracy | Yes                           | +\$1100 <sup>(4)</sup> | +\$1100 <sup>(4)</sup> | No                     | Yes <sup>(5)</sup>      |
| 30 kHz Sampling                   | Yes <sup>(6)</sup>            | No                     | Yes <sup>(7)</sup>     | Yes                    | No                      |
| High Speed Programmable Ranges    | Yes                           | No <sup>(8)</sup>      | No <sup>(8)</sup>      | Yes                    | No                      |
| <b>Other I/O</b>                  |                               |                        |                        |                        |                         |
| 5 12-Bit Voltage Outputs          | Yes                           | +\$187 <sup>(9)</sup>  | +\$937 <sup>(10)</sup> | +\$937 <sup>(10)</sup> | +\$2500 <sup>(11)</sup> |
| 16 Digital Inputs                 | Yes                           | Yes                    | +\$175 <sup>(12)</sup> | +\$330                 | +\$530                  |
| 16 Digital Outputs                | Yes                           | Yes                    | +\$175 <sup>(12)</sup> | +\$350                 | +\$710                  |
| 4 120VAC Outputs                  | Yes                           | No                     | No                     | +\$638 <sup>(13)</sup> | +\$265 <sup>(14)</sup>  |
| <b>System Features</b>            |                               |                        |                        |                        |                         |
| Programmable Timers               | Yes                           | Yes                    | Yes                    | Yes                    | +\$555                  |
| Realtime Clock                    | Yes                           | Yes                    | Yes                    | Yes                    | Yes                     |
| Power Supply                      | Yes                           | +\$350                 | Yes                    | Yes                    | Yes                     |
| <b>Software System</b>            |                               |                        |                        |                        |                         |
| Data Acquisition BASIC            | Yes                           | Yes                    | Yes                    | Yes                    | No                      |
| Foreground/Background             | Yes                           | No                     | Yes <sup>(15)</sup>    | Yes <sup>(15)</sup>    | No                      |
| Data Analysis                     | Yes                           | No                     | No                     | No                     | No                      |
| Realtime Graphing                 | Yes                           | Yes                    | Yes                    | Yes                    | No                      |
| Engineering Units                 | Yes                           | No                     | No                     | No                     | No                      |
| <b>Package Price</b>              | <b>\$4800</b>                 | <b>\$6387</b>          | <b>\$7887</b>          | <b>\$6277</b>          | <b>\$9654</b>           |

1. System 520. 2. 16 channels of \$725 32 channel card. 3. \$1640 A/D card plus 16 channels of \$580 20 channel card. 4. + 0.003% accuracy @ 200 Hz. 5. ± 0.006% accuracy @ 40Hz. 6. Apple system 27 kHz, IBM system 31.4 kHz. 7. 200 kHz option available + \$3825. 8. Only available with 16-bit A/D converter with programmable gain preamplifier + \$1100. 9. 1 channel from \$750 4 channel card. 10. 5 channels from \$750 4 channel card. 11. 5 channels from \$1000 2 channel card. 12. 16 channels of \$350 32 channel card. 13. Price based on 16 channel rack @ \$550 plus 4 AC output relays @ \$22. 14. Four channels of \$525 8 channel card. 15. Or other multi-tasking structure.

channels of analog output, 160 channels of digital I/O, and AC/DC device control. With direct transducer connection and signal conditioning for each individual channel.

It's also the only system equipped with Soft500, the integrated measurement and control software that proves once and for all that easy doesn't have to mean simplistic.

Soft500 gives first time users the accessibility and friendliness they need to get excellent results the first time out. Yet it also provides experienced users with the depth and extended facilities needed for complex applications. Including unique features such as foreground/background architecture, powerful screen graphics and statistical analyses. Plus, automatic conversion of binary data to familiar engineering units.

In all, you'll find the features you need to make the Series 500

increasingly productive through years of new and more demanding applications.

Naturally, we'd like to suggest the Series 500 as the wisest choice in workstation data acquisition. But we also believe that as you compare and examine the facts, the Series 500 will eventually suggest itself.

For complete information on the Keithley DAS Series 500 workstation data acquisition system, call us toll-free at 1-800-552-1115. In Massachusetts call (617) 423-7780. Or write to us at Keithley DAS, 349 Congress Street, Boston, Massachusetts 02210.

## Series 500



©1984 by Keithley DAS, Boston, Massachusetts

Information contained in the comparison chart is correct to the best of our knowledge as of July 3, 1984; however, Keithley DAS assumes no liability for its accuracy. IBM PC is a registered trademark of International Business Machines Corporation. Apple II is a registered trademark of Apple Computer, Inc. ISAAC is a registered trademark of Cyborg Corporation. MACSYM is a registered trademark of Analog Devices, Inc. HP is a registered trademark of Hewlett-Packard, Inc.

# Pascal and C Programmers

Your programs can  
now compile the  
***FirsTime***<sup>™</sup>

*FirsTime* is an intelligent editor that knows the rules of the language being programmed. It checks your statements as you enter them, and if it spots a mistake, it identifies it. *FirsTime* then positions the cursor over the error so you can correct it easily. *FirsTime* will identify all syntax errors, undefined variables, and even statements with mismatched variable types. In fact, any program developed with the *FirsTime* editor will compile on the first try.

### More than a syntax checker!

*FirsTime* has many unique features found in no other editor. These powerful capabilities include a zoom command that allows you to examine the structure of your program, automatic program formatting, and block transforms.

If you wish, you can work even faster by automatically generating program structures with a single key-stroke. This feature is especially useful to those learning a new language, or to those who often switch between different languages.

**Other Features:** Full screen editing, horizontal scrolling, function key menus, help screens, inserts, deletes, appends, searches, and global replacing.

Programmers enjoy using *FirsTime*. It allows them to concentrate on program logic without having to worry about coding details. Debugging is reduced dramatically, and deadlines are more easily met.

|                                   |       |
|-----------------------------------|-------|
| <b><i>FirsTime</i></b> for PASCAL | \$245 |
| <b><i>FirsTime</i></b> for C      | \$295 |
| Microsoft PASCAL Compiler         | \$245 |
| Microsoft C Compiler              | \$395 |
| Demonstration disk                | \$25  |

Get an extra **\$100 off** the compiler when it is purchased with ***FirsTime***. (N.J. residents please add 6% sales tax.)

**Spruce**  
Technology Corporation  
110 Whispering Pines Drive  
Lincroft, N.J. 07738  
(201) 741-8188 or (201) 663-0063

Dealer enquiries welcome. Custom versions for computer manufacturers and language developers are available.

*FirsTime* is a trademark of Spruce Technology Corporation.



## BYTE WEST COAST

*The most intriguing aspect of the IBM LAN is the potential to support video and voice across the network.*

ments. This is a broadband communications network that will use cable television networks as its medium. MetroNet is designed to bring videotex services, as well as conventional television programming, to residential and business subscribers.

According to Gregory Ennis, director of systems engineering at Sytek, the IBM PC Network has been designed to conform to LocalNet architecture. In practice, this means that the IBM version will use standard 75-ohm CATV (cable television) coaxial cable and connection hardware. The Network itself will be a 2-mega-byte Carrier Sense Multiple Access with Collision Detection (CSMA/CD) broadband network. It will consist of a Network Adaptor for each PC, a Network Translator Unit (a stand-alone unit that is designed to provide single-channel frequency translation for the network), and cabling hardware.

The Network Adaptor card, which will plug into IBM PCs, XTs, Portable PCs, and the new PC AT, contains a Network BIOS (basic input/output system) in ROM (read-only memory), its own on-board microprocessor, and an RF (radio frequency) modem that broadcasts onto the network. Each card is given its own unique 48-bit network identifier and provides support that allows each individual PC to be booted from the network, making networks of diskless PCs and a single disk server possible.

The most intriguing aspect of the Sytek LAN is the obvious room for growth—particularly the potential to support video and voice across the network in the future. Also worth mentioning is the capability of each Network Adaptor card to support up to 32 sessions simultaneously. Thus, as PC-DOS moves closer to a true

multitasking architecture it is possible to conceive of an individual PC with the capability of connecting to one or several mainframe hosts and carrying out other LAN-based tasks such as access to files or a distributed database.

Finally, we note that IBM rudely shut the PCjr out of the PC Network. In saying that the PCjr won't be supported on the first LAN to be offered, is IBM giving us some sort of a broader hint on the future of the PCjr?

However, despite IBM's alleged power to make any decision a de facto standard, most existing network manufacturers have shown no signs of abandoning their own network products and insist that they still offer more performance and value than IBM does. Perhaps this announcement was just not compelling enough to pull the rest of the industry along in IBM's wake.

### A DIFFERENT APPROACH

If your local-area networking needs aren't quite as extensive as the capabilities offered by the new IBM PC Network, or if you have the vision of your personal computer controlling a variety of functions around your house or office, you might be interested in hearing about the Power Line Network (PLN) from Mollard Systems Design in San Jose, California. Mollard has recently announced a simple, low-cost network based on a stand-alone controller (developed around a bipolar controller chip from National Semiconductor) that connects to an IBM PC through an RS-232C interface and then directly to any standard 110-volt 60-Hz power outlet. The PLN network allows data transmission at 2880 bps (bits per second) for up to 254 individual network stations as well as a special A/D (analog to digital) converter PLN controller that allows monitoring from one to four analog inputs. Although the PLN data transfer capabilities are only of limited speed, the network does permit peripheral sharing. And because the network will support a large number of device controllers from BSR, it offers an inexpensive way to use an IBM PC

(continued)

# MicroAge<sup>®</sup>

## "THEY PROVIDED THE LINK BETWEEN US AND MILWAUKEE'S MAJOR CORPORATIONS."

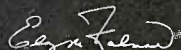
*"Both of us had experience in the corporate world and we wanted to open a business reflecting that orientation. We chose MicroAge because they shared our business philosophy."*

*"Back in 1981, some of the major vendors still hadn't entered the microcomputer market. We anticipated that when they did, they would channel their products through a national organization. With MicroAge behind us, we're able to offer Milwaukee businesspeople and professionals such respected products as IBM, Compaq, Hewlett-Packard and most recently AT&T. And we have the technical expertise to provide service after the sale."*

*"MicroAge has supported us from day one. Without this help, we wouldn't be opening our second store!"*



Ernie Venta  
Franchise Owner

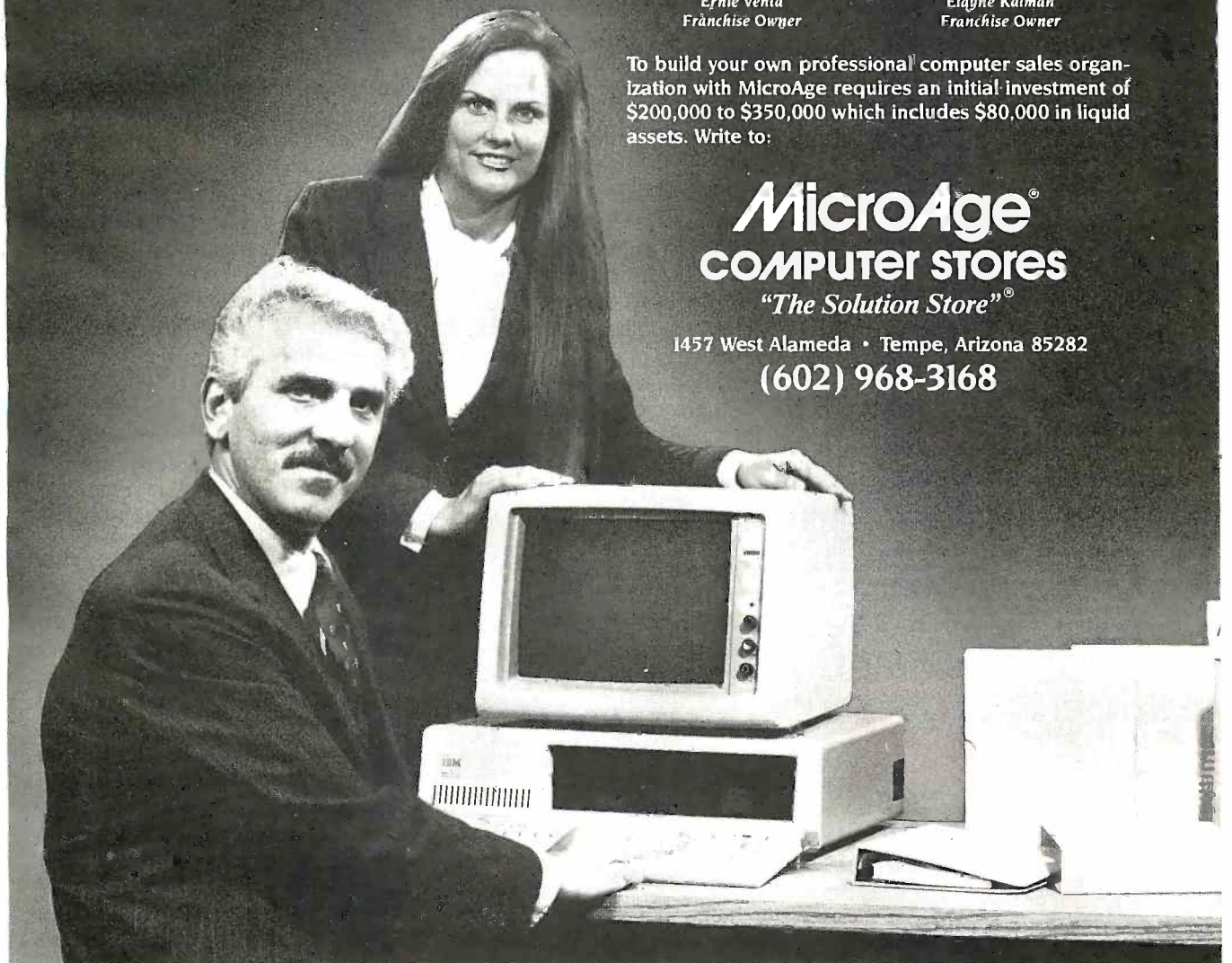


Elayne Kalman  
Franchise Owner

To build your own professional computer sales organization with MicroAge requires an initial investment of \$200,000 to \$350,000 which includes \$80,000 in liquid assets. Write to:

## MicroAge<sup>®</sup> COMPUTER STORES "The Solution Store"<sup>®</sup>

1457 West Alameda • Tempe, Arizona 85282  
(602) 968-3168



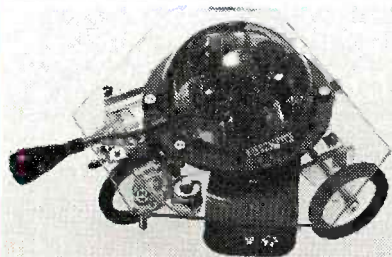
MicroAge franchisees Ernie Venta and Elayne Kalman shown with an IBM Personal Computer.

Circle 253 on inquiry card.

# HAPPY HOLIDAYS!

## OWI EDUCATIONAL ELECTRONIC ROBOT KITS!

Clever, inexpensive robot kits feature pre-assembled pc boards, hardware & mechanical-drive systems that can be handled by anyone. Only basic hand tools required for assembly. OWI's MOVIT line provides innovative, affordable robot kits that entertain as well as educate.

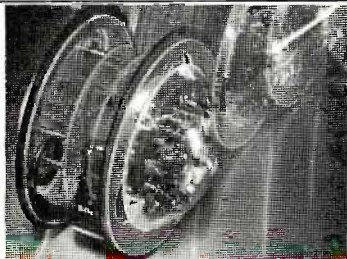


### PEPPY Sound/Touch Sensor Robot Kit

The PEPPY has a 2-way sensor that reacts to noise & solid objects in its path. When the front-located sensor comes in contact with an obstacle, or hears a loud noise such as a clap, it will automatically turn left. Contact with a solid object triggers reverse action and the PEPPY will turn 180° to the left and continue until another object blocks its way.

- Power source: 2 ea. AA batteries (not incl.)
- Color: pink
- Size: 4.75" Radius x 2.75"H

**MV-916 Peppy..... \$24.95**

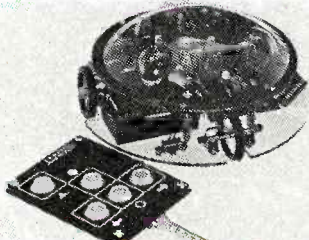


### CIRCULAR Remote Control Robot Kit

The CIRCULAR model has 2 large wheels which roll this super robot left, right, forward, or around. All the movements can be perfectly controlled by a hand-held remote control box.

- Power source (main body): 3 ea. AA batt., 1 ea. 9V battery - (control box): 1 ea. 9V battery (not incl.)
- Color: green
- Size: 2.75" Radius x 5.75"H

**MV-935 Circular..... \$69.95**



### MEMOCON CRAWLER Programmable Memory Robot Kit

#### BUILD AN INTERFACE FROM MEMOCON TO YOUR PERSONAL COMPUTER!

This robot is memory controlled. It operates according to the program you input using the keyboard included with the kit. The keyboard has 5 mode switches: forward, right, left, pause, buzzer/light (LED). The CRAWLER employs a sequence func. static RAM 256x4 bit memory • Movement: 3 wheels driven by 2 DC motors • Control: Memory/electronic circuit (thru the keyboard) • Element: 4-bit static RAM • 256 steps (no repeat steps) approx. 0.7-0.3 sec/1 step • Power source: 2 ea. AA batteries, 1 ea. 9V battery (not incl.) • Color: black • Size: 2.75" Radius x 2.5"H

**MV-918 Memocon..... \$74.95**

**We also specialize in a complete line of IC's (see opposite page). Don't miss our Season's Greetings specials in this issue's Apple Supplement!**

U.S. Funds Only-Prices Subject to Change California Residents Add 6 1/2% Sales Tax Shipping - Add 5% plus \$1.50 insurance Send S.A.S.E. for Monthly Sales Flyer!

Send \$1.00 postage for FREE 1985 Jameco Catalog!



1355 SHOREWAY ROAD, BELMONT, CA 94002  
Phone Orders Welcome - (415) 592-8097 Telex: 176043  
12/84

## BYTE WEST COAST

*User's familiar with either MS-DOS or CP/M can quickly feel at home with the new operating system, Concurrent PC-DOS.*

for computerized control and security applications.

Mollard is offering three different types of controllers: a master PLN for the IBM PC, a controller PLN with a Centronics parallel interface for peripherals, and the A/D converter with provision for inputs with a voltage range between 0 and 5 volts.

According to Fred Louder, one of the designers of the Power Line Network, most small offices and homes have AC power supplies that allow PLNs to communicate. However, without special modifications the network will not extend beyond local transformers. (Common transformers are generally shared within most commercial and industrial buildings and by several houses in residential areas, but floors in large buildings are usually separated.) Although each network can be composed of a maximum of 254 PLNs, an additional security code in the network protocol creates the possibility of having many networks sharing the same power line.

Louder claims that previous attempts at using the local power supply as a network medium have encountered difficulties because they used AM (amplitude modulation) transmission techniques. The Mollard system uses FM (frequency modulation) instead, which makes the network insensitive to electrical noise on the power line. In fact, an earlier application of this technology was for built-in computer control of industrial lighting systems that eliminated the need for any additional wiring beyond the traditional power cabling.

The PLN network includes software that permits viewing of remote PC directories, unattended file transfer, and sending files to remote peripherals such as printers. A simple file-

locking mechanism is incorporated into the network software to exclude unauthorized downloading or modification of existing files on a shared file system. The network controllers and system software cost \$699 each. Currently only network software for the IBM PC is available; however, Mollard plans on extending the network to Apple II computers in the future.

### A NEW DR OPERATING SYSTEM

Concurrent PC-DOS, version 3.2, is another attempt by Digital Research Inc. (DR) to win back a chunk of the micro-computer operating-system market it lost when DR's CP/M line of products received a sound trouncing from Microsoft's MS-DOS and PC-DOS for 16-bit computers. As such, Concurrent PC-DOS raises more questions than it answers.

The new operating system, which was released at the end of September, should not be confused with Concurrent DOS, version 3.1, an earlier DR package, though both products are multitasking operating systems that allow you to create multiple display windows for running an assortment of programs simultaneously.

Older Concurrent DOS closely resembles its CP/M ancestors. Although it can run both MS-DOS and CP/M-86 software in individual windows, it retains CP/M's command syntax. The utilities that come with the operating system have familiar CP/M names like PIP and STAT, and the Concurrent DOS package includes an assembler, a debugger, software hooks for GSX, a graphics interface, and DRNet, a networking interface.

Concurrent PC-DOS is much more of a consumer product. It is designed to be similar enough to both MS-DOS and CP/M in command structure and name that users familiar with either system can quickly feel at home with it. It's also the first Digital Research operating system to include real applications software—a visually oriented address filer that closely resembles Hewlett-Packard's Personal Cardfile for the HP 150 (though with-

(continued)

7400

74F00

NEW

74ALS00

DigitalKit™

Table with 4 columns: Part No., Pins, Price, and Description. Lists various 7400 series components like NAND gates, inverters, and decoders.

Table with 4 columns: Part No., Pins, Price, and Description. Lists various 74F00 series components like NAND gates, inverters, and decoders.

Table with 4 columns: Part No., Pins, Price, and Description. Lists various 74ALS00 series components like NAND gates, inverters, and decoders.

DT1050 — Applications: Teaching aids, appliances, clocks, automotive, telecommunications, language translations, etc. The DT1050 is a standard DIGITALKIT kit enclosed with 137 separate and useful words, 2 tones, and 5 different sentence durations.

MICROPROCESSOR COMPONENTS

Table with 4 columns: Part No., Price, Description, and Price. Lists microprocessor chips like 8080, 8085, 8088, 8086, and 8088P.

Table with 4 columns: Part No., Pins, Price, and Description. Lists various 74LS series components like NAND gates, inverters, and decoders.

Table with 4 columns: Part No., Price, Description, and Price. Lists microprocessor chips like 6502, 6502A, 6502B, 6502C, 6502D, 6502E, 6502F, 6502G, 6502H, 6502I, 6502J, 6502K, 6502L, 6502M, 6502N, 6502O, 6502P, 6502Q, 6502R, 6502S, 6502T, 6502U, 6502V, 6502W, 6502X, 6502Y, 6502Z.

Table with 4 columns: Part No., Price, Description, and Price. Lists microprocessor chips like 6800, 6801, 6802, 6803, 6804, 6805, 6806, 6807, 6808, 6809, 6810, 6811, 6812, 6813, 6814, 6815, 6816, 6817, 6818, 6819, 6820, 6821, 6822, 6823, 6824, 6825, 6826, 6827, 6828, 6829, 6830, 6831, 6832, 6833, 6834, 6835, 6836, 6837, 6838, 6839, 6840, 6841, 6842, 6843, 6844, 6845, 6846, 6847, 6848, 6849, 6850, 6851, 6852, 6853, 6854, 6855, 6856, 6857, 6858, 6859, 6860, 6861, 6862, 6863, 6864, 6865, 6866, 6867, 6868, 6869, 6870, 6871, 6872, 6873, 6874, 6875, 6876, 6877, 6878, 6879, 6880, 6881, 6882, 6883, 6884, 6885, 6886, 6887, 6888, 6889, 6890, 6891, 6892, 6893, 6894, 6895, 6896, 6897, 6898, 6899, 6900.

DT1050 DigitalKit™ ..... \$34.95 ea. MM54104 Processor Chip ..... \$14.95 ea.

DT1057 - Expands the DT1050 vocabulary from 137 to over 260 words. Includes 2 ROMs and specs. Part No. DT1057 ..... \$24.95 ea.

Table with 4 columns: Part No., Price, Description, and Price. Lists various digital kits and components like DT1050, DT1057, DT1058, DT1059, DT1060, DT1061, DT1062, DT1063, DT1064, DT1065, DT1066, DT1067, DT1068, DT1069, DT1070, DT1071, DT1072, DT1073, DT1074, DT1075, DT1076, DT1077, DT1078, DT1079, DT1080, DT1081, DT1082, DT1083, DT1084, DT1085, DT1086, DT1087, DT1088, DT1089, DT1090, DT1091, DT1092, DT1093, DT1094, DT1095, DT1096, DT1097, DT1098, DT1099, DT1100, DT1101, DT1102, DT1103, DT1104, DT1105, DT1106, DT1107, DT1108, DT1109, DT1110, DT1111, DT1112, DT1113, DT1114, DT1115, DT1116, DT1117, DT1118, DT1119, DT1120, DT1121, DT1122, DT1123, DT1124, DT1125, DT1126, DT1127, DT1128, DT1129, DT1130, DT1131, DT1132, DT1133, DT1134, DT1135, DT1136, DT1137, DT1138, DT1139, DT1140, DT1141, DT1142, DT1143, DT1144, DT1145, DT1146, DT1147, DT1148, DT1149, DT1150, DT1151, DT1152, DT1153, DT1154, DT1155, DT1156, DT1157, DT1158, DT1159, DT1160, DT1161, DT1162, DT1163, DT1164, DT1165, DT1166, DT1167, DT1168, DT1169, DT1170, DT1171, DT1172, DT1173, DT1174, DT1175, DT1176, DT1177, DT1178, DT1179, DT1180, DT1181, DT1182, DT1183, DT1184, DT1185, DT1186, DT1187, DT1188, DT1189, DT1190, DT1191, DT1192, DT1193, DT1194, DT1195, DT1196, DT1197, DT1198, DT1199, DT1200.

30099 1983 INTERSIL Data Book (13,566) ..... \$9.95

74HC High Speed CMOS

Table with 4 columns: Part No., Price, Description, and Price. Lists various 74HC series components like NAND gates, inverters, and decoders.

Table with 4 columns: Part No., Pins, Price, and Description. Lists various 74S/PROMS series components like NAND gates, inverters, and decoders.

Table with 4 columns: Part No., Price, Description, and Price. Lists microprocessor chips like 80C01, 80C02, 80C03, 80C04, 80C05, 80C06, 80C07, 80C08, 80C09, 80C10, 80C11, 80C12, 80C13, 80C14, 80C15, 80C16, 80C17, 80C18, 80C19, 80C20, 80C21, 80C22, 80C23, 80C24, 80C25, 80C26, 80C27, 80C28, 80C29, 80C30, 80C31, 80C32, 80C33, 80C34, 80C35, 80C36, 80C37, 80C38, 80C39, 80C40, 80C41, 80C42, 80C43, 80C44, 80C45, 80C46, 80C47, 80C48, 80C49, 80C50, 80C51, 80C52, 80C53, 80C54, 80C55, 80C56, 80C57, 80C58, 80C59, 80C60, 80C61, 80C62, 80C63, 80C64, 80C65, 80C66, 80C67, 80C68, 80C69, 80C70, 80C71, 80C72, 80C73, 80C74, 80C75, 80C76, 80C77, 80C78, 80C79, 80C80, 80C81, 80C82, 80C83, 80C84, 80C85, 80C86, 80C87, 80C88, 80C89, 80C90, 80C91, 80C92, 80C93, 80C94, 80C95, 80C96, 80C97, 80C98, 80C99, 80C00.

Table with 4 columns: Part No., Price, Description, and Price. Lists microprocessor chips like 80C01, 80C02, 80C03, 80C04, 80C05, 80C06, 80C07, 80C08, 80C09, 80C10, 80C11, 80C12, 80C13, 80C14, 80C15, 80C16, 80C17, 80C18, 80C19, 80C20, 80C21, 80C22, 80C23, 80C24, 80C25, 80C26, 80C27, 80C28, 80C29, 80C30, 80C31, 80C32, 80C33, 80C34, 80C35, 80C36, 80C37, 80C38, 80C39, 80C40, 80C41, 80C42, 80C43, 80C44, 80C45, 80C46, 80C47, 80C48, 80C49, 80C50, 80C51, 80C52, 80C53, 80C54, 80C55, 80C56, 80C57, 80C58, 80C59, 80C60, 80C61, 80C62, 80C63, 80C64, 80C65, 80C66, 80C67, 80C68, 80C69, 80C70, 80C71, 80C72, 80C73, 80C74, 80C75, 80C76, 80C77, 80C78, 80C79, 80C80, 80C81, 80C82, 80C83, 80C84, 80C85, 80C86, 80C87, 80C88, 80C89, 80C90, 80C91, 80C92, 80C93, 80C94, 80C95, 80C96, 80C97, 80C98, 80C99, 80C00.

74C-C/MOS

Table with 4 columns: Part No., Price, Description, and Price. Lists various 74C-C/MOS series components like NAND gates, inverters, and decoders.

CA-LINEAR

Table with 4 columns: Part No., Price, Description, and Price. Lists various CA-LINEAR series components like op-amps, comparators, and converters.

CD-CMOS

Table with 4 columns: Part No., Price, Description, and Price. Lists various CD-CMOS series components like op-amps, comparators, and converters.

DATA ACQUISITION

Table with 4 columns: Part No., Price, Description, and Price. Lists various data acquisition components like ADCs, DACs, and converters.

LINEAR

Table with 4 columns: Part No., Price, Description, and Price. Lists various linear components like op-amps, comparators, and converters.



Low Profile (Pin) Sockets Solderless (Gold) Standard

Table with 4 columns: Part No., Price, Description, and Price. Lists various socket and standard components.

\$10.00 Minimum Order - U.S. Funds Only. California Residents Add 8 1/2% Sales Tax. Shipping - Add 5% plus \$1.50 Insurance. Send S.A.S.E. for Monthly sales flyer!

Spec Sheets - 30c each. Send \$1.00 Postage for your FREE 1983 JAMECO CATALOG. Prices Subject to Change.

1355 SHOREWAY ROAD, BELMONT, CA 94002. 12/84 PHONE ORDERS WELCOME - (415) 592-8097 Telex: 176043

30003 1982 Nat. Linear Data Book (1952 pgs.) ..... \$11.95

**FREE SHIPPING**WEST OF MISSISSIPPI  
EAST - 1/2 UPS CHARGESCALL FREE  
1-800-841-2748**COMPUTERS**

|                   |       |            |
|-------------------|-------|------------|
| ALTOS 580-20      | ..... | \$3350     |
| ALTOS 586-20      | ..... | \$5350     |
| ALTOS 986-40      | ..... | SCALL      |
| APPLE LOOK-A-LIKE | ..... | SCALL      |
| IBM PC            | ..... | SCALL      |
| LEADING EDGE PC   | ..... | SCALL      |
| NEC 8201          | ..... | \$449      |
| SANYO 550-555     | ..... | SAVE SCALL |

**TELEVIDEO**

|       |       |        |        |       |        |
|-------|-------|--------|--------|-------|--------|
| TPC I | ..... | \$1499 | TPC II | ..... | \$1795 |
| 1605  | ..... |        |        | ..... | SCALL  |

**NORTHSTAR**

|     |       |        |       |       |        |
|-----|-------|--------|-------|-------|--------|
| ADV | ..... | \$1899 | 15MEG | ..... | \$3799 |
|-----|-------|--------|-------|-------|--------|

**PRINTERS**

|                      |       |        |
|----------------------|-------|--------|
| ABATI                | ..... | \$369  |
| RADIX 10             | ..... | \$479  |
| DAISYWRITER 48K      | ..... | \$839  |
| EPSON                | ..... | SCALL  |
| GEMINI 10X           | ..... | \$245  |
| JUKI 6100            | ..... | \$409  |
| OKIDATA (LOW PRICES) | ..... | SCALL  |
| QUME 1140+ W/INF     | ..... | \$1365 |

**CITOH**

|            |       |       |       |       |        |
|------------|-------|-------|-------|-------|--------|
| 8510       | ..... | \$319 | 1550  | ..... | \$499  |
| F10-40C PS | ..... | \$899 | F1055 | ..... | \$1179 |

**DIABLO**

|     |       |       |         |       |        |
|-----|-------|-------|---------|-------|--------|
| 620 | ..... | \$769 | 630 API | ..... | \$1669 |
|-----|-------|-------|---------|-------|--------|

**NEC**

|      |       |        |      |       |        |
|------|-------|--------|------|-------|--------|
| 3550 | ..... | \$1495 | 3510 | ..... | \$1235 |
| 7710 | ..... | \$1645 | 2030 | ..... | \$659  |

**TERMINALS - MONITORS**

|                 |       |       |
|-----------------|-------|-------|
| ALTOS II        | ..... | \$749 |
| QUME 102G       | ..... | \$425 |
| WYSE 50         | ..... | \$485 |
| TELEVIDEO 924   | ..... | \$655 |
| TELEVIDEO 950   | ..... | \$895 |
| TELEVIDEO 970   | ..... | \$965 |
| AMDEK 300G      | ..... | \$129 |
| AMDEK 300A      | ..... | \$145 |
| AMKEK COLOR I+  | ..... | \$275 |
| AMDEK COLOR II+ | ..... | \$399 |
| B.M.C. COLOR    | ..... | \$235 |
| PRINSTON HX12   | ..... | \$464 |

**DISK DRIVES - MODEMS**

|                        |       |       |
|------------------------|-------|-------|
| INDUS APPLE            | ..... | \$259 |
| MICRO SCI A2           | ..... | \$185 |
| INDUS COMMODORE        | ..... | \$315 |
| INDUS ATARI            | ..... | \$299 |
| ASTRA ATARI            | ..... | \$525 |
| PROMODEM 1200          | ..... | \$325 |
| HAYS SMART MODEM       | ..... | \$199 |
| SMARTMODEM 1200        | ..... | \$469 |
| SMARTMODEM 1200B       | ..... | \$415 |
| MICROMODEM II E        | ..... | \$235 |
| RIXON 212A             | ..... | \$449 |
| U.S. ROBOTICS PASSWORD | ..... | \$315 |

**1st PLACE**COMPUTER SYSTEMS  
13422 N. CAVECREEK RD.

PHOENIX, AZ. 85022

OTHER INFORMATION: 602-867-9897



Free shipping is on UPS ground only.

Send cashier's check or money order ..... all other checks will  
delay shipping two weeks.

Prices &amp; availability subject to change without notice.



## BYTE WEST COAST

**COMPANIES MENTIONED****DIGITAL RESEARCH INC.**60 Garden Court  
POB DRI  
Monterey, CA 93942  
(800) 772-3545  
ext: 400 in California  
(800) 227-1617  
ext. 400 elsewhere**MOLLARD SYSTEMS DESIGN INC.**1977 O'Toole Ave., Suite B106  
San Jose, CA 95131  
(408) 943-0163**ROLM CORPORATION**4900 Old Ironside Dr.  
Santa Clara, CA 95050  
(408) 986-3025  
in California, Alaska, Hawaii  
(800) 538-8154 elsewhere**SYTEK INC.**1255 Charleston Rd.  
Mountain View, CA 94039  
(415) 966-7330

out the touchscreen interface), a communications program called DR Talk that's a modestly revised version of the popular PC-Talk III freeware program, a sophisticated menu generator, and a flexible text editor that replaces DR's venerable ED line editor (the new editor, DR Edix, is licensed from Emerging Technologies of Colorado, which also sells it as just plain Edix). The assembler and debugger are no longer included but can be purchased as part of a "programmer's toolkit" for between \$50 and \$100. Neither GSX nor DRNet are part of the Concurrent PC-DOS package, and the program can only handle a maximum of two users.

But Concurrent PC-DOS has some nice features. It will recognize, read, and write both CP/M and MS-DOS disks and can run CP/M programs stored on MS-DOS disks and vice versa. Its front-end file-handling utility and extensive help screens simplify novice use. Full MS-DOS 2.xx file and directory structures are supported, and Concurrent PC-DOS makes changes, and removes named directories with ease, while still allowing you to employ the CP/M "user area" convention.

However, windowing remains something of a chore. You can create a multitude of windows for application programs all over the screen, but because window creation does not employ a mouse (like Visi On, Microsoft Windows, and DesQ), you have to be adept at entering lengthy and

rather cryptic command lines. And if your software was designed to avoid the operating system and write directly to the screen, the display can be corrupted and final results are unpredictable. Though multitasking is indeed possible, you have to keep close watch over memory allocation and usage to avoid disaster. Finally, not all 8088/8086 software will run under Concurrent PC-DOS, and that which will may not be able to run in more than one window at a time. (The operating system comes with a list of acceptable software that includes most top-selling programs, such as WordStar, MultiMate, dBASE II, Lotus 1-2-3, the PFS series, etc.)

Looking at the prospects for the program, there is as yet no indisputable proof of a crying demand for concurrency on the 8088-based IBM PC and IBM is responding to that challenge with TopView, a product of its own. The ability to mix CP/M-86 and MS-DOS software is a marginal benefit when you consider how little CP/M-86 software has been sold to date. Also, in an era when "ease of use" is a watchword, an operating system that requires as much care to operate as this one does seems something of an anachronism. Lastly, as most 16-bit computers are sold with an MS-DOS operating system to begin with, one wonders how many consumers will be willing to shell out an additional \$295 for a second operating system that's a mixed blessing. ■

Circle 14 for Dealer inquiries.

Circle 15 for End-User inquiries. →

# Multi-User PC

With **Advanced Digital's** PC-Slave  
and "Dumb" Terminals



"True" multi-user PC operation. Using inexpensive "dumb" terminals, you can run PC-DOS, MS-DOS, CCP/M and popular applications software such as LOTUS 1-2-3, MULTI-PLAN, and WORDSTAR.

## Up To 12 Users

Adding users to your PC is simple . . . just plug PC-SLAVE's into expansion slots and connect the terminals. ADC's Executive software turns your PC into the master processor and shares disks, peripherals and data with the slave PC's. By using the ADC PC-EXBUS expansion chassis, you can build clusters of up to 12 users.

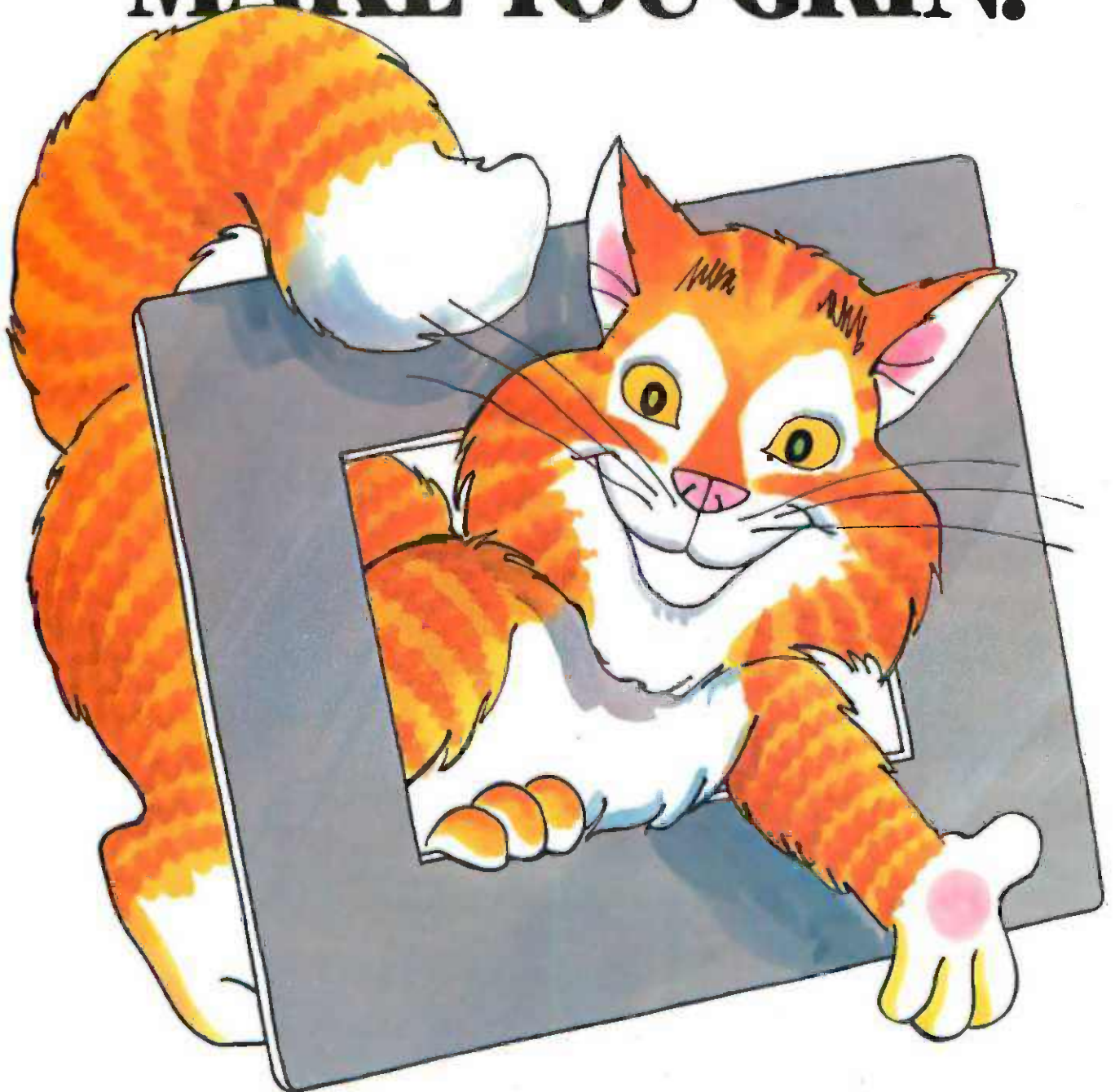
**ADVANCED  
DIGITAL  
CORPORATION**

Advanced Digital  
5432 Production Drive, Huntington Beach, CA 92649 • Tel. (714) 891-4004  
Telex 183210 ADVANCED HTBH

Advanced Digital U.K. Limited  
27 Princess St., Hanover Square  
London W1R8NO • United Kingdom  
409-0077 • 409-3351 Telex 265840 FINEST

\*RTNX is a trademark of Alloy Computer Products  
\*PC-DOS is a trademark of International Business Machines  
\*MS-DOS is a trademark of Microsoft Corporation  
\*CCP/M is a trademark of Digital Research Corporation  
\*LOTUS 1-2-3 is a trademark of Lotus Development Corporation  
\*Multi-Plan is a trademark of Micro Soft Corporation  
\*Wordstar is a trademark of MicroPro Corporation

*Slide Cat* FROM KODAK INTRODUCES:  
**THE CAT-QUICK  
SLIDE-MAKERS  
THAT WILL  
MAKE YOU GRIN.**







# Turn CRT Data Into A Slide, Cat-Quick.

"Now you can make presentation-quality *instant* slides from CRT screens, one at a time. Slides that integrate beautifully into the rest of your show. It's like having your own instant slide department. And you don't have to be an audio-visual professional to do it.

"Kodak's new cat-quick slide-makers are a versatile group of



**KODAK INSTAGRAPHIC CRT Slide Imager**  
Contains KODAK INSTAGRAPHIC Camera Back, KODAK INSTAGRAPHIC Slide Module, and KODAK INSTAGRAPHIC CRT Cone. Just add the appropriate CRT adapter to make instant presentation-quality slides that integrate beautifully into the rest of your show. There's even an optional module that lets you make prints.



**KODAK CRT Adapters**  
Make an instant slide or print from your screen, any screen—9-, 12-, 13-, even 19-inch—with your choice of adapter to fit between the imager and the CRT screen.

**KODAK INSTAGRAPHIC Slide Mounter and Mounts**

Last step. Mount your slide quickly and easily with this simple-to-use device. Eases film into the slide mount automatically, so you never have to snap the mount together or touch the image area.



"To learn more about these new state-of-the-art

conversion from CRT to slide can save you time, and money! For slides from hard copy use our

sleek copy stand. Both methods are easy and affordable.

"Your options are many. You can buy one product, or the entire line. Make a single slide or an entire presentation. Prove a point, or wow an audience.

Even use our camera back, module, and film to photograph images electronically transferred with many manufacturers' video image recorders! And get results that make a grin begin.



**KODAK INSTAGRAPHIC Copy Stand**

Use this well-designed unit to make slides of pictures, printed material, and artwork up to 11" x 17". Or small, three-dimensional objects. Right in your office. In ordinary room light.

state-of-the-art products designed to convert computer-generated material into slides, fast!

"With our new imager, you can make instant slides (or prints) from just about any data that appears on your CRT screen...pie charts, bar charts, organization charts, etc. And you can use just about any size terminal—9-, 12-, 13-, even 19-inch screens. Direct

Circle 138 on inquiry card.



**KODAK INSTAGRAPHIC Color Slide Film**  
Shoot just one slide or an entire presentation. One-at-a-time exposure means you waste no film, waste no money. If you need instant color prints of CRT displays, use KODAK INSTAGRAPHIC Color Print Film and substitute the KODAK INSTAGRAPHIC Print Module.

products, call 1 800 44KODAK, Ext 233 (1 800 445-6325, Ext 233), or use the coupon below. Or contact your local dealer in Kodak audiovisual products, listed in the Yellow Pages under 'AV equipment and supplies.' "



**New cat-quick slide-makers from Kodak.**  
**THEY'RE GONNA MAKE YOU GRIN.**

Eastman Kodak Company, Dept 412L  
Motion Picture and Audiovisual Markets Division  
Rochester, NY 14650

- Please have a representative call me. A8071
- Please send me your informative Slide Cat brochure. A8072

NAME \_\_\_\_\_

TITLE \_\_\_\_\_

COMPANY \_\_\_\_\_

ADDRESS \_\_\_\_\_

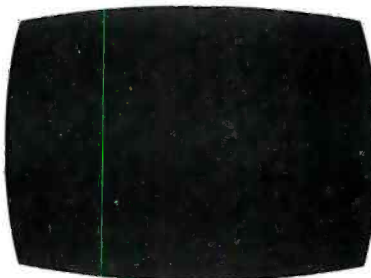
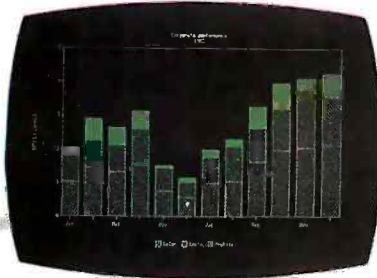
CITY \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_

PHONE \_\_\_\_\_

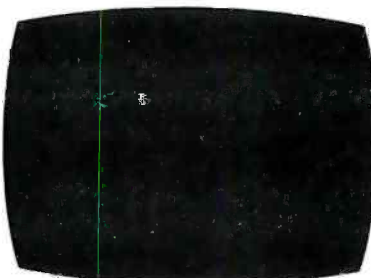
# IBM MONOCHROME GRAPHICS. NO COMPROMISE.



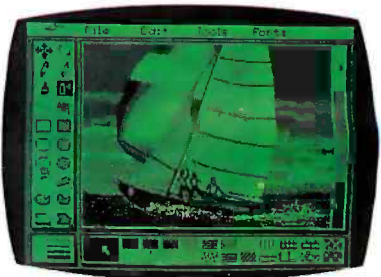
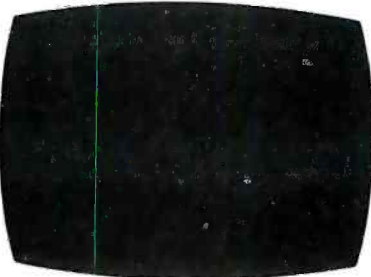
Lotus™ 1-2-3™



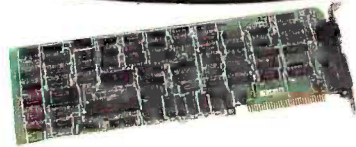
Flight Simulator®



Mouse Systems™  
PC Paint



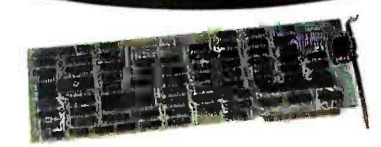
IBM PC Tutorial®



The Hercules Graphics Card™ \$499



The IBM® Monochrome Adapter \$250



The Paradise Modular Graphics Card™ \$395

The Paradise Modular Graphics Card is the *only* video card that runs all popular IBM color/graphics software—full-screen—on an IBM (or equivalent) monochrome monitor. *Unmodified.*

Right off the shelf.

And not just ordinary monochrome: Crisp, full-screen, flicker-free monochrome graphics translated in up to 16 shades.

- Includes IBM-compatible color graphics on an RGB or composite video monitor.

- Optional memory (up to 384Kb), clock/calendar or floppy disk controller, and parallel, serial or game ports available.

*All in a single PC or XT slot.*

*This may be the only card you'll ever need.*

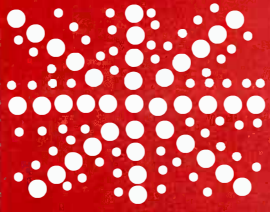
**Call today for more information:**

**1-800-527-7977, In CA: 1-800-822-2020 (Dept. 135)**

150 North Hill Drive, Brisbane, CA 94005, 415-468-6000

# PARADISE

*You can measure it.*



# Prolog on Microcomputers

Logical  
propositions  
replace  
computer-  
oriented  
instructions

BY DICK POUNTAIN

In a recent column (September, page 415) I alluded to the relatively great importance of the Prolog language in European artificial-intelligence (AI) laboratories. Interest in Prolog is hotting up in the U.S.A. (where LISP has been the traditional AI tool for many years). As the language is now available on humble home computers in the U.K., I'll devote this month's column to a brief look at micro-Prolog, a dialect written originally for the Z80, which was the first microcomputer implementation of Prolog.

The name Prolog is a contraction for "programming in logic," and the intention of its inventors was to create a computer language in which logical propositions about known facts could replace computer-oriented instructions about data structures. In other words, Prolog was to be (and to a large degree is) the highest-level computer language yet devised. Prolog was first implemented at the University of Marseilles in 1972 by Colmerauer and Rousell, and since then many mainframe dialects have been produced at various universities, including Edinburgh, London's Imperial College, and Budapest. Much publicity has been given to the adoption of Prolog by Japanese workers as the "core" language for their Fifth Generation project.

The philosophy of logic programming is fundamentally different from that of other computer languages. In the terminology of Prolog users, most languages are imperative: to solve a problem you must find a way to tell the computer what to do (in converting an algorithm into a program you are seeing things from the computer's point of view, giving it objects that it understands). Prolog sets out to be declarative: to solve a problem you tell the computer the facts you know already and, in the ideal case, the way the machine works it out is of no concern to you.

Here's an example that illustrates the difference. Multiply three by five in your head. Now ask yourself how you did it. Unless you

are very unusual, you will not have used any sort of multiplication algorithm for so simple a calculation. In fact, you have a built-in database of such results, which you learned at school. If instead I ask you to multiply 56134 by 678103, then you will have to resort to an imperative method (long multiplication), which explicitly sets out the steps required to achieve an answer, though at the bottom level of this calculation you will still call upon your declarative knowledge to do the single-digit partial multiplications.

Computers are still at a stage where the simplest of activities have to be spelled out in an imperative way, painstakingly describing, in machine terms, the steps that a human being takes for granted. The ideal of logic programmers is to reach a stage where by formally specifying your problem (using a logical predicate calculus), you will have written the program to solve it; the specification is the program.

Prolog is not yet by any means a pure-logic language. It's much more declarative than other languages, but it still runs on a real computer, which you can't ignore completely. Prolog programmers have to read their programs in two distinct ways: a declarative (problem-oriented) reading and an imperative reading that considers matters such as control flow (which should ideally be of concern only to the computer).

## MICRO-PROLOG

Written by Frank G. McCabe and Keith L. Clark, micro-PROLOG is a simple dialect of Prolog. It was written at Imperial College in the Logic Programming Unit, which is headed by Prolog guru Professor Robert Kowalski. The first version appeared over two years ago, written in Z80 assembler for CP/M 2.2 systems. Since then versions have been produced for the Sinclair Spectrum (Z80), the Acorn BBC Micro (6502), and for 8088-based systems including the IBM PC under MS-DOS or CP/M-86. Logic Program-

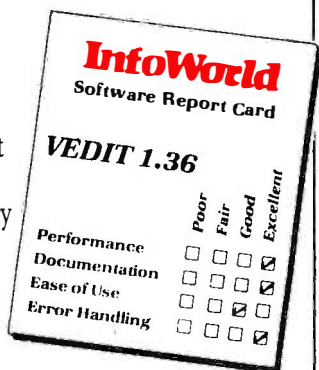
*(continued)*

Dick Pountain is a technical author and software consultant living in London, England. Address correspondence to him to BYTE, POB 372, Hancock, NH 02349.



**Easy to Use  
Word Processor with the  
Power of BASIC**

VEDIT has been acclaimed for the last four years the industry standard in text editing.



Now there's VEDIT PLUS.

VEDIT PLUS is easy to learn, yet can do things far beyond ordinary word processors:

- Sort a mailing list
- Perform arithmetic computations
- Compare files
- Edit multiple files of unlimited size

The power of VEDIT PLUS is equal to a high-level language - it gives you:

- If-then-else decision making
- Pattern matching
- User prompts and input
- An optional Z80 to 8086 translator

Expect a lot from VEDIT PLUS. It's from CompuView - nationally recognized for user support.

For a demo disk, more information or the dealer nearest you call toll free:

1-800-327-5895

VEDIT PLUS is available for practically every microcomputer . . . \$225

**CompuView**  
PRODUCTS, INC.

1955 Pauline, Ann Arbor, Mi 48103  
(313) 996-1299 • (800) 327-5895

BYTE U.K.

*Micro-PROLOG has floating-point arithmetic—quite an achievement given that there are many C compilers and LISPs that don't.*

ming Associates, a company set up by the author and colleagues, sells the CP/M and MS-DOS versions.

Prolog can be, like LISP, rather greedy for both memory and processor time; to make it work usefully on a microcomputer, micro-PROLOG has a much simplified syntax compared to "standard" systems (in the U.K., Edinburgh DEC-10 Prolog is considered the standard). It is, however, extensible, either by adding a range of utility modules provided or by the user's own code, written in micro-PROLOG, assembly language, or compiled languages like FORTRAN.

One of the supplied modules includes a front-end program called Simple, which provides a friendlier syntax than the LISP-like list form used internally. (Programs entered under Simple are translated into internal form.) Experienced users can dispense with this, and various other aids, to free more space. In the interests of clarity I shall use Simple syntax for all the examples here. The version referred to is 3.0 for CP/M 2.2 throughout.

**PROGRAMMING  
IN MICRO-PROLOG**

The micro-PROLOG language is, like BASIC and LISP, an interpreted language. A program consists of a database of facts and rules that you query to solve problems. Typical facts look like this:

John likes Maple-Walnut  
Mary likes Butter-Pecan  
John male  
Mary female

Simple also allows such relation-

ships to be expressed in a prefix form:

likes (John Maple-Walnut)  
female (Mary)

This has advantages for relations that involve more than two things:

gives (John Mary ice cream)

though the infix form gives a more English-like appearance (which may or may not be a good thing). You can enter the preceding facts in either form or a mixture of both.

You can add facts about relationships of this sort to the database, list them (by *relation* name, e.g., "list likes"), delete them, or edit them using a special structure editor written in micro-PROLOG.

Once a database exists, you can make queries such as

is (John male)  
YES

or

which (x : x likes Maple-Walnut)  
John  
No (more) answers

This latter query demonstrates the heart of Prolog programming: the search for pattern matches that result in variables becoming bound to the matched values. Logic programmers say that they become "instantiated." It's not dissimilar from the process of using wild-card matches in an operating system like CP/M or PC-DOS, except that instead of \* or ? you use named variables that come back containing the values that match. This search facility is already built into Prolog and thus requires no programming effort from you at all; this is the mainspring of its power.

The Simple front-end program has the useful effect of automatically printing the value of the instantiated variables at the terminal (along with the message "No (more) answers") when a query is evaluated. The internal form of micro-PROLOG is more austere and free of side effects; it only prints the values if you explicitly add an instruction to do so, using the PP (print) relation. Otherwise, a query will

## BYTE U.K.

reply with nothing at all if it succeeds and a ? if it fails, which can be confusing for the beginner. I used the word "succeed" because Prolog programs can be regarded as either failing or succeeding, depending upon whether they can find a match in the database—for this reason queries often are referred to as "goals." In common with functional languages like LISP, the variables in a Prolog program only have a value during evaluation and cease to exist when it finishes.

If more than one person is known to like maple walnut ice cream, the which query will search for all of them and return something like

John  
Fred  
Wilma  
No (more) answers

You could impose a further condition to narrow the search, so that

which (x : x likes Maple-Walnut  
and x female)

would only find Wilma.

You can use logical operators to combine existing relations and build rules, which themselves go into the database as new relations:

x fails-to-impress y if  
y likes Maple-Walnut  
and gives (x y Butter-Pecan)

A rule differs from a fact in that you don't have to enter any instances; Prolog deduces them itself from its existing knowledge. You'd use it in the form which (x : x fails-to-impress Wilma). This deductive ability is, of course, what makes Prolog suitable for writing expert systems. You can probably see a certain symmetry in this query. It would be just as easy to ask which (y : John fails-to-impress y). Such symmetry is characteristic of Prolog programs, which are often reversible; take for instance the arithmetic relation SUM:

which (x : SUM(4.5 6.3 x))  
10.8  
No (more) answers

(micro-PROLOG has floating-point

arithmetic, which is quite an achievement given that many microcomputer C compilers and LISPs don't). You also can use SUM "backward" to do subtraction:

which (z : SUM(35 z 97))  
62  
No (more) answers

Once we get into rules and queries involving several variables and logical relations, it helps to know how Prolog performs its searches. Facts are stored in the database in the order in which they were entered, and Prolog searches from the top. When two (or more) conditions are to be met, say, "John loves x and x likes spinach," Prolog tries to fulfill the first one (say, with Mary), then tries to comply with the second. If it can't do this, because Mary doesn't like spinach, "backtracking" occurs; in other words, Prolog abandons Mary and tries to find another solution to the first query, then starts again on the second. If Mary *did* like spinach, backtracking still would occur in case John has any polygamous leanings. All of this is again automatic and built into Prolog, and it is usually totally transparent to the programmer.

The departures from pure "declarative" style in Prolog often arise when you must intervene in the backtracking process because a solution is dependent on the ordering of the database. You do this with a construct called the "cut" (signified by /), which inhibits backtracking; just like GOTO among Pascal programmers, the cut is regarded as a distasteful necessity.

Prolog shares many features with LISP; in particular it works with lists and relies heavily on recursion. As an example of a recursive rule, take the definition of an ancestor given that the relation "parent-of" already exists:

x ancestor-of y if x parent-of y  
x ancestor-of y if z parent-of y  
and x ancestor-of z

Notice that here we have a pair of rules. When reading such a pair it helps to imagine an implied "or" between them; x is an ancestor if they're

(continued)

# EXPOTEK

## 1-800-528-8960

### ORDER LINE

#### Guaranteed Low Prices

All prices are for cash, cashiers check or money order. Allow 4 weeks bank clearance for personal checks. C.O.D.'s, Visa, MC, and P.O.'s accepted at additional charge. Prices subject to change. Returns must have authorization number and are subject to a restocking charge.

#### COMPUTERS & TERMINALS

|                                                                                                                                                            |                                                                                                                                                              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>ALTOS</b><br><b>APPLE</b><br><b>COLUMBIA</b><br><b>COMPAQ</b><br><b>FRANKLIN</b><br><b>IBM</b><br><b>LEADING EDGE</b><br><b>NEC</b><br><b>NORTHSTAR</b> | <b>SANYO</b><br><b>TELEVIDEO</b><br><b>ZENITH</b><br><b>ADDS</b><br><b>ESPIRIT</b><br><b>QUME</b><br><b>102.G. &amp; 389</b><br><b>VISUAL</b><br><b>WYSE</b> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|

#### MODEMS

|                                               |         |
|-----------------------------------------------|---------|
| Novation-Access 1-2-3 w/Crosstalk XVI .....   | 429     |
| Smart Cat 300/1200 .....                      | 439     |
| Hayes Smart Modem 300/1200 .....              | 219/479 |
| 1200B .....                                   | 429     |
| Anchor Volksmodem .....                       | Call    |
| Signalman Mark VII/XII .....                  | 119/299 |
| Microcom Era-2 Internal Model w/Software..... | 370     |

#### ACCESSORIES

|                                      |            |
|--------------------------------------|------------|
| AST latest boards .....              | Call       |
| Chips & Microprocessors .....        | Call       |
| GSI Surge Protector .....            | 59         |
| Hercules Graphics Card .....         | 369        |
| Kraft Joysticks (IBM or Apple) ..... | 29         |
| Paradise Multidisplay Card .....     | 379        |
| Quadram all products .....           | Call       |
| Ribbons (doz.) & Printwheels .....   | Call       |
| Standby Power Systems .....          | Best Price |
| Switch Boxes Parallel & Serial ..... | Save       |
| Tractors & Sheetfeeders .....        | Call       |

#### DISK DRIVES

|                                       |      |
|---------------------------------------|------|
| Alpha Omega 10MB w/controller .....   | 799  |
| TEAC 55B slimline DSD .....           | 179  |
| TEAC 55F slimline DSQD .....          | 249  |
| Tandon 100-1 .....                    | 150  |
| Tandon 100-2 .....                    | 199  |
| Maynard 10MB-WS-2 with EPROM .....    | 1149 |
| Tallgrass Tech Hard Disk System ..... | Call |
| Microsci A2 .....                     | 189  |
| CDC, Qume, Shugart .....              | Call |

#### MONITORS

|                              |      |
|------------------------------|------|
| Amdek .....                  | Call |
| Leading Edge Color RGB ..... | 399  |
| PGS-HX-12 .....              | 459  |
| PGS MAX-12 Amber .....       | 169  |
| Zenith 122/123 .....         | 79   |

#### PRINTERS

|                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>C. Itoh</b><br>1550 AP ..... 499<br>1550 BCD ..... 549<br>8510 AP ..... 319<br>8510 BC2 ..... 419<br>8510 BPI ..... 389<br>A10-20 ..... 449<br>F10-40 ..... 899<br>F10-55 ..... 1199<br><b>Daisywriter</b><br>2000 ..... 985<br><b>Diablo</b><br>620 API ..... 739<br>630 API ..... 1699<br>630 ECS ..... 1999<br><b>Epson</b><br>FX80 ..... 329<br>Others ..... Call | <b>Juki</b><br>6100 ..... 429<br><b>Okidata</b><br>All Models ..... Call<br><b>Panasonic</b><br>All Models ..... Call<br><b>Qume</b><br>Letter Pro ..... 629<br>11/40 WIBM IF..1369<br>11/55 WIBM IF..1569<br><b>Star Microtronics</b><br>All Models ..... Call<br><b>Tally</b><br>160L w/Tractor...559<br>180L w/Tractor...779<br><b>Toshiba</b><br>1340 ..... 749<br>1351 ..... 1359 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

#### 2017 E. Cactus, Phoenix, AZ 85022 (602) 482-0400

DECEMBER 1984 • BYTE 357

a parent or if they're an ancestor of a parent.

The language micro-PROLOG uses a simple but elegant notation for lists—the expression (x|y) represents a list whose head is x and tail is y. If we match this expression to the list (fish chips peas) then x would be instantiated to (fish) and y to (chips peas). Though this notation can cause your brain to hurt at first, it is in fact very powerful and general. It's easy to write LISP-style functions if you want them; the definitions of car, cdr, and cons look like this:

```
car((x|y) x)
cdr((x|y) y)
cons(x y (x|y))
```

and you could use them so:

```
which(x : car((flip flop fly) x))
flip
No (more) answers
```

It may appear to you, from the scanty evidence presented so far, that Prolog is just a glorified database-query language. This is not so; it's a very general-purpose language, and, perhaps surprisingly, you can use it for system programs. Sizable parts of micro-PROLOG are written in micro-PROLOG, including the editor and the Simple front end.

As an example of a non-database program, why not the good old factorial, as I don't seem to have got it in yet this month:

```
factorial (1 1)
factorial (x y) if 1 LESS x
and SUM (z 1 x)
and factorial (z y1)
and TIMES (x y1 y)
```

The first clause is merely the assertion that the factorial of 1 is 1. The second clause can only succeed if x is greater than 1 (the LESS relation)

and proceeds by subtracting 1 and finding the factorial of the result in traditional fashion. The y1 is just another variable name; micro-PROLOG, for implementation reasons, only allows the letters x, y, or z optionally followed by a number as variable names, like some of the older BASICs. The program is used as in which(y : factorial(10 y)). In this case, you can't use the relation backward to find a number whose factorial is supplied, because LESS is only a test—it can't generate all the numbers that are greater than 1.

One of the more advanced features of micro-PROLOG is its "query the user" facility. If a program fails to find a match in the database, you can make it ask the user to supply the necessary information, add it to the database, and then succeed. This offers a neat way to create expert systems.

A somewhat similar facility is provided in the error-handling routine. When an error occurs (under Simple) you are given a number of options: the query can be made to fail or succeed; you can issue a command (e.g., to load a file) or edit the program; you can supply missing information to the database and then in all cases resume evaluation where it left off. The error response also can be customized by writing micro-PROLOG programs to take whatever action you wish.

#### DEVELOPMENT AIDS

The error trap just described creates a very powerful debugging environment, but there is more. You can load a trace package that goes well beyond those found in most other languages. As a query is evaluated step by step, the source code is displayed with the variables "filled in" with their current values. Again, there are options to succeed or fail particular conditions or to skip the trace for bits you're not interested in and merely show the result.

A structure editor is supplied to edit items in the database, but like some LISP editors it will not be to everyone's taste (mine included). It works

(continued)

**IF POWER FAILS, DATASAVER® TAKES OVER!**

**PROTECTION** - saves data during power failures.  
- saves hardware from overvoltage transients.

**PORTABILITY** - allows mobile or extended holdup time using auxiliary 12 volt battery.

**FEATURES** - internal battery provides 5 min. + operating time - AC line conditioning  
- audible and visual alarms, interrupt signal - compact, desktop styling  
- no installation required.

200 WATT - \$495 / 90 WATT - \$350  
For special applications and product information, call 805-541-4160.

Instant power order line  
**805-541-4161**

**CUESTA SYSTEMS, INC.**  
3440 Roberto Court, San Luis Obispo, California 93401

**INSTANT AC POWER**



**SPEED  
300  
CPS**

North  
Atlantic  
**Qantex 7065**

# New Qantex 7065. A fast printer at a slow price.

No matter how heavy the traffic, our new Qantex 7065 multimode printer will keep your documents flowing smoothly. At a very affordable price.

Use it for data processing, and the 7065 zips along at 300 cps bidirectionally. Both user-defined formats and six-part forms capability are standard.

Switch to word processing and the 7065 delivers near letter quality at 125 cps. Plus features such as proportional spacing, justification, auto-underline and bold.

And as a 65 cps letter quality

printer, it's fast enough and quiet enough to leave the competition in the dust. You get high density, double pass printing in your choice of some 20 fonts.

The 7065 is also a dot addressable graphics printer with resolution to 144 x 144 dots per inch and a full complement of line drawing graphics.

Besides being very fast, the 7065 is very compatible — with IBM, Apple, Lotus 1-2-3 and just about any other personal computer or software on the market. It offers built-in bar code capability. And its 500-million-plus char-

acter print head and industrial quality construction are designed for long, hard use.

To find out how quickly the Qantex 7065 could bring your information processing up to speed, contact Qantex for details or a demo. Qantex, 60 Plant Avenue, Hauppauge, NY 11788. Call toll-free 800-645-5292; in New York State 516-582-6060.

 **north atlantic**  
**Qantex**



# About Bulls & Bears & Savings Bonds.

The stock market says that bulls are good and bears are bad. But if you buy U.S. Savings Bonds through the Payroll Savings Plan, you can get the most out of both markets.

Rates are high during bull markets, so the variable interest rate you get on Bonds lets you share in those higher returns.

But if the bear takes over and rates fall, don't panic; you're protected by a guaranteed minimum of 7.5%.

Just hold your Bonds 5 years or more, and you can ride the bull and beat the bear.

**Take  
stock  
in America.**



on the stored form of programs in internal-list syntax, rather than the Simple infix syntax, which is an immediate source of confusion. You edit by moving up and down in the levels of the list structure, rather than by moving the cursor through the text. Fortunately, you can always use an external editor such as WordStar, and for large jobs I suspect most people will.

You also can write and save modules similar to those used for the system options. You load a module en bloc and it only reveals those definitions that are on its export list; similarly, it only can use external definitions on its import list. All names not on the lists are private to the module and may be safely used outside it. You can kill a loaded module with a single command.

Random and sequential files of formatted records are supported and there is access to a variety of CP/M functions.

Virtual memory support is provided by allowing a program to refer to relations held on disk rather than in main memory. The clauses defining the relation in the database are merely replaced by a single clause referring to a disk file via the RPRED relation. Combined with the ability to have four files open simultaneously, this permits you to easily program quite sophisticated database-management applications.

For more experienced programmers there is a second front-end program called Micro that has the advantage of taking up less memory than Simple. It accepts programs in internal-list syntax but provides some of the nice features of Simple such as the error trapping. For the record, this is what internal syntax looks like:

((ancestor-of x y)(parent x y))

Users of the 8088 version also get a third front end called Dec that allows them to enter programs in the Edinburgh syntax.

While on this subject, there is a serious reason for writing in internal (rather than Simple) syntax, apart

(continued)



# 100 MHz scope, counter, timer, multimeter: All one integrated system.

**100 MHz dual time base scope.**

3.5 ns risetime; sweeps from 0.5 s to 5 ns/div; alternate sweep;  $\pm 2\%$  vertical/horizontal accuracy; vertical sensitivity to 2 mV/div @ 90 MHz.

**9-digit fluorescent display.**

Digitally accurate readouts accompany the CRT waveform. Error messages and prompts also appear on the display.

**Dc volts and ac coupled true RMS volts.** Measured through the Ch 1 scope input.

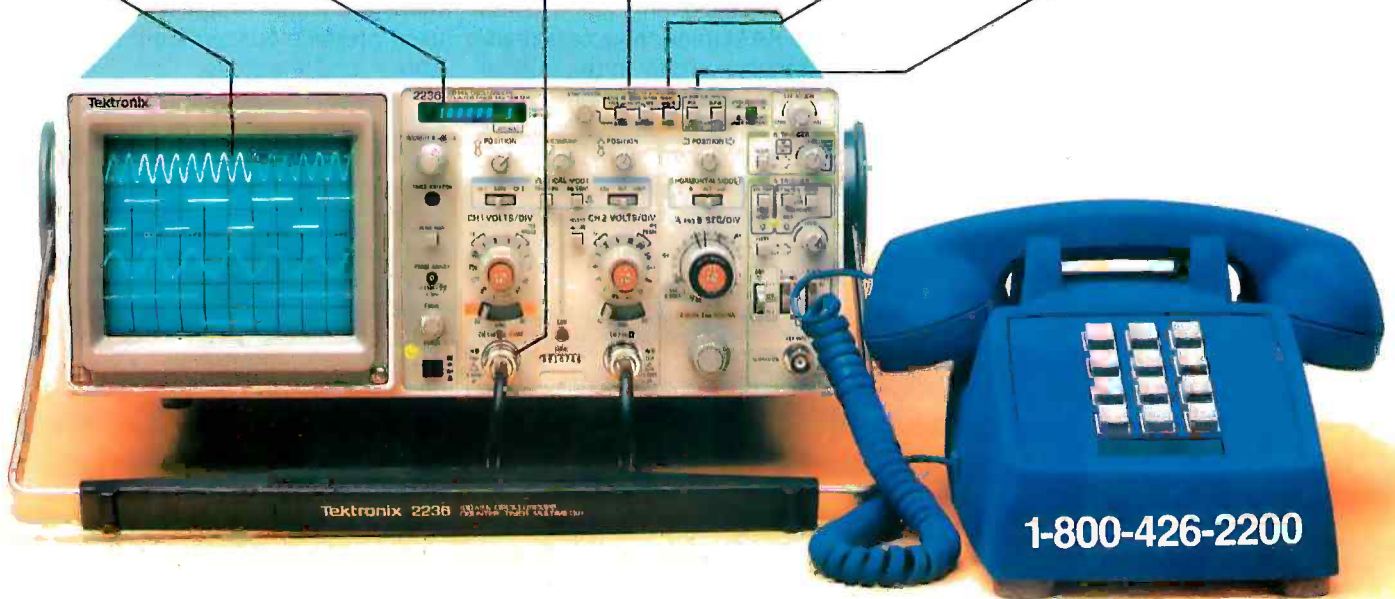
**Gated measurements.** Use the scope's intensified marker to measure frequency, period, width and to count events within specified portions of the signal.

**Auto-ranged, auto-averaged counter/timer.**

Frequency, period, width, delay time,  $\Delta$ -time, plus totalize to more than 8 million events —with 7 digits plus exponent displayed.

**Auto-ranged DMM.**

Use floating DMM side inputs with up to 5000-count resolution. Get precise readouts of average dc and true RMS voltage. Measure resistance from milliohms to gigohms.



1-800-426-2200

**Now make measurements faster, easier, with greater accuracy and user confidence.**

The Tek 2236 makes gated counter measurements, temperature, time, frequency, resistance and voltage measurements push-button easy. You see results concurrently on the 9-digit numeric readout and CRT display.

Its complete trigger system includes pushbutton trigger view, plus peak-to-peak auto, TV line, TV field, single sweep and normal modes.

At just \$2650\*, the 2236 includes the industry's first 3-year warranty on all parts and labor, including the CRT.

**Integrated measurement system. 3-year warranty. 15-day return policy. And expert advice. One free call gets it all!**

You can order, or obtain literature, through the Tek National Marketing Center. Technical personnel, expert in scope applications, can answer your questions and expedite delivery. Direct orders include probes, operating

manual, 15-day return policy, full warranty and worldwide service back-up.

**Order toll-free: 1-800-426-2200 Extension 57**

In Oregon call collect: (503) 627-9000 Ext. 57  
Or write Tektronix, Inc.  
P.O. Box 1700  
Beaverton, OR 97075

**Tektronix®**  
COMMITTED TO EXCELLENCE

from merely saving memory. An extremely powerful programming technique using "metavariables" is only possible in the internal syntax. There is not sufficient space to go into it in detail here but, in brief, a metavariable is a variable used to represent a whole chunk of program that can be given values at run-time. You can use this to achieve lots of "second-order" actions, equivalent in conventional languages to procedures with variable numbers of parameters, passing procedures as parameters, treating multiple parameters as a list, and much more. An advanced programmer can use this facility to write mind-bending system programs in a space that makes C look quite verbose.

#### OVERALL PERFORMANCE

Getting a serious implementation of Prolog onto a personal computer is

an impressive achievement in itself. The Z80 version that I've used occupies around 15K bytes in its naked form and Simple takes up another 8K bytes, which leaves enough room for quite sophisticated programs.

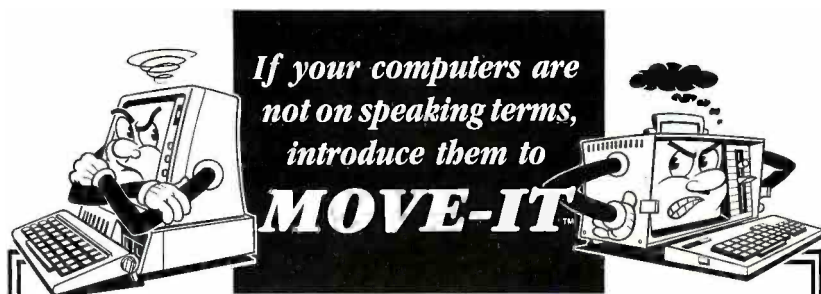
It also runs surprisingly fast, faster than any LISP I've tried and comparable to most interpreted BASICs. A colleague benchmarked it against DEC-10 Prolog (about \$1,000,000 worth of hardware), which only turned out to be twice as fast as micro-PROLOG running on a 4-MHz Z80. Like any list-based language it tends to use up RAM (random-access read/write memory) quickly in the middle of a complex evaluation, but this is kept in check by automatic "success popping" to discard redundant stack items, and by not growing the stack at all for "tail recursive" definitions (ones in which the recursive call is the last item).

The main gripes I have with micro-PROLOG are the idiosyncratic editor (you might like it, though), the crude variable-naming system, and the overall complexity introduced by three different user interfaces, two syntaxes, and a host of optional module files. The variable naming is even worse than I have described so far, in that the names you give to variables when typing in a program are not preserved; when you later list the rule, more often than not micro-PROLOG will have changed all the names. Also there are a few rough edges to the user interface concerning the use of upper- and lowercase letters, which are distinguished in a very unforgiving way.

Even though it has some problems, the system remains a very good buy for anyone who would like to find out more about Prolog at a reasonable price. I don't find logic programming as easy as its most enthusiastic adherents would suggest, but using the Simple front end with its powerful aids is about as easy an introduction as you can get. The documentation is well written and comprehensive (including a thick paperback *Primer* and a *Reference Manual*) and the software is robust. A considerable bonus is the fact that you get the source code for Simple, Micro, and the other modules to modify or merely to study as examples of non-trivial Prolog programs.

Logic Programming Associates also has a related product called sigma-PROLOG that runs on large UNIX systems. Future plans are based around a compiler for micro-PROLOG that will produce pseudocode that is more compact and runs over five times faster than the interpreted version, and which accepts arbitrary-length variable names; this will not be ready until late 1985.

The DOS and CP/M versions of micro-PROLOG already are being distributed in the United States. Each version lists for \$295. Further information can be obtained by contacting Programming Logic Systems, 31 Crescent Dr., Milford, CT 06460, (203) 877-7988. ■



**Now you can move files, programs and data between incompatible computers.** When adding a new computer, data and programs from one system can be transferred to another with MOVE-IT, even if the two have different disk formats and use different operating systems.

**A mini-network** can be set up by equipping each computer with MOVE-IT, increasing utilization by sharing information freely between machines.

**Error Free.** A 16 bit error checking technique assures accurate and error-free data transmission even at high speeds and over "dirty" telephone lines or long cable runs. MOVE-IT is the ideal program for telephone line use with modems as well as direct wire applications.

If you have ever faced the problem of intercomputer communication, MOVE-IT is what you need.

**The simplest dependable solution,** the lowest in cost. No expensive circuit boards to install. Easiest to set up. No programming knowledge necessary. Over 17,000 programs sold and operating.

**Also MOVE-IT puts you in touch with information networks** such as "The Source," "CompuServe," "Dow Jones" and "News Net."

**With MOVE-IT you can communicate with over 120 different makes of computers using PC DOS, CPM/86 and CP/M systems.** Retail price is \$125 for all CP/M systems and \$150 for all CPM/86 and MS-DOS systems including the IBM PC. Available from your local dealer or from:

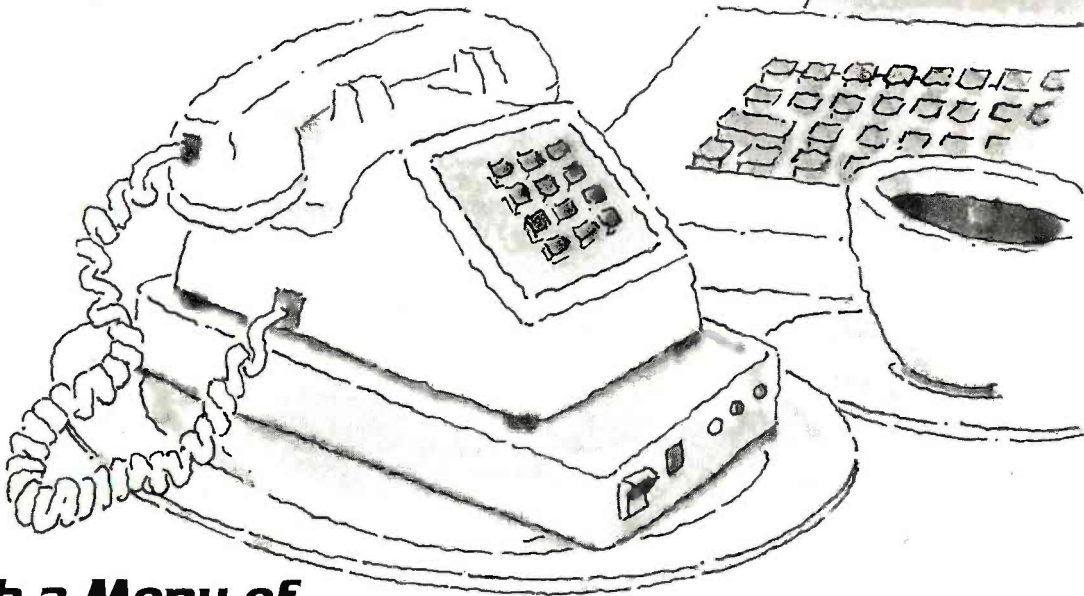
### WOOLF SOFTWARE SYSTEMS, INC.

6754 ETON AVE., CANOGA PARK, CA 91303 • (818) 703-8112

Dealer inquiries invited.

© COPYRIGHT 1984 WOOLF SOFTWARE SYSTEMS, INC.

# Bank à la Modem



## With a Menu of HomeBanking Services...

Bank of America is one of the first to bring an appealing menu of services to your personal computer. With HomeBanking service and a Bank of America checking account, you can check your daily balance, review your checking statement records, transfer funds, even send and receive messages.

You can also make on-line payments—prescheduled up to 30 days in advance—to more than 800 department stores, utilities, insurance companies, and other financial institutions.

You'll handle many of your routine banking transactions conveniently in your home or office—6 a.m. to midnight, every day. And best of all, Bank of America's advanced technology handles all the necessary interface, so HomeBanking service is compatible with any personal computer or terminal with communications capability.

You can bank à la modem with all these services for only \$8.00\* a month!

## An Appetizing Rebate Offer

Sign up now for HomeBanking service and we'll give you an appetizer that makes it almost irresistible! You'll have a choice of rebates on any or all of the following:

- \$50 off Apple\* Modem 1200\*\*
- \$30 off Apple Modem 300\*\*
- \$30 off Dollars & Sense™ and Forecast™ for Apple personal computers
- \$30 off Dollars & Sense with Forecast for IBM and IBM-compatible personal computers
- \$20 off PFS:\* ACCESS for selected MS-DOS and the Apple IIc and IIe personal computers
- \$20 off PFS:\* WRITE for selected MS-DOS and the Apple IIc and IIe personal computers.

Circle 39 on inquiry card.

## Call 1-800-652-1111

Complete and return the coupon and you can be on-line with HomeBanking service. Or simply call toll-free 1-800-652-1111 from 8 a.m. to 5 p.m. (Pacific Time), Monday through Friday, for an on-line demonstration.

To take advantage of this special rebate offer from HomeBanking service, sign up before December 31, 1984... and join the thousands who bank à la modem.

\*Regular checking account charges still apply.

Note: Special restrictions apply to Cash Maximizer™ accounts.

\*\*Apple modems must be purchased from an authorized Apple dealer.

Apple is a registered trademark of Apple Computer, Inc.

Dollars & Sense and Forecast are trademarks of Monogram.

PFS: is a registered trademark of Software Publishing Corporation.

Bank of America NT & SA • Member FDIC

Mail this coupon to:

Bank of America  
HomeBanking Service Center  
P.O. Box 306  
Half Moon Bay, CA 94019  
1-800-652-1111



YES! I'd like to bank à la modem with HomeBanking service and receive my rebate package.

I am already a Bank of America checking account customer. Please begin my HomeBanking service immediately.

Signature \_\_\_\_\_

Checking Account Number \_\_\_\_\_

VERSATEL® Customer Number \_\_\_\_\_ (last nine digits on your card)

I am not yet a Bank of America checking account customer. Please send me all the information I need to open an account and sign up for HomeBanking service.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Phone (\_\_\_\_\_) \_\_\_\_\_ Best time to call \_\_\_\_\_

Act now! You must sign up for HomeBanking service before December 31, 1984 to qualify for the rebate offer. (Note: One rebate package per customer. To qualify for rebates you must receive the rebate package prior to purchase(s). Proof of purchase by March 15, 1985 will be required.)

**Bank of America**

501

# THE FORTH SOURCE™

## MVP-FORTH

Stable - Transportable - Public Domain - Tools  
 You need two primary features in a software development package... a stable operating system and the ability to move programs easily and quickly to a variety of computers. MVP-FORTH gives you both these features and many extras. This public domain product includes an editor, FORTH assembler, tools, utilities and the vocabulary for the best selling book "Starting FORTH". The Programmer's Kit provides a complete FORTH for a number of computers. Other MVP-FORTH products will simplify the development of your applications.

### MVP Books - A Series

- Volume 1, All about FORTH** by Haydon. MVP-FORTH glossary with cross references to fig-FORTH, *Starting FORTH* and FORTH-79 Standard. 2nd Ed. \$25
- Volume 2, MVP-FORTH Assembly Source Code.** Includes CP/M®, IBM-PC®, and APPLE® listing for kernel \$20
- Volume 3, Floating Point Glossary** by Springer \$10
- Volume 4, Expert System** with source code by Park \$25
- Volume 5, File Management System** with interrupt security by Moreton \$25

### MVP-FORTH Software - A Transportable FORTH

- MVP-FORTH Programmer's Kit** including disk, documentation Volumes 1 & 2 of MVP-FORTH Series (*All About FORTH*, 2nd Ed. & *Assembly Source Code*), and *Starting FORTH*. Specify  CP/M,  CP/M 86,  CP/M+,  APPLE,  IBM PC/XT/AT,  MS-DOS,  Osborne,  Kaypro,  H89/Z89,  Z100,  TI-PC,  MicroDecisions,  Northstar,  Compupro,  Cromenco,  DEC Rainbow,  NEC 8201,  TRS-80/100,  HP 110,  HP 150,  STM PC \$150

NEW

NEW

NEW

- MVP-FORTH Enhancement Package** for IBM PC/XT/AT Programmer's Kit. Includes full screen editor, MS-DOS file interface, disk, display and assembler operators. \$110
- MVP-FORTH Cross Compiler** for CP/M Programmer's Kit. Generates headerless code for ROM or target CPU \$300
- MVP-FORTH Meta Compiler** for CP/M Programmer's kit. Use for applications on CP/M based computer. Includes public domain source \$150
- MVP-FORTH Fast Floating Point** Includes 9511 math chip on board with disks, documentation and enhanced virtual MVP-FORTH for Apple II+, and Ile. \$450
- MVP-FORTH Programming Aids** for CP/M, IBM or APPLE Programmer's Kit. Extremely useful tool for decompiling, callfinding, and translating. \$200
- MVP-FORTH PADS (Professional Application Development System)** for  IBM PC/XT/AT or PCjr or Apple II, II+ or Ile. An integrated system for customizing your FORTH programs and applications. The editor includes a bi-directional string search and is a word processor specially designed for fast development. PADS has almost triple the compile speed of most FORTH's and provides fast debugging techniques. Minimum size target systems are easy with or without heads. Virtual overlays can be compiled in object code. PADS is a true professional development system. Specify Computer. \$500
- MVP-FORTH Floating Point & Matrix Math** for IBM PC/XT/AT with 8087 or Apple with Applesoft on Programmer's Kit or PADS. \$85
- MVP-FORTH Graphics Extension** for IBM PC/XT/AT or Apple on Programmer's Kit or PADS. \$65
- MVP-FORTH MS-DOS** file interface for IBM PC PADS \$80
- MVP-FORTH Expert System** for development of knowledge-based programs for Apple, IBM, or CP/M. \$100

**FORTH CROSS COMPILERS** Allow extending, modifying and compiling for speed and memory savings, can also produce ROMable code. Specify CP/M, 8086, 68000, IBM, Z80, or Apple II, II+ \$300

**Ordering Information:** Check, Money Order (payable to MOUNTAIN VIEW PRESS, INC.), VISA, MasterCard, American Express. COD's \$5 extra. Minimum order \$15. No billing or unpaid PO's. California residents add sales tax. Shipping costs in US included in price. Foreign orders, pay in US funds on US bank, include for handling and shipping by Air: \$5 for each item under \$25. \$10 for each item between \$25 and \$99 and \$20 for each item over \$100. All prices and products subject to change or withdrawal without notice. Single system and/or single user license agreement required on some products.

## FORTH DISKS

FORTH with editor, assembler, and manual.

- APPLE** by MM, 83 \$100
- ATARI® valFORTH** \$60
- CP/M** by MM, 83 \$100
- HP-85** by Lange \$90
- HP-75** by Cassady \$150
- IBM-PC** by LM, 83 \$100
- NOVA** by CCI 8" \$175
- Z80** by LM, 83 \$100
- 8086/88** by LM, 83 \$100
- 68000** by LM, 83 \$250
- VIC FORTH** by HES, VIC20 cartridge \$50
- C64** by HES Commodore 64 cartridge \$40
- Timex** by HW \$25

**Enhanced FORTH** with: F-Floating Point, G-Graphics, T-Tutorial, S-Stand Alone, M-Math Chip Support, MT-Multi-Tasking, X-Other Extras, 79-FORTH-79, 83-FORTH-83.

- APPLE** by MM, F, G, & 83 \$180
- ATARI** by PNS, F, G, & X. \$90
- CP/M** by MM, F & 83 \$140
- Multi-Tasking FORTH** by SL, CP/M, X & 79 \$395
- TRS-80/II or III** by MMS, F, X, & 79 \$130
- Timex** by FD, tape G, X, & 79 \$45
- C64** by ParSec. MVP, F, 79, G & X \$96
- Victor 9000** by DE, G, X \$150
- Extensions** for LM Specify IBM, Z80, or 8086
  - Software Floating Point \$100
  - 8087 Support (IBM-PC or 8086) \$100
  - 9511 Support (Z80 or 8086) \$100
  - Color Graphics (IBM-PC) \$100
  - Data Base Management \$200
- fig-FORTH Programming Aids** for decompiling, callfinding, debugging and translating. CP/M, IBM-PC, Z80 or Apple. \$200

## FORTH MANUALS, GUIDES & DOCUMENTS

NEW

- Thinking FORTH** by Leo Brodie, author of best selling "Starting FORTH" \$16
- ALL ABOUT FORTH** by Haydon. See above. \$25
- FORTH Encyclopedia** by Derick & Baker \$25
- The Complete FORTH** by Winfield \$16
- Understanding FORTH** by Reymann \$3
- FORTH Fundamentals**, Vol. I by McCabe \$16
- FORTH Fundamentals**, Vol. II by McCabe \$13
- FORTH Tools, Vol.1** by Anderson & Tracy \$20
- Beginning FORTH** by Chirlian \$17
- FORTH Encyclopedia Pocket Guide** \$7
- And So FORTH** by Huang. A college level text. \$25
- FORTH Programming** by Scanlon \$17
- FORTH on the ATARI** by E. Floegel \$8
- Starting FORTH** by Brodie. Best instructional manual available. (soft cover) \$19
- Starting FORTH** (hard cover) \$23
- 68000 fig-Forth** with assembler \$25
- 1980 FORML Proc.** \$25
- 1981 FORML Proc 2 Vol** \$40
- 1982 FORML Proc.** \$25
- 1981 Rochester FORTH Proc.** \$25
- 1982 Rochester FORTH Proc.** \$25
- 1983 Rochester FORTH Proc.** \$25
- A Bibliography of FORTH References, 1st Ed.** \$15
- The Journal of FORTH Application & Research**
  - Vol. 1, No. 1 \$15
  - Vol. 1, No. 2 \$15
- META-FORTH** by Cassady \$30
- Threaded Interpretive Languages** \$23
- Systems Guide to fig-FORTH** by Ting \$25
- FORTH Notebook** by Ting \$25
- Invitation to FORTH** \$20
- PDP-11 User Man.** \$20
- FORTH-83 Standard** \$15
- FORTH-79 Standard** \$15
- FORTH-79 Standard Conversion** \$10
- Tiny Pascal fig-FORTH** \$10
- NOVA fig-FORTH** by CCI Source Listing \$25
- NOVA by CCI User's Manual** \$25
- Installation Manual for fig-FORTH** \$15

**Source Listings of fig-FORTH**, for specific CPU's and computers.

The Installation Manual is required for implementation. Each \$15

- 1802  6502  6800  AlphaMicro  IBM
- 8080  8086/88  9900  APPLE II
- PACE  6809  NOVA  PDP-11/LSI-11
- 68000  Eclipse  VAX  Z80

# MOUNTAIN VIEW PRESS, INC.

PO BOX 4656

MOUNTAIN VIEW, CA 94040

(415) 961-4103

# Hand-held Computers and MSX Standards

Epson HC-88/80  
Ampere Big.APL  
MSX Machines

BY WILLIAM M. RAIKE

**I**n the October BYTE Japan column, I wrote about the inexpensive, RS-232C-equipped Brother EP-44 portable electronic typewriter/printer/terminal. I decided to buy it instead of a hand-held computer, and I'm still delighted with it; when I'm not traveling, it's my backup printer. It now looks like there's another good reason for having postponed buying a portable: some interesting new machines are available, and more will be coming along.

## HAND-HELD COMPUTERS FROM EPSON

Hand-held computers are proliferating these days, with hot competition among Hewlett-Packard, Epson, Apple, Tandy, Sharp, NEC, and others. On the Japanese scene, Epson has released the new HC-88 and its companion, the HC-80. The HC-88 incorporates extensive Japanese-language processing features: large Japanese-character dictionaries are implemented in ROM (read-only memory), and it has a new, efficient method for entering Japanese characters from the keyboard. In addition to the *katakana* and *hiragana* phonetic alphabets, you can enter any of the 725 most frequently used characters using only two keystrokes, while the remaining 1800 require only three keystrokes. Lots of different systems exist for converting keyboard entries to Japanese-character displays, but this is just about the simplest and fastest one yet, and it is supported at the operating system level.

The HC-88 uses the CP/M operating system, stored in ROM. Standard applications software, also ROM-based, includes a Japanese-language word processor called "Portable Symphony Word," plus "Portable Supercalc" and BASIC.

The HC-88 (and the HC-80) is a triple-processor machine; the main processor is a Z80-equivalent CMOS (complementary metal-oxide semiconductor) microprocessor running at 2.45 MHz. For external storage, it has a built-in microcassette drive,

similar to those in other Epson portables like the HC-40 and HC-20. Main memory consists of 64K bytes of CMOS RAM (random-access read/write memory), and an additional 64K bytes of RAM are configured as a RAM disk, backed up by a nickel-cadmium (nicad) battery. The liquid-crystal display (LCD) operates in three modes: a 480- by 64-dot graphics mode, an 8-line by 80-character alphanumeric mode, and a 3-line by 30-character Japanese-character mode. The built-in RS-232C interface operates at speeds ranging from 75 to 19,200 bits per second (bps), and a separate high-speed serial interface works at up to 38,400 bps. You also can buy a portable 3½-inch, 360K-byte microfloppy-disk drive as an option; list price for the microfloppy (which works through the high-speed serial interface) is about \$425. The HC-88 itself lists for about \$1225. That seems a bit steep in comparison to the HC-80, which offers just about all the features of the HC-88 except for the Japanese-language capabilities and carries a list price of only about \$825. Epson says that WordStar and SuperCalc also are available (in ROM) as options for the HC-80, but I haven't had the opportunity to try out either of them.

## APL TAKES WING

Not long ago I had a chance to get an advance look at an engineering prototype of a beautiful and unconventional new hand-held computer, the Big.APL. Since the appearance of the October What's New item, I've talked to Ampere about the specifics. I hope to have a chance to give one of the production prototypes a work-out sometime soon; although the machine was expected to be in production by November, no one has actually confirmed a fixed date.

Ampere is a medium-sized company, based in Tokyo, that in the past has produced communications equipment, in-circuit emulators, and custom integrated cir-

(continued)

William M. Raïke, who holds a Ph.D. in applied mathematics from Northwestern University, has taught operations research and computer science in Austin, Texas, and Monterey, California. He holds a patent on a voice scrambler and was formerly an officer of Cryptext Corporation in the United States. In 1980, he went to Japan looking for 64K-bit RAMs. He has been there ever since as a technical translator and a software developer.

cuits, in addition to software development activities. Its president, Takashi Kusanagi, talks about the APL language with missionary fervor and is understandably enthusiastic about the Big.APL.

Very few computers are visually distinctive; this one looks like a cross section of an airplane wing or, with the cover/display screen open, like a graceful futuristic chair (see the photos in the October BYTE, page 42). The case for the Big.APL was designed by Kumeo Tamura, whose design credits include the Datsun 280Z.

The rest of the Ampere computer is just as unconventional and as intriguing as its appearance. It's built around the powerful 32-/16-bit HD68000 microprocessor, running at 8 MHz. The heart of the machine is the software environment, which is an APL interpreter. The custom operat-

ing system, called Big.DOS, is APL-based, supports one foreground and one background task, and provides some windowing capabilities.

Although I haven't yet seen it, an integrated software package, written in APL and stored in ROM, will be supplied with the computer. Ampere says it will include a word processor, spreadsheet, and database handler, plus a communications package.

APL is a programming language that has proven extremely popular within the IBM mainframe community, particularly among scientific and academic users; it provides a concise way to state many numerical and statistical algorithms and is also suitable for text manipulation. The character set is very large and, at first, very confusing; instead of keywords like WRITE, FOR, etc., as in conventional languages, APL has unique characters for mathematical opera-

tions like finding the maximum, minimum, or sum of an array and for producing the transpose of a matrix, as well as for input/output operations. Usually interpreted instead of being compiled, it is subject to many of the same limitations (and advantages) as all interpreters. There are relatively few implementations of APL for personal computers; one is APL.68000, which I saw operating on the Sord M68, a 68000-based desktop computer. As far as I know, Ampere will be the first to use APL in a portable computer; its version of APL is an adaptation of APL.68000.

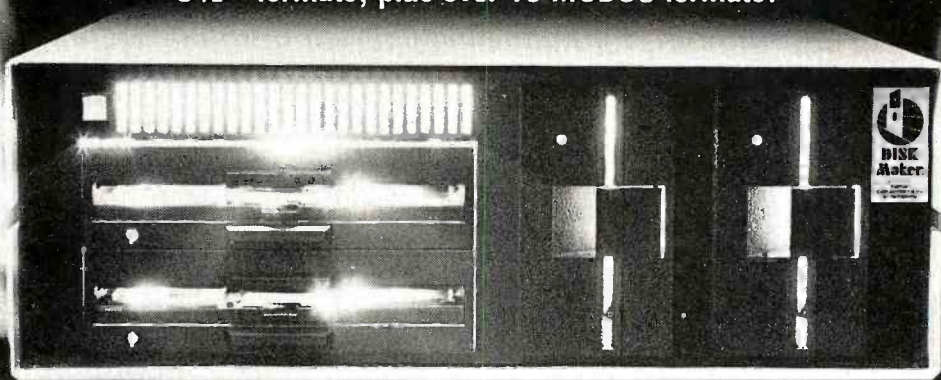
The Big.APL has lots of memory. Basic system RAM is 64K bytes, and 128K bytes of ROM is standard. Ampere reports that the RAM will be expandable to 512K bytes. In addition, it has three RAM/ROM cartridge slots; each cartridge can hold 64K

(continued)

# The Most Affordable Disk Maker™ in the Universe

**NEW!**

Now with Apple™ interface, DecMate II to CP/M utility,  
3 1/2" formats, plus over 10 MSDOS formats!



Disk Maker II shown with opt. drives

## Download fast, read over 150 formats easily, reformat rapidly

The more disk formats you work with, the more our Disk Maker™ system saves time and money by reading and/or writing disks in any of over 150 formats. No modems, no patches, no other special software necessary.

Disk Maker II is a complete, stand alone system with one 8" DSDD disk drive, one 48 tpi 5 1/4" DSDD disk drive, 6 MHz Z80B, 64K CP/M system with Disk Maker™ software. (96 tpi and second 8" drive optional.) Just plug in your terminal and make disks! Bundled software includes MicroShell™/MCALL-II communications software.

Supported with comprehensive, easy-to-read manual, software updates (\$25.00, all formats in revision), and additional drives and hard disk options.

**Disk Maker™**  
prices from  
**\$1,495**

Disk Maker I runs as a peripheral with an S-100 system and comes with S-100 controller board, one 48 tpi DSDD 5 1/4" disk drive, dual drive cabinet and power supply, cables and Disk Maker software. 96 tpi and 8" drives are optional. Circle 285 on inquiry card.



1800 Michael Faraday Drive, Suite 206, Reston, VA 22090  
(703) 471-5598 Order Line: (800) 368-3359  
Dealer inquiries welcomed.

# BEHIND EVERY GREAT PROGRAM IS A GREAT PROGRAM

Introducing Spotlight.™

**Note it. File it. Schedule it. Calculate it. Save it. Find it fast.**



The Spotlight™ program is a set of convenient desktop accessories all in one package. No matter which application program you're working in – including VisiCalc,™ 1-2-3,™ WordStar,® dBase II,® pfs:File,® MultiMate,® MicroSoft Word,™ TK!Solver,® and Symphony™ – Spotlight gives you instant access to six essential functions.

Just a keystroke suspends your application program and gives you a window into Spotlight. Another keystroke gets you back to where you were just as fast. It's that easy.

#### Here's what you get:

**Appointment Book** – schedule daily and weekly meetings or display monthly calendar. Set a sound alarm to remind you of appointments, even if you're using another program.

**DOS File** – perform operating system tasks without leaving your program. List, create, delete, copy, and sort files and directories. Even format disks.

**Phone Book** – find and instantly display any name, address and phone number from 36 available lists. Each list can hold 500 different entries.

**Note Pad** – jot a note or write and edit messages up to eight pages long.

**Index Card File** – search up to 36 separate files, each of which contains 500 cards. Cards are alphabetically sorted.

**Calculator** – calculate any problems and insert the answers into the program you're using.

Spotlight is the great program behind any great program you use.

*System requirements:* IBM® PC or XT™, or COMPAQ® portable computers, one disk drive, 75K memory for RAM resident portion, DOS 2.0 or higher. Printer optional. Can be installed on hard disk. Runs with most IBM PC software packages.

**Spotlight**™  
By Software Arts™

27 Mica Lane, Wellesley, Massachusetts 02181

bytes of RAM or a megabyte of ROM. The internal 16-bit bus configuration is a standard Motorola VME (virtual machine environment) bus. Peripheral interfaces include a Centronics printer port and two RS-232C serial ports capable of speeds ranging from 75 to 19,200 bps. One of the serial ports is equipped with a built-in auto-dial 300-bps modem. No disk drive will be available initially, but the company says it's developing a portable 1-megabyte, 3½-inch microfloppy-disk drive as a companion to the Big.APL.

The display is an LCD panel built into the hinged cover, along with membrane-type function keys. The screen displays 25 lines by 80 characters in character mode and 200 by 480 dots in graphics mode, an upgrade from the planned 120- by 480-dot display and a respectable graphics performance for a hand-held.

The Big.APL contains a built-in microcassette drive, but the storage and transfer-rate specifications were not firm at the time of publication. In addition to the data storage, a separate voice track is provided on the cassette, and the computer includes a built-in microphone and speaker. The potential for educational applications is enormous—in fact, Ampere estimates that about 25 percent of the market will be in that area—and the possibilities for using voice instructions to provide a friendly but nonpatronizing user interface are also good. The availability of a voice track, combined with the built-in modem, also lets you use the computer as an intelligent telephone terminal and/or answering machine, capable of transmitting and receiving voice or data.

No price has been set, but a figure in the neighborhood of \$2000, rather

than \$1500, seems more likely. I hope to be able to report on this machine again after I've had a chance to give it and its software a good workout.

### MSX MACHINES

As I mentioned in last month's BYTE Japan, the IBM PC-compatibility issue has barely touched the Japanese personal computer market. But at the low end of the computer market here, as measured in terms of price, there's another standard: the MSX standard. The prices of MSX computers range from a little over \$200 up to about \$415 (not including a monitor), with most of them clustered near the bottom figure of the price range.

Introduced last year by Microsoft, MSX is a hardware and software standard for computers that are based on the 8-/8-bit Z80 microprocessor and that incorporate Microsoft BASIC in

(continued)



**NOT ANOTHER BLACK BOX**

## A Software Implementation within Your Product Hardware

If you manufacture a computer system or a computer based product, allow it to EMULATE/COMMUNICATE by installing one or more of Systems Strategies' "C" Language based communication packages.

- 3270 SNA/SDLC Emulation
- 3270 BSC Emulation
- 2780/3780/HASP Emulation
- X.25 Levels 1, 2, 3 Communication

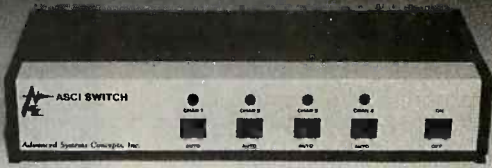
You can purchase these "C" Language packages with source code and license to distribute in your hardware product. Each package is available either "Port it Yourself" with instruction manual and training or ported to your hardware by Systems Strategies' communications staff.

**Systems Strategies/Advanced Technology Division  
Specialists in Data Communications Software**



Systems Strategies Inc.  
225 West 34th Street  
New York, New York 10001  
(212) 279-8400

## Peripheral Networking Now




### Buy ASCI Intelligent Port Expanders

- Eliminate Manual Switching by Remote Control
- Improve Productivity and Reliability
- Share Printers, Modems or Plotters
- Expand Computers or Terminals
- Use Matrix Switching for Multiple Transmission or Security
- Supports Polling and Queing

INSTANT COMPATIBILITY with new computer devices and MAJOR OEM PRODUCTS:

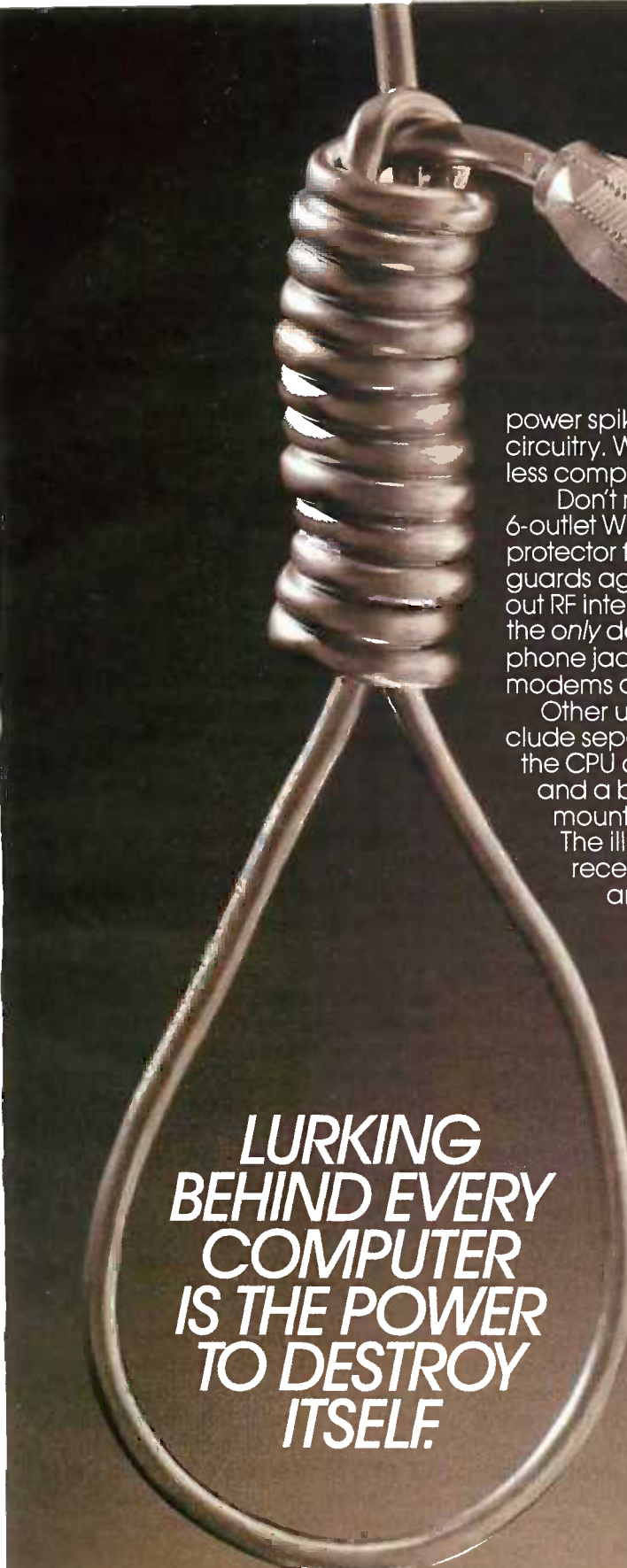
Altos — Burroughs — Data General — DEC  
H.P. — IBM — NCR — Northstar — Victor  
and other key manufacturers.

Call **213-793-8979** to EXPAND YOUR SYSTEMS TODAY.



**Advanced Systems Concepts Inc.**  
435 N. Lake Ave., Dept. B12  
Pasadena, CA 91101  
**800-824-7080 Telex: 701 215**





That power cord may look innocent. But it could suddenly turn against your PC.

It could, for example, hurl a power spike from static or lightning into its delicate circuitry. Wiping out its memory. Or destroying a defenseless component.

Don't risk it. Get a 6-outlet Wire Tree Plus™ surge protector from NETWORX™. It guards against spikes. Filters out RF interference. And it's the *only* device with two phone jacks to protect modems against surges.

Other unique features include separate switches for the CPU and peripherals and a bracket that

mounts under the front of the workstation.

The illuminated switches are easy to reach, and yet recessed, so you can't accidentally shut down power and lose data.

If you don't need 6 outlets, pick up our 4-outlet Wire Tree™. Or our single-outlet Wire Cube™ that's ideal for portable computers.

That'll take care of power surges. But what if your foot gets tangled in a power cord? Prevent this potential disaster with the Wire Away™. It stores up to four 18-gauge wires and ends the hazardous mess of dangling cords.

All our products are backed by a 5-year warranty. So when you shop for a PC, ask for NETWORX computer station accessories. And don't go home without them.

**LURKING  
BEHIND EVERY  
COMPUTER  
IS THE POWER  
TO DESTROY  
ITSELF.**



**NETWORX™**

Computer Station Accessories

Networx, Brooklyn, NY 4237-1587 (716) 821-7555

Circle 279 on inquiry card.

32K bytes of ROM. All MSX machines have a standard cassette-tape interface and can accept standard ROM cartridges; all have 256- by 192-dot color graphics and 24-line by 40-character displays. Most models have built-in RF (radio frequency) modulators in addition to a composite video output, so that an ordinary television set can be used as a display, and provide an 8-bit parallel printer interface (Centronics-type). The amount of main memory varies from 16K bytes up to 64K bytes; most models incorporate an additional 16K bytes of video RAM for graphics, along with 8-octave sound generators, dual joystick interfaces, and other features. None of the machines I've seen yet has RS-232C serial interfaces, although several vendors have announced that RS-232C interface cartridges and/or expansion units will be available Any Day Now.

Well over a dozen MSX machines are on the market now; several new ones were introduced at this year's Microcomputer Show (see the September BYTE Japan). A separate magazine caters to owners of MSX machines, and a mammoth supply of games is available, both on tape cassettes and in ROM cartridges. Sadly, the marketing approaches to these machines are all targeted at the teenage and preteen market and the parents who buy such "toys." The idea that these computers might actually be useful for something besides game playing, generating sound effects, or learning to program in BASIC doesn't seem to be very widespread yet, judging from the fact that "software" has been nearly synonymous with "game" for MSX users up to now.

One development that could change the MSX image from frivolous to utilitarian is the coming availability of MSX-compatible 3½-inch micro-floppy-disk drives. Although at this point Sony is the only manufacturer from which you can buy one (list price for a single 360K-byte drive is about \$375), Microsoft has already developed an operating system called MSX-DOS that supports them. (Toshiba supposedly has a drive on

the market, but I couldn't find a dealer that knew anything about it; Sanyo and Mitsubishi will release their drives Any Day Now.) As an operating system, MSX-DOS is file-compatible with MS-DOS in that it uses MS-DOS file formats, and Microsoft claims that it provides an environment that allows you to run "nearly all" CP/M-based programs directly.

With the wide range of available CP/M applications software, MSX machines could become appealing to a whole new class of users; in the MSX price class, the limited Japanese-language support and the 40-column screen format may not be severe limitations. (Although they don't provide Japanese-character support, the extended ASCII [American Standard Code for Information Interchange] character sets do include either the *hiragana* or *katakana* phonetic alphabets.) Also, limited Japanese-character support and (fairly primitive) Japanese-language word processing are available on ROM cartridges; however, they cost between \$100 and \$200 instead of being in the typical \$12 to \$20 game-cartridge range.

Some typical MSX models are described below, with approximate list prices and individual features.

1. Canon V-10 and V-20. 16K and 64K bytes of RAM, and priced at \$225 and \$270, respectively. Two slots for ROM, RAM, and/or interface cartridges. Available in two colors: black or white.
2. Toshiba HX-10S and HX-10D. 16K and 64K bytes of RAM, and priced at \$230 and \$275, respectively. One cartridge slot. No printer interface, but the HX-10DN has one and costs about \$10 extra. Available in three colors: red, white, or black.
3. Victor (JVC) AV Personal Computer HC-6. 32K bytes of RAM, \$270. For about \$120 extra, a "superimpose adapter" is available that lets you superimpose computer-generated titles or games over ordinary television or video images.
4. Sanyo "Wavy" MPC-5, MPC-10, and MPC-11. Priced at about \$225, \$310, and \$415, respectively. The MPC-5 has 16K bytes of RAM, while the other

two have 32K bytes. The MPC-11 has a separate RGB (red-green-blue) video output and video-superimpose capability; both the MPC-10 and MPC-11 include a light pen. Japanese phonetic keyboard.

5. Pioneer PALCOM PX-7. About \$370. Separate RBG video output and video-superimpose capability. Extended P-BASIC in addition to MSX BASIC. Two cartridge slots. A video-disk controller is built in, and Pioneer supplies various games on video-discs. A video input and a video output are provided. Stereo input and output for audio.

6. Sony "Hit Bit" HD-55 and HD-75. About \$225 and \$290, respectively. The HD-55 has 16K bytes of RAM; the HD-75 has 64K bytes. Available in various color combinations. Japanese phonetic keyboard.

7. Hitachi HI. The model MB-HI has 32K bytes of RAM, while the HB-HIE has 16K bytes and does not include an RF video output; they are priced at about \$225 and \$260, respectively. Both have two cartridge slots. Japanese phonetic keyboard. Requires a separate power supply.

8. Yamaha YIS503. About \$270. Two slots, 32K bytes of RAM. An extensive range of music synthesizers and associated software is available. Japanese phonetic keyboard. The YIS303 with no printer interface, only 16K bytes of RAM, and a cheaper keyboard costs only about \$205.

9. Fujitsu FM-X. About \$205. 16K bytes of RAM and one cartridge slot. No printer interface.

10. Mitsubishi ML-F120. About \$270. 32K bytes of RAM, two cartridge slots.

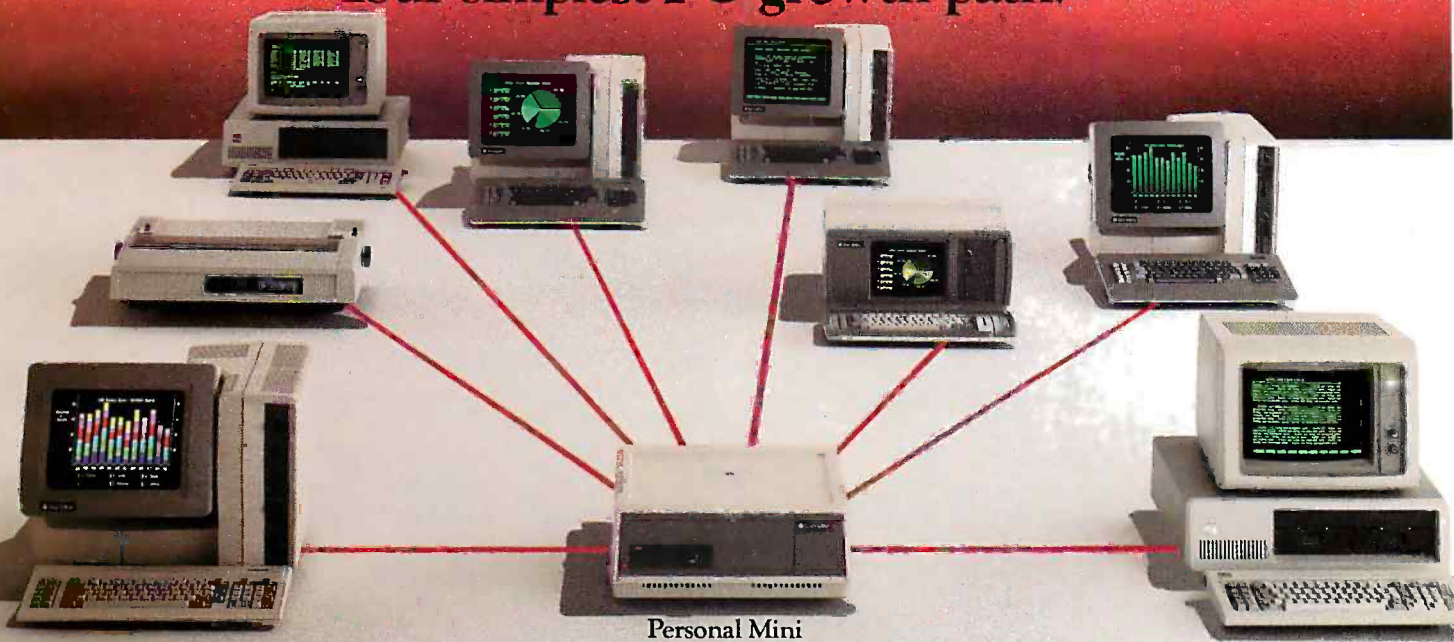
11. Matsushita CF-2000 and CF-3000, about \$270 and \$330 for 16K and 64K bytes of RAM, respectively. The CF-3000 has a separate keyboard and a superimpose option is available. Japanese phonetic keyboard.

## COMING UP

The January BYTE Japan will cover the latest on integrated circuits, a new hand-held from NEC, and a high-tech printer from Casio, as well as my most recent computer purchase and the serious issue of software piracy. ■

# You've probably already outgrown your personal computer.

Introducing the TeleVideo Personal Mini.  
Your simplest PC growth path.



Personal Mini

You'll know you've outgrown your personal computer the first time you realize it won't let people share resources or work on the same job simultaneously.

The fact is, the isolated, standalone PC is only the beginning of how computers can meet today's business needs.

The fact is, your next step to growth is the new TeleVideo® Personal Mini.™ Simply plug it in and grow.

#### Runs PC, mini and multiuser software.

With the TeleVideo Personal Mini, users of IBM® or TeleVideo PCs, XTs, and portable computers can share data and expensive peripherals like printers and plotters.

The Personal Mini dramatically increases computing power. So it not only runs PC software, but also hundreds of popular, fast minicomputer and multiuser software programs in your established PC environment.

And, unlike less advanced networks, the Personal Mini never sacrifices performance or speed regardless of how many workstations are on line. It also offers multitasking.

#### Enhance your original PC investment.

Even system expansion costs are substantially less than what you'd pay to add new IBM PCs. And your original investment in hardware, software and personal computer education is never lost.

Your TeleVideo dealer now has the Personal Mini. Arrange to see it today by calling toll free, 800-521-4897. In California, call 800-821-3774. Ask for operator 10.


This is the first PC compatible multiuser, multitasking system. And the computer solution you'll never outgrow. Regional Sales Offices: Northwest (408) 745-7760, Southwest (714) 476-0244, Southcentral (214) 258-6776, Midwest (312) 397-5400, Southeast (404) 447-1231, Mid-Atlantic (703) 556-7764, Northeast (617) 890-3282, East (516) 496-4777, Rocky Mountain (408) 745-7760.

IBM is a registered trademark of International Business Machines.



Computers  
TeleVideo Systems, Inc.

The TeleVideo Personal Mini. The first PC compatible multiuser system.

A black and white photograph of a car driving on a road at night. The car is in the distance, its headlights illuminating the road ahead. The scene is dark, with silhouettes of trees and utility poles visible against a slightly lighter sky. A large speech bubble is positioned above the car, containing a humorous quote. The quote is written in a stylized, bold font. The overall mood is mysterious and slightly ironic.

**"JUST WHEN I GET  
A GREAT IDEA,  
THE DICTATING MACHINE  
BREAKS!"**



# SEE LANIER.

The Lanier Pocket Caddy II®. Lightweight. Rugged. Reliable. It works where you work. And it's backed by service second to none. High technology? Absolutely. Lanier is now part of

Harris Corporation, a world leader in Information Technology. Call us at 800-241-1706.\* Or send the coupon. Today.

**FOR YOUR INFORMATION,  
WE'RE NOW PART OF HARRIS.**

\*In Georgia call 404-321-1244 collect.

Lanier, A Harris Company—Thought Processing Division  
For more information on the Lanier Pocket Caddy II™, circle # 219

Thought Processing Division  
1700 Chantilly Drive, N.E.  
Atlanta, GA 30324

**LANIER**  
A Harris Company

Name \_\_\_\_\_  
Firm \_\_\_\_\_ Title \_\_\_\_\_  
Address \_\_\_\_\_  
County \_\_\_\_\_ Phone \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

**HARRIS**

Nov '84, Byte 175 BK4

# SIGN-MASTER™

## Number 1 in word charts for presentations and reports

Create powerful headlines using SIGN-MASTER's color, size, and font options. Here we chose Bold Roman font.

Highlight a single character, word or an entire line at the touch of a button. Here we focus attention on one number with color and underline.

Indicate source, date, author, etc. with SIGN-MASTER's footnote option. Bold Standard font was used in this example.

**THE BOTTOM LINE**  
PROJECTED EARNINGS  
(Millions of \$)

|            | '78  | '79   | '80   | '81   | '82   |
|------------|------|-------|-------|-------|-------|
| Sales      | 86.4 | 121.0 | 144.0 | 163.8 | 182.0 |
| Net Income | 5.9  | 8.8   | 11.4  | 13.4  | 15.7  |
| ROS(%)     | 6.9  | 7.3   | 7.9   | 8.2   | 8.6   |
| Mkt. Share | 48%  | 61%   | 65%   | 71%   | 76%   |

Capital expenditure required: \$5 Million  
Net present value = **\$24.25** Million  
(opportunity cost of capital = 24%)

(Source: Annual Report)

Develop professional tables quickly and easily. Once data and text is entered, SIGN-MASTER determines the spacing and layout.

Produce SIGN-MASTER word charts on paper, overheads or slides.

With SIGN-MASTER, the possibilities are unlimited:

| <p><b>CASUAL USER MARKET</b></p> <p>* 51% Chain Saw Buyers are 1st Time Buyers</p> <table border="1"> <tr><th>Year</th><th>1981</th><th>1982</th><th>1983</th></tr> <tr><td>74</td><td>200</td><td>15</td><td>250</td></tr> <tr><td>76</td><td>400</td><td>75</td><td>200</td></tr> <tr><td>78</td><td>700</td><td>17</td><td>600</td></tr> <tr><td>79</td><td>800</td><td>78</td><td>1500</td></tr> <tr><td>80</td><td>1100</td><td>81</td><td>1150</td></tr> <tr><td>82</td><td>1200</td><td></td><td></td></tr> </table> | Year         | 1981      | 1982      | 1983   | 74          | 200 | 15 | 250 | 76 | 400 | 75 | 200 | 78 | 700 | 17 | 600 | 79 | 800 | 78 | 1500 | 80 | 1100 | 81 | 1150 | 82 | 1200 |  |  | <p><b>SUMMARY FINANCIAL DATA</b></p> <table border="1"> <tr><th>Item</th><th>PLN</th><th>ACTUAL</th><th>BUSINESS</th></tr> <tr><td>SALDO ADVENUE</td><td>885,000</td><td>1,038,000</td><td>31,200</td></tr> <tr><td>ROD</td><td>218,000</td><td>218,500</td><td>(3,500)</td></tr> <tr><td>GROUP PROFIT</td><td>770,000</td><td>819,500</td><td>49,500</td></tr> <tr><td>NETO EXPENSE</td><td>355,000</td><td>248,200</td><td>6230</td></tr> <tr><td>GRU EXPENSE</td><td>218,000</td><td>221,000</td><td>3,000</td></tr> <tr><td>GRU TAX PROFIT</td><td>181,500</td><td>148,300</td><td>(28,200)</td></tr> <tr><td></td><td>85.0</td><td>65.5</td><td>-9.5</td></tr> </table> | Item | PLN | ACTUAL | BUSINESS | SALDO ADVENUE | 885,000 | 1,038,000 | 31,200 | ROD | 218,000 | 218,500 | (3,500) | GROUP PROFIT | 770,000 | 819,500 | 49,500 | NETO EXPENSE | 355,000 | 248,200 | 6230 | GRU EXPENSE | 218,000 | 221,000 | 3,000 | GRU TAX PROFIT | 181,500 | 148,300 | (28,200) |  | 85.0 | 65.5 | -9.5 | <p><b>Table 1 OPERATIONS PLAN</b></p> <table border="1"> <tr><th>Year</th><th>1981</th><th>1982</th><th>1983</th></tr> <tr><td>Units</td><td>100</td><td>120</td><td>150</td></tr> <tr><td>Revenue</td><td>100</td><td>120</td><td>150</td></tr> <tr><td>Expenses</td><td>100</td><td>120</td><td>150</td></tr> <tr><td>Profit</td><td>100</td><td>120</td><td>150</td></tr> </table> | Year | 1981 | 1982 | 1983 | Units | 100 | 120 | 150 | Revenue | 100 | 120 | 150 | Expenses | 100 | 120 | 150 | Profit | 100 | 120 | 150 | <p><b>EXHIBIT 1</b></p> <p><b>COMPUTRON ELECTRONICS</b></p> <p>Product Development Schedule</p> <p>1981-1982-1983-1984-1985</p> | <p><b>FINANCIAL SUMMARY</b></p> <table border="1"> <tr><td>Income Statement</td><td>\$ 9,340,000</td></tr> <tr><td>Cost of Sales Exp.</td><td>3,400,000</td></tr> <tr><td>Income from Operations</td><td>\$ 5,940,000</td></tr> <tr><td>Income Tax Expense</td><td>2,000,000</td></tr> <tr><td>Minority Interest</td><td>25,000</td></tr> <tr><td>Minority Share</td><td>25,000</td></tr> <tr><td>Net Income</td><td>\$ 3,910,000</td></tr> </table> | Income Statement | \$ 9,340,000 | Cost of Sales Exp. | 3,400,000 | Income from Operations | \$ 5,940,000 | Income Tax Expense | 2,000,000 | Minority Interest | 25,000 | Minority Share | 25,000 | Net Income | \$ 3,910,000 | <p><b>NEW PRODUCT PROPOSAL</b></p> <p>For the introduction of the</p> <p style="text-align: center;"><i>Buzzer</i></p> <p>A Backyard Chain Saw for the Growing Casual User Market</p> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|-----------|--------|-------------|-----|----|-----|----|-----|----|-----|----|-----|----|-----|----|-----|----|------|----|------|----|------|----|------|--|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----|--------|----------|---------------|---------|-----------|--------|-----|---------|---------|---------|--------------|---------|---------|--------|--------------|---------|---------|------|-------------|---------|---------|-------|----------------|---------|---------|----------|--|------|------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|-------|-----|-----|-----|---------|-----|-----|-----|----------|-----|-----|-----|--------|-----|-----|-----|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------------|--------------------|-----------|------------------------|--------------|--------------------|-----------|-------------------|--------|----------------|--------|------------|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Year                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1981         | 1982      | 1983      |        |             |     |    |     |    |     |    |     |    |     |    |     |    |     |    |      |    |      |    |      |    |      |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |     |        |          |               |         |           |        |     |         |         |         |              |         |         |        |              |         |         |      |             |         |         |       |                |         |         |          |  |      |      |      |                                                                                                                                                                                                                                                                                                                                                                                       |      |      |      |      |       |     |     |     |         |     |     |     |          |     |     |     |        |     |     |     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |              |                    |           |                        |              |                    |           |                   |        |                |        |            |              |                                                                                                                                                                                       |
| 74                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 200          | 15        | 250       |        |             |     |    |     |    |     |    |     |    |     |    |     |    |     |    |      |    |      |    |      |    |      |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |     |        |          |               |         |           |        |     |         |         |         |              |         |         |        |              |         |         |      |             |         |         |       |                |         |         |          |  |      |      |      |                                                                                                                                                                                                                                                                                                                                                                                       |      |      |      |      |       |     |     |     |         |     |     |     |          |     |     |     |        |     |     |     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |              |                    |           |                        |              |                    |           |                   |        |                |        |            |              |                                                                                                                                                                                       |
| 76                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 400          | 75        | 200       |        |             |     |    |     |    |     |    |     |    |     |    |     |    |     |    |      |    |      |    |      |    |      |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |     |        |          |               |         |           |        |     |         |         |         |              |         |         |        |              |         |         |      |             |         |         |       |                |         |         |          |  |      |      |      |                                                                                                                                                                                                                                                                                                                                                                                       |      |      |      |      |       |     |     |     |         |     |     |     |          |     |     |     |        |     |     |     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |              |                    |           |                        |              |                    |           |                   |        |                |        |            |              |                                                                                                                                                                                       |
| 78                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 700          | 17        | 600       |        |             |     |    |     |    |     |    |     |    |     |    |     |    |     |    |      |    |      |    |      |    |      |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |     |        |          |               |         |           |        |     |         |         |         |              |         |         |        |              |         |         |      |             |         |         |       |                |         |         |          |  |      |      |      |                                                                                                                                                                                                                                                                                                                                                                                       |      |      |      |      |       |     |     |     |         |     |     |     |          |     |     |     |        |     |     |     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |              |                    |           |                        |              |                    |           |                   |        |                |        |            |              |                                                                                                                                                                                       |
| 79                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 800          | 78        | 1500      |        |             |     |    |     |    |     |    |     |    |     |    |     |    |     |    |      |    |      |    |      |    |      |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |     |        |          |               |         |           |        |     |         |         |         |              |         |         |        |              |         |         |      |             |         |         |       |                |         |         |          |  |      |      |      |                                                                                                                                                                                                                                                                                                                                                                                       |      |      |      |      |       |     |     |     |         |     |     |     |          |     |     |     |        |     |     |     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |              |                    |           |                        |              |                    |           |                   |        |                |        |            |              |                                                                                                                                                                                       |
| 80                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1100         | 81        | 1150      |        |             |     |    |     |    |     |    |     |    |     |    |     |    |     |    |      |    |      |    |      |    |      |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |     |        |          |               |         |           |        |     |         |         |         |              |         |         |        |              |         |         |      |             |         |         |       |                |         |         |          |  |      |      |      |                                                                                                                                                                                                                                                                                                                                                                                       |      |      |      |      |       |     |     |     |         |     |     |     |          |     |     |     |        |     |     |     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |              |                    |           |                        |              |                    |           |                   |        |                |        |            |              |                                                                                                                                                                                       |
| 82                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1200         |           |           |        |             |     |    |     |    |     |    |     |    |     |    |     |    |     |    |      |    |      |    |      |    |      |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |     |        |          |               |         |           |        |     |         |         |         |              |         |         |        |              |         |         |      |             |         |         |       |                |         |         |          |  |      |      |      |                                                                                                                                                                                                                                                                                                                                                                                       |      |      |      |      |       |     |     |     |         |     |     |     |          |     |     |     |        |     |     |     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |              |                    |           |                        |              |                    |           |                   |        |                |        |            |              |                                                                                                                                                                                       |
| Item                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | PLN          | ACTUAL    | BUSINESS  |        |             |     |    |     |    |     |    |     |    |     |    |     |    |     |    |      |    |      |    |      |    |      |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |     |        |          |               |         |           |        |     |         |         |         |              |         |         |        |              |         |         |      |             |         |         |       |                |         |         |          |  |      |      |      |                                                                                                                                                                                                                                                                                                                                                                                       |      |      |      |      |       |     |     |     |         |     |     |     |          |     |     |     |        |     |     |     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |              |                    |           |                        |              |                    |           |                   |        |                |        |            |              |                                                                                                                                                                                       |
| SALDO ADVENUE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 885,000      | 1,038,000 | 31,200    |        |             |     |    |     |    |     |    |     |    |     |    |     |    |     |    |      |    |      |    |      |    |      |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |     |        |          |               |         |           |        |     |         |         |         |              |         |         |        |              |         |         |      |             |         |         |       |                |         |         |          |  |      |      |      |                                                                                                                                                                                                                                                                                                                                                                                       |      |      |      |      |       |     |     |     |         |     |     |     |          |     |     |     |        |     |     |     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |              |                    |           |                        |              |                    |           |                   |        |                |        |            |              |                                                                                                                                                                                       |
| ROD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 218,000      | 218,500   | (3,500)   |        |             |     |    |     |    |     |    |     |    |     |    |     |    |     |    |      |    |      |    |      |    |      |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |     |        |          |               |         |           |        |     |         |         |         |              |         |         |        |              |         |         |      |             |         |         |       |                |         |         |          |  |      |      |      |                                                                                                                                                                                                                                                                                                                                                                                       |      |      |      |      |       |     |     |     |         |     |     |     |          |     |     |     |        |     |     |     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |              |                    |           |                        |              |                    |           |                   |        |                |        |            |              |                                                                                                                                                                                       |
| GROUP PROFIT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 770,000      | 819,500   | 49,500    |        |             |     |    |     |    |     |    |     |    |     |    |     |    |     |    |      |    |      |    |      |    |      |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |     |        |          |               |         |           |        |     |         |         |         |              |         |         |        |              |         |         |      |             |         |         |       |                |         |         |          |  |      |      |      |                                                                                                                                                                                                                                                                                                                                                                                       |      |      |      |      |       |     |     |     |         |     |     |     |          |     |     |     |        |     |     |     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |              |                    |           |                        |              |                    |           |                   |        |                |        |            |              |                                                                                                                                                                                       |
| NETO EXPENSE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 355,000      | 248,200   | 6230      |        |             |     |    |     |    |     |    |     |    |     |    |     |    |     |    |      |    |      |    |      |    |      |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |     |        |          |               |         |           |        |     |         |         |         |              |         |         |        |              |         |         |      |             |         |         |       |                |         |         |          |  |      |      |      |                                                                                                                                                                                                                                                                                                                                                                                       |      |      |      |      |       |     |     |     |         |     |     |     |          |     |     |     |        |     |     |     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |              |                    |           |                        |              |                    |           |                   |        |                |        |            |              |                                                                                                                                                                                       |
| GRU EXPENSE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 218,000      | 221,000   | 3,000     |        |             |     |    |     |    |     |    |     |    |     |    |     |    |     |    |      |    |      |    |      |    |      |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |     |        |          |               |         |           |        |     |         |         |         |              |         |         |        |              |         |         |      |             |         |         |       |                |         |         |          |  |      |      |      |                                                                                                                                                                                                                                                                                                                                                                                       |      |      |      |      |       |     |     |     |         |     |     |     |          |     |     |     |        |     |     |     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |              |                    |           |                        |              |                    |           |                   |        |                |        |            |              |                                                                                                                                                                                       |
| GRU TAX PROFIT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 181,500      | 148,300   | (28,200)  |        |             |     |    |     |    |     |    |     |    |     |    |     |    |     |    |      |    |      |    |      |    |      |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |     |        |          |               |         |           |        |     |         |         |         |              |         |         |        |              |         |         |      |             |         |         |       |                |         |         |          |  |      |      |      |                                                                                                                                                                                                                                                                                                                                                                                       |      |      |      |      |       |     |     |     |         |     |     |     |          |     |     |     |        |     |     |     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |              |                    |           |                        |              |                    |           |                   |        |                |        |            |              |                                                                                                                                                                                       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 85.0         | 65.5      | -9.5      |        |             |     |    |     |    |     |    |     |    |     |    |     |    |     |    |      |    |      |    |      |    |      |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |     |        |          |               |         |           |        |     |         |         |         |              |         |         |        |              |         |         |      |             |         |         |       |                |         |         |          |  |      |      |      |                                                                                                                                                                                                                                                                                                                                                                                       |      |      |      |      |       |     |     |     |         |     |     |     |          |     |     |     |        |     |     |     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |              |                    |           |                        |              |                    |           |                   |        |                |        |            |              |                                                                                                                                                                                       |
| Year                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1981         | 1982      | 1983      |        |             |     |    |     |    |     |    |     |    |     |    |     |    |     |    |      |    |      |    |      |    |      |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |     |        |          |               |         |           |        |     |         |         |         |              |         |         |        |              |         |         |      |             |         |         |       |                |         |         |          |  |      |      |      |                                                                                                                                                                                                                                                                                                                                                                                       |      |      |      |      |       |     |     |     |         |     |     |     |          |     |     |     |        |     |     |     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |              |                    |           |                        |              |                    |           |                   |        |                |        |            |              |                                                                                                                                                                                       |
| Units                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 100          | 120       | 150       |        |             |     |    |     |    |     |    |     |    |     |    |     |    |     |    |      |    |      |    |      |    |      |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |     |        |          |               |         |           |        |     |         |         |         |              |         |         |        |              |         |         |      |             |         |         |       |                |         |         |          |  |      |      |      |                                                                                                                                                                                                                                                                                                                                                                                       |      |      |      |      |       |     |     |     |         |     |     |     |          |     |     |     |        |     |     |     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |              |                    |           |                        |              |                    |           |                   |        |                |        |            |              |                                                                                                                                                                                       |
| Revenue                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 100          | 120       | 150       |        |             |     |    |     |    |     |    |     |    |     |    |     |    |     |    |      |    |      |    |      |    |      |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |     |        |          |               |         |           |        |     |         |         |         |              |         |         |        |              |         |         |      |             |         |         |       |                |         |         |          |  |      |      |      |                                                                                                                                                                                                                                                                                                                                                                                       |      |      |      |      |       |     |     |     |         |     |     |     |          |     |     |     |        |     |     |     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |              |                    |           |                        |              |                    |           |                   |        |                |        |            |              |                                                                                                                                                                                       |
| Expenses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 100          | 120       | 150       |        |             |     |    |     |    |     |    |     |    |     |    |     |    |     |    |      |    |      |    |      |    |      |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |     |        |          |               |         |           |        |     |         |         |         |              |         |         |        |              |         |         |      |             |         |         |       |                |         |         |          |  |      |      |      |                                                                                                                                                                                                                                                                                                                                                                                       |      |      |      |      |       |     |     |     |         |     |     |     |          |     |     |     |        |     |     |     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |              |                    |           |                        |              |                    |           |                   |        |                |        |            |              |                                                                                                                                                                                       |
| Profit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 100          | 120       | 150       |        |             |     |    |     |    |     |    |     |    |     |    |     |    |     |    |      |    |      |    |      |    |      |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |     |        |          |               |         |           |        |     |         |         |         |              |         |         |        |              |         |         |      |             |         |         |       |                |         |         |          |  |      |      |      |                                                                                                                                                                                                                                                                                                                                                                                       |      |      |      |      |       |     |     |     |         |     |     |     |          |     |     |     |        |     |     |     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |              |                    |           |                        |              |                    |           |                   |        |                |        |            |              |                                                                                                                                                                                       |
| Income Statement                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | \$ 9,340,000 |           |           |        |             |     |    |     |    |     |    |     |    |     |    |     |    |     |    |      |    |      |    |      |    |      |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |     |        |          |               |         |           |        |     |         |         |         |              |         |         |        |              |         |         |      |             |         |         |       |                |         |         |          |  |      |      |      |                                                                                                                                                                                                                                                                                                                                                                                       |      |      |      |      |       |     |     |     |         |     |     |     |          |     |     |     |        |     |     |     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |              |                    |           |                        |              |                    |           |                   |        |                |        |            |              |                                                                                                                                                                                       |
| Cost of Sales Exp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3,400,000    |           |           |        |             |     |    |     |    |     |    |     |    |     |    |     |    |     |    |      |    |      |    |      |    |      |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |     |        |          |               |         |           |        |     |         |         |         |              |         |         |        |              |         |         |      |             |         |         |       |                |         |         |          |  |      |      |      |                                                                                                                                                                                                                                                                                                                                                                                       |      |      |      |      |       |     |     |     |         |     |     |     |          |     |     |     |        |     |     |     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |              |                    |           |                        |              |                    |           |                   |        |                |        |            |              |                                                                                                                                                                                       |
| Income from Operations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | \$ 5,940,000 |           |           |        |             |     |    |     |    |     |    |     |    |     |    |     |    |     |    |      |    |      |    |      |    |      |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |     |        |          |               |         |           |        |     |         |         |         |              |         |         |        |              |         |         |      |             |         |         |       |                |         |         |          |  |      |      |      |                                                                                                                                                                                                                                                                                                                                                                                       |      |      |      |      |       |     |     |     |         |     |     |     |          |     |     |     |        |     |     |     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |              |                    |           |                        |              |                    |           |                   |        |                |        |            |              |                                                                                                                                                                                       |
| Income Tax Expense                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2,000,000    |           |           |        |             |     |    |     |    |     |    |     |    |     |    |     |    |     |    |      |    |      |    |      |    |      |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |     |        |          |               |         |           |        |     |         |         |         |              |         |         |        |              |         |         |      |             |         |         |       |                |         |         |          |  |      |      |      |                                                                                                                                                                                                                                                                                                                                                                                       |      |      |      |      |       |     |     |     |         |     |     |     |          |     |     |     |        |     |     |     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |              |                    |           |                        |              |                    |           |                   |        |                |        |            |              |                                                                                                                                                                                       |
| Minority Interest                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 25,000       |           |           |        |             |     |    |     |    |     |    |     |    |     |    |     |    |     |    |      |    |      |    |      |    |      |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |     |        |          |               |         |           |        |     |         |         |         |              |         |         |        |              |         |         |      |             |         |         |       |                |         |         |          |  |      |      |      |                                                                                                                                                                                                                                                                                                                                                                                       |      |      |      |      |       |     |     |     |         |     |     |     |          |     |     |     |        |     |     |     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |              |                    |           |                        |              |                    |           |                   |        |                |        |            |              |                                                                                                                                                                                       |
| Minority Share                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 25,000       |           |           |        |             |     |    |     |    |     |    |     |    |     |    |     |    |     |    |      |    |      |    |      |    |      |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |     |        |          |               |         |           |        |     |         |         |         |              |         |         |        |              |         |         |      |             |         |         |       |                |         |         |          |  |      |      |      |                                                                                                                                                                                                                                                                                                                                                                                       |      |      |      |      |       |     |     |     |         |     |     |     |          |     |     |     |        |     |     |     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |              |                    |           |                        |              |                    |           |                   |        |                |        |            |              |                                                                                                                                                                                       |
| Net Income                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | \$ 3,910,000 |           |           |        |             |     |    |     |    |     |    |     |    |     |    |     |    |     |    |      |    |      |    |      |    |      |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |     |        |          |               |         |           |        |     |         |         |         |              |         |         |        |              |         |         |      |             |         |         |       |                |         |         |          |  |      |      |      |                                                                                                                                                                                                                                                                                                                                                                                       |      |      |      |      |       |     |     |     |         |     |     |     |          |     |     |     |        |     |     |     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |              |                    |           |                        |              |                    |           |                   |        |                |        |            |              |                                                                                                                                                                                       |
| Proposals                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Summaries    | Exhibits  | Schedules | Tables | Title Pages |     |    |     |    |     |    |     |    |     |    |     |    |     |    |      |    |      |    |      |    |      |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |     |        |          |               |         |           |        |     |         |         |         |              |         |         |        |              |         |         |      |             |         |         |       |                |         |         |          |  |      |      |      |                                                                                                                                                                                                                                                                                                                                                                                       |      |      |      |      |       |     |     |     |         |     |     |     |          |     |     |     |        |     |     |     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |              |                    |           |                        |              |                    |           |                   |        |                |        |            |              |                                                                                                                                                                                       |



SIGN-MASTER is the first program designed to allow everyone from top management on down to produce colorful, attention-gaining

"word charts" and tables for presentations and reports.

Created on an IBM PC with a compatible plotter or printer, SIGN-MASTER word charts are superior in quality to typing and less expensive than typesetting or printing.

### Professional Word Charts Made Easy

In just minutes, this unique menu-driven program lets you create impressive, easy-to-read documents using words, numbers, lines and SIGN-MASTER's simple-to-master Table Mode.

### Number 1 in Quality Text

SIGN-MASTER offers the greatest variety of text options. In addition to 6 fonts, 16 sizes and 8 colors, you can justify text, underline, italicize, set margins, spacing, and more.

### An Important Presentation Tool

With SIGN-MASTER and any one of over 40

plotters, you can produce full color originals on paper and overheads. The program also works with most popular printers to create the highest quality printer graphics possible.

### Make Super Slides Quickly and Economically

Presentation-quality 35mm slides can be created in-house and inexpensively using the Polaroid Palette in conjunction with SIGN-MASTER.

For reports and presentations that get noticed, get SIGN-MASTER — Number 1 in word charts.

The retail price is \$245.00. Call or write today for a complete information kit and a demonstration at your nearest dealer. Decision Resources, Inc., 25 Sylvan Road South, Westport, CT 06880 (203) 222-1974

Circle 114 on inquiry card.

The developers of CHART-MASTER  
**DecisionResources**  
Software Designed for Decision Makers

## Conducted by Steve Ciarcia

### 65816 INFO, PLEASE

Dear Steve,

Do you have information on the new 65816 chip that has been announced as an upgrade for 6502 systems?

If this chip is available, please print information as to company, price, and any comments you have regarding its use for upgrade of 6502 systems.

BILL BUNN  
Covelo, CA

*The Western Design Center of Mesa, Arizona, is in the production-test phase of the 65816, a 16-bit CMOS version of the 6502. (See the August and September issues for a two-part article on the 65816.) It will feature an 8-bit data bus and 24-bit addressing to address up to 16 megabytes of RAM. One version will be pin-compatible with the current 6502, so a direct replacement is possible. Existing 6502 software can be run with this new chip.*

*No further chip data is available at this time, but Hayden Software of Lowell, Massachusetts, is preparing an assembler and Pascal compiler for use with the 65816.—Steve*

### DIGITIZED STAMPS

Dear Steve,

I was very interested in reading your articles on the solid-state video camera (September and October 1983). I became interested in this field about a year ago because of my hobby, stamp collecting. I collect the first issues of Greece, which were printed in 1861-82. Because of the crude printing method, there are variations between each of the stamp positions on the printing plate. A study of these variations allows one to determine from which position any stamp was printed.

Visual inspection with a magnifying glass is tedious and often in error. Since I have an IBM PC, I thought that it would be possible to digitize an image of the stamp using a video camera and then have the computer recognize variations in each stamp by a pattern-recognition program.

I purchased a Tecmar Video Van Gogh digitizer board (\$300) and an RCA TC2000 closed-circuit video camera (\$300 without lens). Using a Nikon close-up lens I already had, I was able to digitize the images of about 1500 stamps whose position I had previously determined by visual means. Standard variations for each of 150 positions were stored in memory and used as a comparison (by least squares) with stamps whose positions were unknown. This procedure was successful.

In addition to its use in my hobby, I also tried digitizing photographs and printing the image on an Epson MX-100 printer. The Tecmar board digitizes a 255- by 255-pixel image with 255 levels of gray scale for each pixel. Since the Epson MX-100 prints 810 dots horizontally in single-density bit mode, I wrote a program to digitize an image with 200 pixels across. To print the gray scale, a 4- by 4-dot matrix was used for each pixel (4 x 200=800). This matrix allowed the printing of 17 gray levels (0 to 16 dots). In my program, I divided the 255 gray levels from the digitizer into nine increments and used 2 dots per increment and 0 dots for white.

LOU BASEL  
Stamford, CT

*I am impressed with your application of computerized video imaging to stamp collecting. It is a clever application of a proven concept.*

*The uses for the hardware you described are endless. Your setup has a higher resolution and more gray scale levels than my Micro D-Cam, so sharper pictures with better contrast can be obtained. With proper software and imagination, anything is possible.—Steve*

### MPX-16 KEYBOARD INTERFACE

Dear Steve,

I recently took delivery of an MPX-16 empty board. It is not up and running (still shopping for a good price on a quality terminal) but will be shortly.

My IBM technical manual reveals that interfacing the IBM serial-type keyboard (non-RS-232C) requires a reasonably simple hardware design supplement to the

MPX-16, and software will be needed to drive it.

My problem is primarily time. To wire-wrap my own hardware interface would not be cost-effective.

Do you know where I can get an assembled interface?

ALLAN J. DOMURET  
Fair Oaks, CA

*It is not necessary to wire-wrap a keyboard interface for your MPX-16. The MPX-17 is an IBM Keyboard Interface Card that plugs into an expansion slot to allow the use of your IBM or Key Tronic keyboard. It includes a tone generator and a 2-inch speaker and is available from The Micromint for \$100.—Steve*

### NO MORE RINGING!

Dear Steve,

I can find books on logic design and general interfacing techniques by the pound. But books dealing with the more basic issues of grounding, shielding, and decoupling (I think the generic term is "circuit analysis") have been difficult to find. One specific problem I am concerned with is ringing on lines, as I plan to move up to a 10-MHz system. From what I have read, 10 MHz is where systems become noticeably more susceptible to line noise and other gremlins.

L. A. GRINZO  
Endwell, NY

*Important procedures to follow in design of circuits in the 8- to 10-MHz range, where the faster microcomputers operate, include installing bypass capacitors at the power-supply terminal of each IC, proper termination of all signal lines longer than a few inches, and providing a ground plane for the longer lines.*

*Information may be obtained from IC manufacturers' data books and application notes. For example, the Signetics TTL Logic Data Manual (Signetics Corp., 811 East Arques Ave., Sunnyvale, CA 94086) recommends 100-ohm lines terminated by connecting the line to the center point*

(continued)

**NOW, THE LOWEST PRICES EVER ON**



**3M Scotch®  
DISKETTES**

**\$153** ea. 5 1/4" SSDD QTY. 20  
**\$206** ea. 5 1/4" DSDD QTY. 20

**\$229** ea. 5 1/4" SSDD-96TPI QTY. 20  
**\$290** ea. 5 1/4" DSDD-96TPI QTY. 20

**SOFT SECTOR ONLY!**  
MINIMUM ORDER: 20 DISKETTES

These are factory-fresh 3M diskettes packed in boxes of 10 with Tyvek sleeves, reinforced hubs, identification labels and write-protect tabs.

**LIFETIME WARRANTY!  
ON ALL 3M SCOTCH DISKETTES!**

**SUPER SPECIAL!**



Order 50 3M Scotch Diskettes on this special offer and you can get an Amaray Media Mate 50 for only \$9.99 (shipping included). Normally, a \$14.95 retail value, this is one of the best designed disk storage units we've seen. Special slots and ridges for stacking. A great buy.

With 50 3M Scotch 5 1/4" Diskettes **\$9.99**  
Ordered alone: **\$10.95** + \$2.00 Shpng.

**8" 3M Scotch Diskettes**  
8" SSDD... **\$1.96** ea. 8" SSDD... **\$2.42** ea.  
8" DSDD... **\$2.76** ea.

**SOFT SECTOR ONLY!**  
MINIMUM ORDER 8" DISKETTES: 20

**3M HEADCLEANING KITS**

Stop swearing and start cleaning. This non-abrasive cleaning kit has everything you need for 30 applications. **\$18.00** Shpng.

**DISKETTE 70 STORAGE:  
STILL A GREAT BUY**

Dust-free storage for 70 5 1/4" diskettes. Six dividers included. An excellent value. **\$11.95** + \$3.00 Shpng.

**DISK CADDIES**

The original flip-up holder for 10 5 1/4" diskettes. Beige or grey only. **\$1.65** ea. + 20¢ Shpng.

**PRINTER RIBBONS  
AT BARGAIN PRICES!**

Brand new ribbons produced to manufacturer's specs.  
Epson MX-70/80... **\$3.58** ea. + 25 Shpng.  
Epson MX-100... **\$6.99** ea. + 25 Shpng.  
Okidata Micro 83... **\$1.48** ea. + 25 Shpng.  
Okidata Micro 84... **\$3.66** ea. + 25 Shpng.

Shipping: 5 1/4" DISKETTES—Add \$3.00 per 100 or fewer diskettes. 8" DISKETTES—Add \$4.00 per 100 or fewer diskettes. Other Items: Add shipping charges as shown in addition to diskette shipping charges. Payment: VISA and MASTERCARD accepted. COD orders only, add \$3.00 handling charge. Taxes: Illinois residents only, add 8% sales tax.

MINIMUM ORDER: \$35.00

**FOR ORDERS ONLY:**

**1-800-621-6827**

(In Illinois: 1-312-944-2788)

**INFORMATION & INQUIRIES:**

**1-312-944-2788 only!**

HOURS: 9AM - 5PM Central Time,  
Monday - Friday

**WE WILL BEAT ANY NATIONALLY ADVERTISED PRICE  
ON THE SAME PRODUCTS AND QUANTITIES!**

**DISK WORLD!, Inc.**

Suite 4806 • 30 East Huron Street • Chicago, Illinois 60611

**DISK  
WORLD!**

Authorized Distributor  
Information Processing  
Products



**CIARCIA FEEDBACK**

of a pair of 200-ohm resistors connected from  $V_{cc}$  to ground for lines more than a foot long. Reflections on shorter lines are usually not a problem at CMOS or TTL frequencies.

The book Grounding and Shielding Techniques in Instrumentation by Ralph Morrison (John Wiley & Sons, 1977) will also provide useful information.—Steve

there any obvious signs? Panamax Corp. (150 Mitchell Blvd., San Rafael, CA 94903) claims that its surge suppressor reacts in 5 picoseconds. Can any suppressor react that quickly? Panamax also claims that its uninterruptible power system (UPS) has a line-to-battery transfer time of 5 milliseconds. Is that typical?

WALTER I. NISSEN JR.  
Takoma Park, MD

**IT'D BE NEAT IF THERE WERE**

Dear Steve,

I enjoyed your September and October 1983 project, "Build the Micro D-Cam Solid-State Video Camera." I would like to put together a system for capturing mechanical drawings, maps, and various forms of line art on a microcomputer system. I would like to be able to manipulate or improve these drawings by performing functions such as zoom, rotation, thresholding, halftoning, filtering, and edge detection. In addition, I would like to reproduce the processed drawings on a plotter at various sizes and scales. I realize this process will require some fairly complicated vectorization software, which leads me to my question: Does the software necessary to drive such a system exist?

DAVID A. SATKO  
Reston, VA

I don't know of any software system available for microcomputers that can do all the things you want, but a system just announced by Datacopy Corp. is described as a "word image processing system" that runs on an IBM PC XT. This system, called the Model 800, consists of a digitizing camera and supporting software. It reportedly can enter text, photos, and drawings into a computer for processing. Contact Datacopy Corp., 1215 Terra Bella Ave., Mountain View, CA 94043, (415) 965-7900 for more information.—Steve

**POWER QUESTIONS**

Dear Steve,

Your article about power-line pollution (December 1983) was very good, but I have some questions. Does a series installation of protective devices offer any additional protection? Why did you use metal-oxide varistors (MOVs) rather than silicon zener diodes, which appear to have a faster reaction time? Also, how can you determine that an MOV has failed? Are

My article on power-line pollution generated a lot of reader response. I was surprised that so many people were concerned with transient suppression.

Placing protective devices in series can offer increased protection. For example, a line filter placed ahead of a transient suppressor can help reduce some transients due to the filter's time constant. The filter components usually are able to withstand large transients.

I used MOVs instead of silicon zener diodes since they were more readily available (at any Radio Shack) and offered adequate protection. MOV failures usually result in a short circuit. A fuse in series with one leg of the MOV is a good idea to prevent a short across the line, and this can be used to trigger a neon bulb or LED, indicating failure.

The response time of a varistor or silicon zener diode is influenced by its lead length and configuration. It is usually shorter than its inductive lead effect and can be less than a few nanoseconds. The Panamax claim of 5 picoseconds is not unreasonable.

The 5-millisecond battery transfer time of the UPS is not unusual. Many manufacturers advertise times in the 1.5- to 6-millisecond range. Some units use the battery to generate the AC voltage. The power-conversion circuitry serves only to charge the battery. In this case, there is no transfer time.—Steve

**HARDY USERS WANT MODEM**

Dear Steve,

I am the editor of a new newsletter for a hardy group of Epson QX-10 users in the Washington area. We are almost 100 strong after four meetings and are growing. I noticed by a show of hands how few own modems and thus are missing much of the microcomputer world.

I own a Hayes 300 and often decline to download or send because of the length of time required. Modems introduce an intense social pressure into many homes:

(continued)

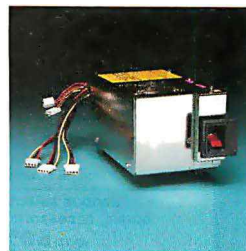


# Interact with a Genius



## 135W POWER SUPPLY

Hard Disk ready  
+12V at 4.5A max  
+5V at 15A max  
Same dimension and plug  
compatible with IBM PC/XT  
power supply



## HARD DISK ASSEMBLY

10 Mb formatted Fixed Disk  
5 Mb formatted Removable  
Cartridge  
Unlimited storage  
Bootable from fixed disk



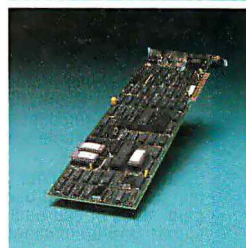
## SUPER MOTHERBOARD

Single layer double sided  
board  
Same dimension as IBM  
motherboard  
Up to 256K Ram on-board  
8 I/O slots



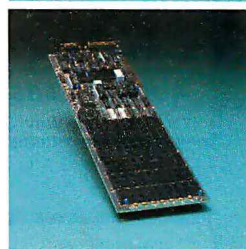
## PERSYST B.O.B. BOARD

Super hi-res display adapter  
on text and graphics  
10 x 16 character cell in  
monochrome and color  
Programmable and software  
selectable character sets



## MULTIFUNCTION CARD

0-384K memory expansion  
plus 256K on board to give  
maximum addressable  
memory.



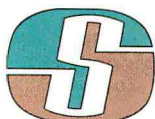
## The Ultimate in IBM PC/XT® compatibles.

The Super XT Plus by Super Computer is a better alternative than the standard PC/XT configuration. The 256Kb of dynamic RAM with parity can be upgraded to 640Kb. Eight I/O slots give you the maximum in tailored expandability. A 16 Bit 8088 Microprocessor with an 8087

coprocessor option gives you the speed to tackle the heavy jobs. Two half-height 360K Floppy Disk Drives are matched with a half-height 5 Mb Removable Hard Disk and a 10 Mb fixed Hard Disk. A Multifunction card is included with Serial and Parallel ports, Clock Calendar, Game port, and memory expansion to

384K. An Ultra High-Res Taxan® monitor equipped with Persyst's B.O.B.\* Board gives you the highest resolution possible (720 x 400). A unique 135 Watt Power Supply offers 220 Voltage conversion as an option. The Super Computer PC/XT.

Interact with a Genius!



**SUPER COMPUTER**

**Manufacturer/Distributor**

17813 South Main St. Suite 103, Gardena, CA 90248

213/532-2133

Circle 358 on inquiry card.

© 1984 Super Computer, Inc.

**DEALER AND OEM INQUIRES INVITED**

**FAX 213/532-6342**

**TELEX 3719394 SUPER**

# wabash

Warranted Integrity,  
Incredible Value



## DISKETTES

|     |        |                                              |        |
|-----|--------|----------------------------------------------|--------|
| M11 | 5 1/4" | SINGLE SIDE<br>SINGLE DENSITY<br>SOFT SECTOR | \$1 19 |
| M13 | 5 1/4" | SINGLE SIDE<br>DOUBLE DENSITY<br>SOFT SECTOR | \$1 39 |
| M14 | 5 1/4" | DOUBLE SIDE<br>DOUBLE DENSITY<br>SOFT SECTOR | \$1 89 |

SOLD IN BOXES OF TEN ONLY

tremendous selection of software  
books, accessories and supplies

UP TO **50% OFF!**

### SOFTWARE FOR IBM PC

|                 |       |        |              |            |
|-----------------|-------|--------|--------------|------------|
| DBASE III       | ..... | 415.00 | MULTIMATE    | ... 270.00 |
| FRAMEWORK       | ..... | 430.00 | SYMPHONY     | ... 449.00 |
| HOME ACCT. PLUS | ..    | 85.00  | W.S. PRO PAC | ... 265.00 |
| " W/ULTRAFILE   | ..    | 169.00 | ULTRAFILE    | ... 115.00 |

ABOVE SOFTWARE AVAILABLE IN OTHER FORMATS. CALL FOR AVAILABILITY AND PRICE.

Minimum shipping and handling \$2.00. California residents add 6% sales tax. Prices subject to change without notice. Write for our free catalog.

## ABC data products

P. O. BOX 18720, SAN DIEGO, CALIFORNIA 92118

619-283-5488 800-854-1555

# VT100

## \$150.\*

\*plus your IBM PC or compatible

Use your IBM PC as a DEC VT100 with  
ZSTEMpc-VT100 smart terminal emulator

132 columns by windowing —  
no additional hardware

Double High/Double Wide Characters  
Complete VT100 line graphics

Smooth scrolling

Full keyboard softkeys / MACROS

Bidirectional file transfers —

including XMODEM

Speeds to 38.4KB. High throughput.

ZSTEM Communications Division

KEA SYSTEMS LTD.

#311 - 811 Beach Avenue

Vancouver, B.C.

CANADA V6Z 2B5

(604) 687-2744

## CIARCIA FEEDBACK

who is going to use the phone and when, and who is waiting for a call that can't come through, and all the friends and acquaintances who exclaim about your busy phone.

I know, Circuit Cellar is off on very esoteric, exciting things, but why don't you help computer folks from coast to coast by selling us a kit for a 1200-bps modem? It should be a "smart" modem technically, stand-alone, and the parts, board, and case should cost \$125.

JAMES N. DAVIS  
Falls Church, VA

*I have been thinking about a 1200-bps modem project but have been reluctant because of high cost. The most readily available 1200-bps chips are made by Exar, and a circuit built around them would cost about \$150 just for parts. To offer it as a kit, with a printed-circuit board and instruction manual, would raise the cost to levels comparable with some of the commercially available units.*

*Obtaining FCC device approval would add substantially to the unit cost, so it could be offered only as a kit.*

*I have been waiting for some new devices to become available that will enable the construction of a 1200-bps modem for the price that you mentioned. I want to present such a project. So when I can offer a circuit for a reasonable price, it will be published.—Steve*

## HOME-CONTROL COMPUTER

Dear Steve,

I would like your help in constructing a Touch-Tone decoder for a remote control that would not only survey the situation of my home but would operate a Rainbow air cleaner robotically. This would essentially clean the house from anywhere.

ROBERT B. SINGER  
Toronto, Ontario, Canada

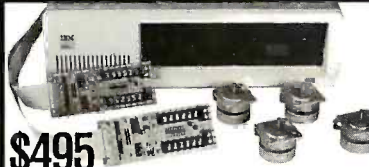
*I am planning a home-security/control project that will use a computer to control various devices directly or via the power lines, have a real-time clock to enable events to occur at precise times, include the capability of reminder messages, be callable via modem, and allow for remote control. It should meet your requirements.*

*On a recent consulting job, I demonstrated the prototype of this home-control computer to representatives from the National Association of Home*

(continued)

Circle 414 on inquiry card.

Circle 413 on inquiry card.



**\$495**

## PCMOTION™ Control Board

IBM PC/XT compatible stepper motor control plug-in board

- 4 Axis stepper motor controller interface
- 32 digital I/O with (5) interrupts
- 4 channels encoder pulse inputs
- Includes real time interrupt-driven easy to use software

Smart board for Industrial and Robotic motion control that uses only a small percentage of cpu time. System needs only simple BASIC commands from application software.

— 100's of satisfied customers use our products —  
\*\*\*30-day money back guarantee\*\*\*

**ROGERS LABS** Tel. (714) 751-0442  
Telex 681393  
2710 S. Croddy Way, Santa Ana, CA 92704

Circle 417 on inquiry card.

## OK-WRITER™.M.

### LETTER QUALITY

Enhancement for Dot Matrix Printers



- Easy to install
- Plug-in module
- Okidata printers
- Letter Quality: 30 cps
- Draft Quality: 120 cps
- 10, 12, 17 cpi

- Full dot addressable graphics
- Front panel access to all features
- Proportional spacing, bold, double width, underlining, self-test, etc.
- Serial and parallel interfaces retained
- HELP mode: Diagnostic HEX dump
- And many other features

Designed for upgrading your current or new ML82A/83A printer.

**RAINBOW TECHNOLOGIES, INC.**  
P.O. Box 7200, Costa Mesa, CA 92628  
(714) 241-0565 Telex 386078

Circle 415 on inquiry card.

### DEVELOPMENT CONTROL



## SBC88 DEVELOPMENT AND CONTROL SYSTEM

WRITE IT — RUN IT — ROM IT

A single board computer development and control system that is so simple to use, you will be developing applications programs the first day!

- \* Choice of Basic or FORTH in ROM
- \* 8 channel, 8 bit analog to digital converter
- \* Two 8 bit input ports
- \* Two 8 bit output ports
- \* Time of day
- \* 8088 16 bit uP
- \* Onboard EPROM programmer for complete program development
- \* 7 current sinking outputs rated at 500 mA, 50 VDC
- \* BSR link available
- \* Up to 32 K of user memory
- \* Assembled and tested \$279
- \* Kits start at \$119

**Vesta Technology, Inc.**  
1777 S. Bellaire St. Suite 211  
Denver, CO 80222 (303)-759-4988

Circle 412 on inquiry card.

## SPEECH SYNTHESIZER

### The Big Mouth

LISTEN! Your computer could be talking to you through the BIG MOUTH from ASTROTRONICS. True speech synthesis for ANY computer through your printer port, (parallel or serial).



Complete **\$199**  
Introductory Price

- No software required
- 400 Character buffer
- Text to speech
- Will run on any computer
- Embed phonemes in text for those special words.
- Programmable: Vocal-tract frequency, intlection rate, duration pitch, articulation amplitude...for all 64 phonemes
- Can be programmed to make sound effects or sing!

Kits from \$59 Add \$5.00 S & H Cal. res. add 6% tax  
Dealer Inquiries Invited  
Phone for Demonstration  
(714) 734-6006

**AstroTronics MICROSYSTEMS** 1137 Topaz Street  
Corona, CA 91720

Circle 416 on inquiry card.

**Thinking of  
buying a modem?  
You owe it  
to yourself to check out the Qubie' 212A modems.**

# Inside Outside

Just a few years ago, computers needed big air-conditioned rooms to operate in, balefuls of money to buy, and a team of wizards to keep them running. The constant march of technological progress has given more and more powerful machines which cost less and less. Desktop computers more powerful than the early mainframe computers are the result of the evolution. The Qubie' modems represent the latest extension of this progress. Because up until now, a 212A compatible modem cost at least \$500. Through the use of four low-cost, state of the art microprocessors, we can now offer two versions of our full featured 212A modem at prices the competition sells 300 baud modems for.

## In The Beginning

In September of 1983 we introduced the first 212A modem card for the IBM PC available for under \$300. The PC212A/1200 is a complete communications package including PC-TALK III software, modular phone cable, card edge guide, and instruction manual. The modem is an auto-dial, auto-answer type, which uses all the Hayes software commands so it can be used with any of the popular software packages including Crosstalk™ and Smartcom™. We picked the best software package we could find based on it's ease of use and features, PC-TALK III. Our modem includes features the old industry standard missed out on. Like being able to fit in one slot in a Portable PC or PC/XT.

Or an optional connector to use the modem's serial port when not using the modem. Of course the topper is the \$299 price, hundreds less than the competition.

## Now Available Outside

Our standalone modem, the 212E/1200 can be used with any computer or terminal with a RS-232C serial port. You can use any Hayes compatible communications software on anything from an Apple to a Zenith. Many owners of IBM PC's are using it because they lack available expansion slots, or have more than one computer they want to use their modem with.

It's attractive gold anodized case houses seven status lights (who says low prices means a shortage of features). It fits comfortably under a standard telephone. It is also a 212A compatible auto-dial, auto-answer modem which supports all Hayes software commands. Even the switch settings are the same, so any software giving recommended switch settings for a Hayes modem can be used, without knowing what the switches do. There is a volume control knob for easy adjustment of the speaker's output. Included in the package is modular phone cable, a cable to hook it to your computer or terminal, and instruction manual. Choose the communications package right for your needs, and you're ready to go!

## Four Hearts

The heart of the Qubie' modems are four digital signal microprocessors. Two handle sending, and two do the receiving. Rather than attempt to filter all but the relevant tones used for modem communications, the

microprocessors measure the tones digitally. This allows them to overcome line noise and static better than analog filter based modems

## Why Buy From Qubie'

Because you will get a product as good or better than any available, pay less for it, and get factory direct help if you need it. If at any time during the one year warranty period your modem should require service, we will fix it or replace it within 48 hours. Notice also there are no hidden charges in our prices. No extra for freight, insurance, credit cards, or COD fees. In a hurry? UPS 2nd day air service is just \$5 extra. If you are like many who say, "Nah, it's too good to be true," just apply the acid test and find out. Then you will be asking yourself, "Why should I pay what these modems used to cost?"

## The Acid Test

Qubie' gives you a 30 day satisfaction guarantee on your modem. If you are not completely satisfied we will refund the entire amount of your purchase including the postage to return it. If you can, get anyone selling another modem to give you the same guarantee. Buy both, and return the one you don't like. We know which one you will keep.

IBM is a trademark of International Business Machines Corporation.  
Crosstalk is a registered trademark of Microstul Inc.  
PC-Talk III is a registered trademark of The Headlands Press Inc.



**PC212A/1200** Includes: Modem Card, PC-TALK III software, card edge guide, modular phone cable, quick reference card, and instruction manual. **\$299**  
Optional external serial port connector **\$20.**

**212E/1200** Includes: Standalone modem with cable (specify male or female), modular phone cable, and instruction manual. **\$329.**



## Order Today, Shipped Tomorrow!

All prices include UPS surface freight and insurance. Add \$5 for two day air service. For fastest delivery send certified check or credit card. Personal checks take 18 days to clear. Calif. residents add 6% sales tax. Corporations and Institutions call for purchase order details.

**(800) 821-4479**

Toll Free Outside California

**(805) 987-9741**

Inside California

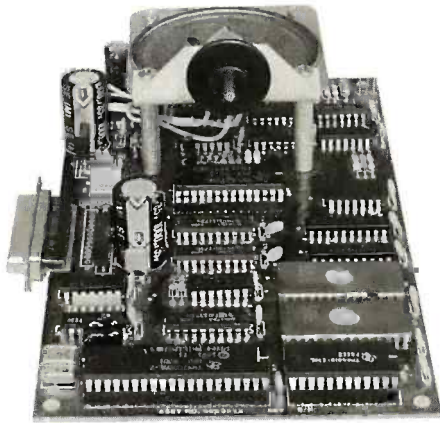
**QUBIE'**

4809 Calle Alto  
Camarillo, Ca. 93010

Tempo House, 15 Falcon Road,  
London SW11 2PH, United Kingdom

© Copyright Qubie' 1984

Circle 323 on inquiry card.



## SCI Model 232 Speech Synthesizer

The SCI Model 232 is a stand-alone digital speech synthesizer board which will directly interface to any device having an RS-232 interface. Model 232 utilizes data encoded from actual human speech to produce high quality, digitally synthesized speech. Model 232 includes a general purpose, 200 word vocabulary, high quality male voice, wall mount power supply, adjustable volume, 8K bytes of RAM capable of buffering up to 30 phrases of 15 words each, and switch selectable baud rates from 300-9600 baud. Model 232 lends itself to a wide variety of applications including: security warning systems, robotics, annunciators, instrumentation, talking clocks and telecommunications. Consumer product applications could include appliances, home computers, games, or as an aid for teaching or the handicapped. Options include a RS-422 interface, an enclosure for mounting, and a female voice. The dimensions for the board are 4½" W x 7½" L. Pricing is \$259.00 in single quantities with discounts for volume purchases. For more information, contact:

### SCI SYSTEMS, INC.

5000 Technology Drive • Huntsville, Alabama 35805  
205-882-4354

## CIARCIA FEEDBACK

*Builders Research Foundation. They ordered three units on the spot, which they intend to demonstrate at the NAHB Show in January 1985.*

*This Circuit Cellar article should be in BYTE soon.—Steve*

### WHERE DO I GET THEM?

Dear Steve,

I am currently pursuing the idea of building the Term-Mite ST Smart Terminal and the Sweet Talker II and interfacing them with my homebrew 6800 system, but where do I buy an NS455A Terminal Management Processor and an SSI263 Phoneme Speech Generator? I have tried all the electronics parts houses in my area, and no one can even provide me with addresses of manufacturers.

The second thing I need is information on some 6800 programs I have seen listed on the inside cover of *Ciarcia's Circuit Cellar, Volume 1*. I wrote a letter to BYTE Books asking about these programs and have received nothing in return to date. Can you help me get a copy of these programs?

DOUGLAS A. KERSLAKE  
Norfolk, VA

*The chip you want is the NS405A, which is presently available only from National Semiconductor. As production quantities increase, it probably will be stocked by distributors and mail-order houses. Contact National Semiconductor Corporation, 2900 Semiconductor Dr., Santa Clara, CA 95051, (408) 721-5000.*

*The SSI263 is a product of Silicon Systems Inc. and may be obtained from JDR Microdevices, 1224 South Bascom Ave., San Jose, CA 95128, (800) 538-5000.*

*The programs listed on the inside cover in volume 1 of Ciarcia's Circuit Cellar were published in a bar-code format known as PAPERBYTE and may still be available from BYTE Books. I am not aware of any other listing.—Steve ■*

*Over the years I have presented many different projects in BYTE. I know many of you have built them and are making use of them in many ways.*

*I am interested in hearing from any of you telling me what you've done with these projects or how you may have been influenced by the basic ideas. Write me at Circuit Cellar Feedback, POB 582, Glastonbury, CT 06033 and fill me in on your applications. All letters and photographs become the property of Steve Ciarcia and cannot be returned.*

# SEEKER!



## Multifunction Products for the TI Professional Computers

### SEEKER S1 BOARD

- Expandable memory from 0 to 512K bytes, fully socketed
- SCSI/SASI interface
- RS-232 Sync/Async port
- Optional clock
- Completely TI PC hardware and software compatible
- Plugs into any open TI PC expansion slot

### INTERNAL WINCHESTER

- Resides inside the Texas Instruments PC, interfaced to the SEEKER S1 board.
- 10 & 20 Megabyte
- TI software compatible
- Includes bootstrap EPROM
- Format and test routines included

### EXPANDABILITY

- Western Automation SEEKER products allow TI Professional Computers to expand to their full 768K memory. The SEEKER S1 board will control eight SCSI/SASI Winchester disks and streaming tape drives, like the SEEKER 60MB streaming tape system.

### SEEKER S2 BOARD

- RAM from 0K to 192K
- Fully TI compatible
- Will attach to SEEKER S1

### EXTERNAL WINCHESTERS

- Cables to SEEKER S1
- 10 & 20 Megabyte
- Cabinet matches TI PC
- 110/220 VAC operation

- SEEKER S1 board list \$425
- SEEKER S1 and 10 MB internal drive list \$1895

Ninety day warranty on all products. Available through Dealers and OEMs.



WESTERN AUTOMATION LABORATORIES, INC.  
5595 Arapahoe Road, Boulder, CO 80303

For Information write or call (303) 449-6400 or Toll Free (800) 227-4637

# IT'S ABOUT TIME.

If you're losing time because of missed connections, garbled messages, wrong numbers and never ending busy signals, your time has finally come.

Because now there's a way to combine the power and speed of your IBM® PC with the practicality of your telephone.

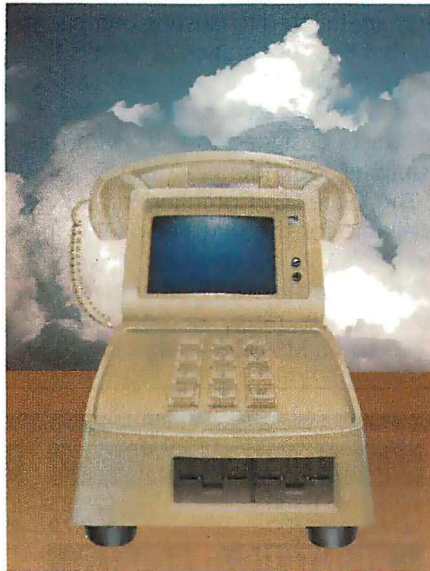
And wind up with a personal productivity tool that's far greater than the sum of its parts.

Its name is Watson.™ And its function is to save you time. *A lot* of time.

Just slip Watson into your PC, hook up your telephone, and *instantly* both become part of a personal office automation and communication system that can double, triple, even quadruple your productivity.

How? By providing instant access to the people and information you need. No matter where you happen to be.

In the office or on the road, Watson will have you doing things you never



thought a telephone or PC could do. Even while you're asleep.

Watson will forever eliminate the wasted time and frustration of "telephone tag," unclear or garbled messages, the tedium of looking up numbers, dialing and redialing wrong numbers and busy signals.

You get sophisticated digital voice messaging, powerful information management, electronic mail capability, scheduling, time billing, remote-editing dictation and more. *Plus* a built-in 300/1200 baud modem.

And all this includes time-sharing and function switching, so you can run other programs like Lotus 1-2-3™ and

Wordstar™ while Watson is taking care of your telephone.

Take this ad to your computer products dealer today, and ask for a demonstration. You'll be amazed.

Or, call Watson directly at 1-800-6-WATSON and we'll send you some helpful information plus tell you where to find the Watson dealer nearest you.

Do it today. After all, time is money.



## Watson

Instant access to people and information.

**Natural MicroSystems™**

Natural MicroSystems Corporation  
6 Mercer Road, Natick, Massachusetts 01760  
Telephone 617/655-0700

IBM is a registered trademark of International Business Machines Corporation. Watson and Natural MicroSystems are trademarks of Natural MicroSystems Corporation. Lotus 1-2-3 is a trademark of Lotus Development Corporation. Wordstar is a trademark of MicroPro International Corporation. © Natural MicroSystems Corporation, 1984

(continued from page 120)

statement executes. The Profiler even generates a histogram showing the percentage of time the program executes a function or statement.

By revealing which parts of a program execute most often, the Safe C Profiler points the programmer to the code where optimization yields the greatest results. For example, in a function where multiple if...else tests are made, the test executed most often should appear first for optimal performance. The Profiler identifies this code for proper alignment by the programmer. This process is analogous to a delivery service analyzing all its truck deliveries to ensure that the truck doesn't backtrack when delivering goods.

The Safe C Profiler also profiles code that does not get executed. Often this exposes subtle errors, such as using a single = instead of the

equivalence operator ==. This error, syntactically and lexically correct, could be hard to find unless you could show that a certain test was never being made—an indication that a bug existed. Profiling identifies code that hasn't been tested by repeated program execution, giving the testing phase of program development a new dimension.

Using these tools is similar to using a standard compiler. Catalytix's products are tailored to existing compilers so that the appearance of both is the same. If you work with the Lattice compiler, for example, the Safe C products designed to work with this compiler look identical to it.

The Safe C Compiler/Profiler is available for the IBM Personal Computer (PC), its compatibles, and computers from at least 17 other manufacturers. Prices range all the way from \$400 for an MS-DOS version to \$4000

for minicomputer versions.

Catalytix will shortly announce a C interpreter and an English-to-C/C-to-English translator, products BYTE will preview.

**INSTANT-C**

The value of interaction with programming languages is evident in the recent consumer release of an interpreted Pascal (see "Macintosh Pascal" in the June BYTE, page 136) and the success of Turbo Pascal, a fast compiler that provides the illusion of interpretation for small programs.

Several attempts at writing an interpreter for C have failed within the university community, but at least two commercial attempts appear headed for success. One is the Catalytix product mentioned earlier; the second is Rational Systems' Instant-C, which runs on Intel 8086-/8088-based com-

(continued)

|                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>CAD SYSTEM</b></p> <p><b>2D Starting at \$9,999.99</b><br/> <b>3D Also Available — CALL</b></p> <p>All Plotters, Digitizers, Software and Training, one place for all your needs.</p>                                                                                                                                                                                                                                               | <p><b>DISKETTES</b></p> <p>VERBATIM DS/DD ..... \$25.85<br/>         VERBATIM SS/DD ..... \$19.79</p>                                                                                                                                                                                                                                                                                                                                                 | <p><b>DISC DRIVES</b></p> <p>EVEREX COGITO 10 MB INTL . . . \$848<br/>         SIGMA 10 MB INTERNAL . . . . \$875<br/>         TEAC - 1/2 HT for IBM 360K . . . \$149<br/>         SHUGART 455 for IBM 360K . . . \$155<br/>         TANDON 100-2 . . . . . \$170<br/>         IBM DISC DRIVE . . . . . \$199<br/>         CDC DRIVE for IBM . . . . . \$195<br/>         TEC 1/2 HT for IBM 360K . . . . \$135</p>                                                                                                                                                                                 |
| <p><b>COMPUTERS</b></p> <p>IBM PC 64K 1 DR. . . . . \$1449<br/>         IBM PC 256K 2 1/2 HT DR. . . . \$1630<br/>         IBM PC 256K HT DR + 10 MB. . . \$2699<br/>         SANYO 555-2 (2) DS/DD+SOFTWARE \$999<br/>         SANYO 555-2 (2) DS/DD+MON+8 . . \$1399<br/>         IBM PC XT 256K. . . . . \$3848<br/>         IBM PORTABLE. . . . . CALL<br/>         SANYO 555-2+COL.MON<br/>         +5 SOFTWARE . . . . . \$1599</p> | <p><b>PRINTERS SPECIALS</b></p> <p>CABLE . . . . . \$19<br/>         OKIDATA 92P . . . . . \$395<br/>         OKIDATA 93P . . . . . \$625<br/>         EPSON FX100/80 . . . . . very very low<br/>         BROTHER HR 15/HR 25 . . . . \$398/659<br/>         BROTHER HR 35 . . . . . \$898<br/>         DTC STYLE WRITER 35K BUF. . . . \$499<br/>         DTS 380Z + 48K BUFF. . . . . \$933<br/>         EPSON LQ 1500 . . . . . very very low</p> | <p><b>HARDWARE</b></p> <p>PC PEACOCK . . . . . \$234<br/>         HERCULES CARD . . . . . \$313<br/>         64K RAM SET . . . . . \$42<br/>         AST 6-PACK 64K/256K . . . . . CALL<br/>         AST MEGA PLUS II 64K . . . . . CALL<br/>         KEY TRONIC KEYBOARD 5151 . . . \$209<br/>         TELMAR GRAPHICS . . . . . \$485<br/>         EVERX BOARD . . . . . CALL<br/>         OTHER HARDWARE . . . . . CALL<br/>         SIGMA MAXMISER . . . . . \$249<br/>         8087 CHIP . . . . . \$178<br/>         QUAD BOARD. . . . . \$278<br/>         PLANTONIC PLUS. . . . . \$385</p> |
| <p><b>SOFTWARE</b></p> <p>SYMPHONY . . . . . \$469<br/>         LOTUS 123 . . . . . \$285<br/>         dBASE II/III . . . . . \$289/\$398<br/>         WORD STAR PROPACK . . . . . \$348<br/>         OTHER SOFTWARE. . . . . CALL<br/>         R BASE . . . . . CALL</p>                                                                                                                                                                 | <p><b>MODEM SALE</b></p> <p>HAYES 1200 MODEM. . . . . \$480<br/>         HAYES 1200B . . . . . \$397</p> <p>1200 BAUD Auto Dial, Auto Answer, Auto Log On, File Transfer, Printing, Call Progress Monitoring, Auto Baud Rate Selection For IBM PC, XT Portable and Compatible. Made in Sunnyvale U.S.A. . . . \$249</p> <p>Dealer inquiries welcome.</p>                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <p><b>MONITORS</b></p> <p>AMDEC 310A. . . . . \$165<br/>         AMDEC 11+. . . . . \$415<br/>         PRINCETON GRAPHIC HX 12 . . . . \$469<br/>         SANYO . . . . . \$149<br/>         TAXAN RGB . . . . . \$448<br/>         PGS MAX 12 . . . . . \$195</p>                                                                                                                                                                        | <p><b>WE'LL BEAT ANY<br/>         ADVERTISED<br/>         PRICE<br/>         (IF WE BOTH HAVE IN STOCK)</b></p>                                                                                                                                                                                                                                                                                                                                       | <p>LEASING ARRANGED UP TO \$1 MILLION AT LOW RATES. CAN INTRODUCE YOUR NEW PRODUCTS TO MARKETS. UPGRADE YOUR PRESENT COMPUTERS WITH 10MB PLUS HARD DRIVES. COMPANY P.O. WELCOME. MC/VISA + 3% CASH PRICES SUBJECT TO STOCK ON HAND. OPEN 7 DAYS.</p>                                                                                                                                                                                                                                                                                                                                                |
| <p><b>ADVANCED COMPUTER SYSTEMS</b></p> <p>Sunnyvale Fremont San Francisco Walnut Creek 665 Grape Ave. 39138 State St. 690 Market St. 1987 No. Main St. (408) 732-6200 Town &amp; Faire Center (415) 397-1311 (415) 945-8011</p>                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

# SQUEEZE MORE OUT OF EVERY ON-LINE MINUTE.



## WITH NEW VIDTEX™ COMMUNICATIONS SOFTWARE FROM COMPU SERVE.

### Presenting the software package that makes your computer more productive and cost-efficient.

CompuServe's new Vidtex™ is compatible with many personal computers sold today (including Apple®, Commodore®, and Tandy/Radio Shack® brands). And it offers the following features\*—and more—to let you communicate more economically with most time-sharing services (including CompuServe's Information Service).

**Auto-Logon.** Lets you log on to a host simply and quickly by utilizing prompts and responses defined by you. Also allows quick transmission of predefined responses to host application programs after logging on.

**Function Keys.** Let you consolidate long commands into single keystrokes. Definitions can be saved to and loaded from disk file, allowing multiple definitions for multiple applications.

**Error-Free Uploading and Downloading.** CompuServe "B" Protocol contained in Vidtex lets you transfer from your computer to CompuServe and from CompuServe to your computer anywhere in the country. Also provides error-free downloading from CompuServe's extensive software libraries.

**Full Printer Support.** Printer buffer automatically buffers characters until printer can process; automatically stops on-line transmission when full; and automatically resumes transmission when capacity is re-established. Also, lets you print contents of textual video screen or RAM buffer at any time.

**Capture Buffer.** Saves selected parts of a session. Contents can be written to a disk file; displayed both on and off line; loaded from disk; and transmitted to the host.

**On-line Graphics.** Integral graphics protocol displays stock charts, weather maps and more.

If you are already a CompuServe subscriber, you can order Vidtex on line by using the GO ORDER command. Otherwise, check with your nearest computer dealer; or to order direct, call or write:

Circle 72 on inquiry card.

## CompuServe

P.O. Box 20212, 5000 Arlington Centre Blvd.  
Columbus, Ohio 43220

**1-800-848-8199**  
In Ohio, call 614-457-0802

An H&R Block Company

\*Some versions of the Vidtex software do not implement all features listed.

Vidtex is a trademark of CompuServe, Incorporated. Apple is a trademark of Apple Computer, Inc. Commodore is a trademark of Commodore Business Machines. Radio Shack is a trademark of Tandy Corp.

Early buyers of Instant-C help finance its development.

puters under MS-DOS or CP/M-86 and costs \$500.

Instant-C supports all standard C features except initialization, parameterized #defines, declaration in compound fields, and an assembly-language interface.

Envisioned primarily as a language-development tool, Instant-C features a compiler, an interpreter, a full-screen editor, a linker/loader, a library of C functions, a source debugger, a UNIX-like lint utility (that checks for the number of arguments passed to a function and for external variable declarations), and a source-code formatter.

Although Instant-C has been advertised since midsummer, as of this writing (October) the product is still under development. A potential buyer receives an explanation of this situation; if he decides to buy, he gets the latest version (in my case version 0.88) with the promise of subsequent versions as they become available. This means that early buyers of the product help to finance its development. The people at Rational Systems deserve credit for being honest with their customers about this unusual marketing technique.

To use Instant-C, you load the interpreter and can subsequently enter and execute any valid C-language code. You can call library functions or user-written functions stored on disk. Typing a function's name, including arguments where they are necessary, calls the function. The interpreter cannot use compiled code but must have

source files for interpretation.

The most obvious use of the interpreter for execution of individual commands or library functions is for instructing the novice C programmer.

Experienced programmers will use a different scheme. From the interpreter, typing `ed filename` places you in the editor to create a new function or edit an existing function. The full-screen editor offers reasonable functionality and an attractive display area. On the IBM PC, the editor uses the cursor, insert/delete, and page-move keys.

Within the editor, you write C source code in the normal manner. When you execute the editor's exit command, the source code is partially compiled and, if there are no errors, you return to the interpreter. Calling the name of the function just written executes the code, providing an im-

(continued)

BARGAIN PRICES

BARGAIN PRICES

BARGAIN PRICES

Computer Software Technology, Inc. of Sunnyvale, makes computer communication easy, simple and error free by introducing "SYSTALK" Software available for IBM PC/XT and compatibles, Compu Pro, Kay Pro, etc.

SPECIAL INTRODUCTORY PRICE through 12/15/84 . . . . . (SAVE \$100) . . . . . \$ 99.99

RETAIL PRICE . . . . . \$199.99

For "SYSTALK" contact your dealer/distributor or CST direct. Distributor/Dealer/International inquiries welcome.

|                                                  |        |                                             |       |                            |        |                              |       |
|--------------------------------------------------|--------|---------------------------------------------|-------|----------------------------|--------|------------------------------|-------|
| <b>SYSTEMS</b>                                   |        | MS Multitool with Mouse                     | 309   | AST Mega plus II           |        | Parallel Printer Cable       | 22    |
| IBM-PC 64K/2 Drives                              | \$1875 | MS Pascal compiler                          | 235   | with 64K                   | 260    | Okidata 92P                  | 400   |
| Controller Card                                  |        | MS C compiler                               | 323   | Hercules Graphic Card      | 329    | Okidata 93P                  | 645   |
| IBM-XT                                           | \$3450 | Accounting Pkge                             | CALL  | Hercules Color Card        | 199    | Dynax DX-15 (LQ)             | 430   |
| Televideo PC 1605                                | \$2150 | MS Multiplan                                | 134   | Hayes 1200 B Modem         | 415    | Taxan RGB Super Hi-Res       |       |
| (2 Drives, Monitor, & Graphic card)              |        | Knowledge Man                               | 290   | Hayes 12000 Modem          | 485    | IBM                          | 475   |
| <b>SOFTWARE</b>                                  |        | Harvard Project Mgr.                        | 295   | STB Color Graphic Card     | 369    | Taxan Hi-Res Amber           | 169   |
| Symphony                                         | CALL   | Micro Soft Project                          | 199   | Quadboard II w/64K         | 290    | Princeton Graphic RGB        |       |
| Lotus 123                                        | 295    | Micro Soft Chart                            | 199   | Quadboard w/OK             | 279    | (Hi-Res)                     | 480   |
| dBase III                                        | 390    | Super Calc III                              | 235   | 64K Ram Chips set          | 45     | <b>HARD DISKS</b>            |       |
| dBase II                                         | 295    | Prokey                                      | 85    | TEAC 1/2 height            | 160    | 1/2ht 10MB internal          |       |
| Wordstar Propak                                  | 295    | Data Base Manager II                        | 219   | Panasonic 1/2 height       | 160    | with card/software           | \$865 |
| Multimate                                        | 270    | Apple-IBM Connection                        | 155   | Everex Graphic Edge        | 445    | Cogito 1/2ht 10MB            |       |
| Microfilm R-Base 4000                            | 295    | <b>HARDWARE</b>                             |       | <b>MONITORS/PRINTERS</b>   |        | internal with card           | 950   |
| Think Tank                                       | 125    | TANDON TM 100-2                             | \$185 | Epson LQ1500 with Parallel |        | Data Mac 10 MB external with |       |
| EZ Writer II System                              | 245    | CDC Drive DS/DD                             | 210   | Interface Card             | \$1325 | card, Power Supply           | 935   |
| SYSTALK                                          | 99.99  | AST Sixpak plus                             |       | Epson FX-80                | 469    | Tall Grass 20 MB HD and Tape | 2675  |
|                                                  |        | with 64/K                                   | 260   | Epson FX-100               | 675    |                              |       |
| HOURS: MON. - FRI. 8AM - 7PM SAT. 10AM - 4PM PST |        | ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE |       |                            |        |                              |       |

**CST** 491 Macara Ave. #1008  
Sunnyvale, CA 94086



VISA/MASTERCARD/COD/COMPANY P.O.'s Add 3%

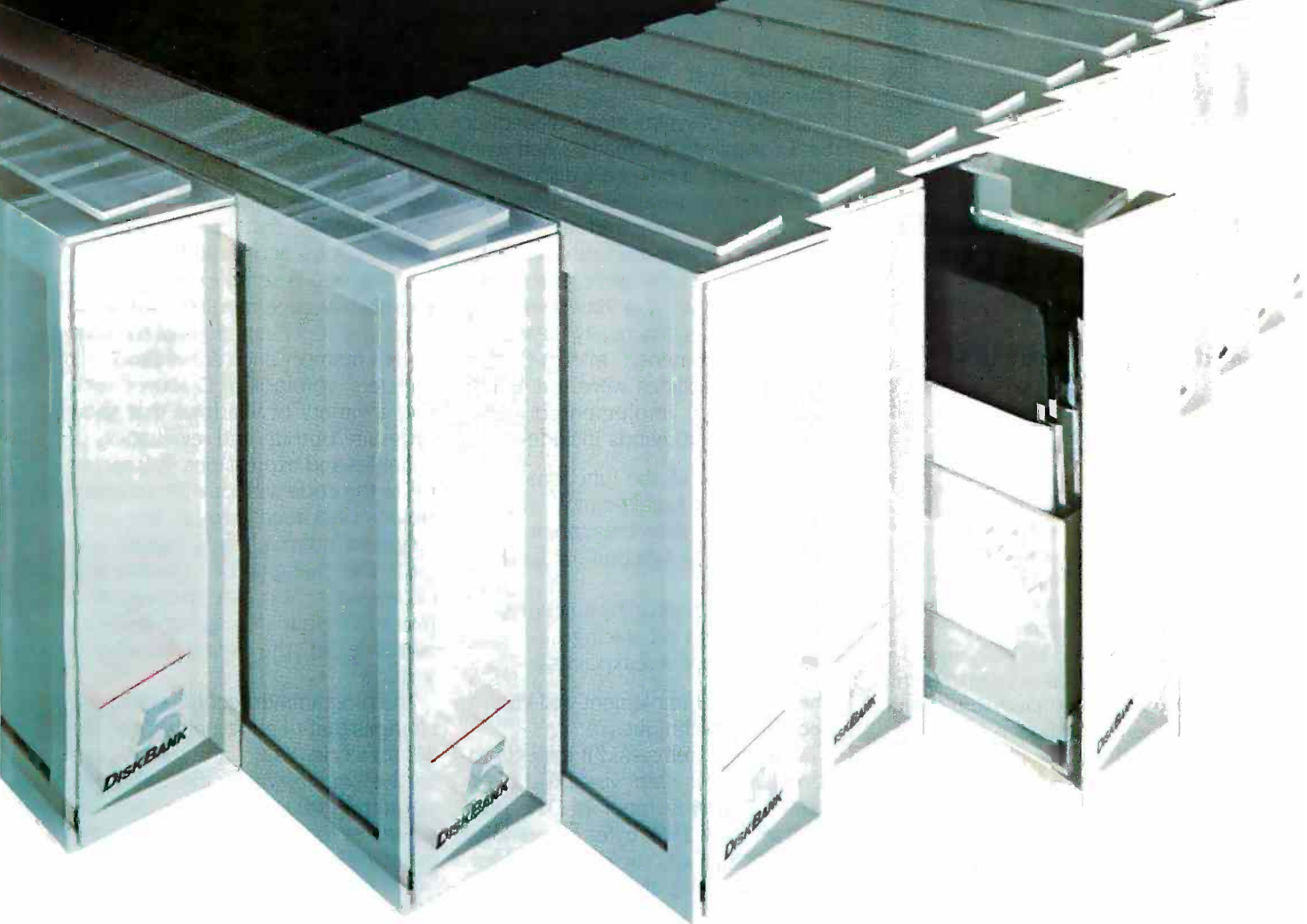
For inquiries and technical support (408) 720-8908

For orders only (800) 982-8899 (Calif. only)  
(800) 325-3487 (Outside Calif.)

NOTE: We will give you additional discount of 2% not to exceed \$200.00 on all items if your purchase includes SYSTALK. This offer expires 12/15/84.



# ADD-INFINITUM



## Add Diskette Storage When You Need It With The DiskBank® System.



No matter how large or small your diskette filing and storage requirements may be, the DiskBank System by Amaray is the most revolutionary, versatile and cost-effective approach available today.

Its unique modular interlocking design allows you to add new modules as your storage needs expand. Each impact-resistant module conveniently

organizes up to 10 diskettes in a safe, dust-free environment. When you need a diskette, simply open the DiskBank drawer and slide it out. Diskettes automatically come forward allowing you to select the one you need.

In addition, the System is portable. Disk Bank modules are designed to go with you anywhere. Simply slide out the modules you need, put them in your briefcase, and go.

Available in three media format sizes, System 3 for 3¼"-3½" diskettes, System 5 for 5¼" diskettes, and System 8 for 8" diskettes, DiskBank System may be purchased individually or in money-saving volume packs.

Why settle for less? Give your valuable diskettes the protection they deserve. Buy a Bank. Buy a DiskBank. The DiskBank System.

### AMARAY DISKBANK

AMARAY INTERNATIONAL CORPORATION  
14935 N.E. 95th Street, Redmond, Washington  
98052-2508 Toll Free Number: 800-4-AMARAY





## New graphics system offers wide open architecture to the designer.

- ♦ Open architecture.
- ♦ Industry standard buses.
- ♦ Adapts to thousands of tasks.
- ♦ Expandable with modules from us and many others.
- ♦ Obsolescence proof.
- ♦ Color or monochrome.

Our new Perigraf 1 is built around a standard Q-bus with slots for many extra cards to expand or customize your system.

Peritek offers cards for color or monochrome, for dot graphics or alpha-numeric, for low to high resolution, and for one or more display channels.

You can choose a single unified bus or a bus split for two microprocessors. Choose a standard single-wide enclosure or a double-wide enclosure for super micros.

You get a hard disk and two floppies on a single plug-in module that you can replace in one minute.

You can link up to six Perigraf's for parallel data transfer by DMA at 250,000 bytes/sec.—or link any number for local area networking by Ethernet.

Complete development software is included. Image editor. Vector de-jagging. System diagnostics. GKS-compatible software. All supported by popular operating systems.

Basic \$14,500 price includes 11/73 CPU, 512 Kb RAM, 2 RX50 type floppies, 36 Mb hard disk, 4 port serial I/O, RT clock, and graphics interface.

Contact Peritek Corporation, 5550 Redwood Road, Oakland, CA 94619 (415) 531-6500. Eastern Regional Sales Office (516) 931-4664. TWX 910-366-2029.

# Peritek

## C DEVELOPMENT TOOLS

mediate way to verify logical correctness.

Checking of syntax errors is handled by a compiler pass made when exiting the editor. If errors are discovered, an error message appears on the top line of the screen and the cursor drops back within the source code to the location of the error. Errors are uncovered one at a time until the source file is syntactically clean.

When I examined Instant-C, the debugging facilities were just being defined and implemented. The debugging commands include

- back—show all the functions called to a breakpoint
- go—resume after breakpoint
- local—enter a function for local execution
- trace—set breakpoint functions
- untrace—turn off tracing
- reset—turn off breakpoints

These facilities implement well-known debugging techniques.

Rational Systems said it expects to complete and ship version 1.0 of Instant-C by November 15. The program requires 256K bytes of memory, but 384K bytes is recommended for developing programs of any length.

### C SOURCE DEBUGGER

Mark Williams Company, purveyor of the UNIX-like Coherent operating system, introduced its MWC-86 C compiler and an accompanying C Source Debugger on September 1. The products work together and sell as a package for \$495. In this description, I'll look only at the debugger.

The C Source Debugger (called by the company, in typical UNIX fashion, *dbc*) can debug your C programs in C instead of in machine language. *dbc* does not add code to your programs and enables you to view the source code as you debug. *dbc* can provide

- a trace of the execution of any statement with or without breakpoints
- a display of the value of variables and expressions during program execution
- single-step execution of code

- separate windows for source, program output, history, and evaluation of expressions
- exploration of the stack

These features make use of a simple user interface that relies heavily on function keys and page-move keys.

Using *dbc* resembles using an assembly-language monitor. Instead of looking at representations of the computer's memory and central-processor registers, you look at C source code and a variety of windows that show program output and evaluation of variables and expressions. You can execute the code with or without breakpoints, backtrace through the code, single-step through the program, and track the changing of variables and expressions. You can also record a history of your debugging sessions, available in the separate history window.

The programmer records errors and changes that need to be made to the source code. You can make changes to the source within the debugger, permitting a way to test different strategies for solving a problem; however, the changes cannot be saved.

You can set breakpoints (*tracepoints* in the lexicon of *dbc*) to halt execution when a line of code executes or when the value of an expression changes. Programmers can toggle *tracepoints* on and off. You can execute programs with *tracepoints* through to the end with *tracepoints* overridden, but a trace history is listed in the history file.

The program window displays the output of your program as if it were executing without *dbc*. This window is saved and restored when the programmer switches between windows.

The underlying theory behind *dbc* is analogous to building a car's engine block out of clear plastic so that mechanics can watch the internal engine parts function. If something goes wrong, the mechanic can spot it and then later go inside the engine to make repairs.

The C Source Debugger, like the MWC-86 C Compiler, requires 256K bytes of memory. ■



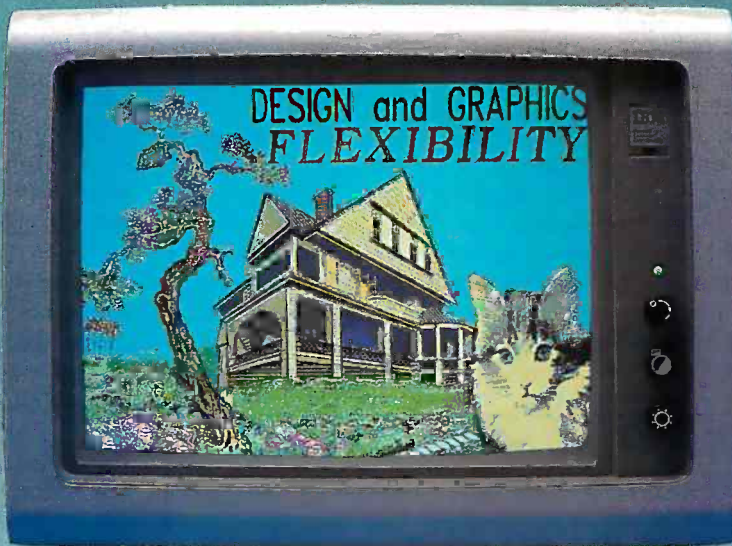
# Combine VISION with PC Graphics



**Captures  
Anything You Can See.**

IMIGIT adds icon-  
selected Graphic  
Functions, text, and  
textures with a full  
palette of vibrant colors.

Together You Enjoy  
Unparalleled Economy  
and Applications  
Flexibility.



*The illustration incorpo-  
rates line art, photos, text,  
textures and color elements.  
You can do the same with  
this icon-driven, user-  
friendly system.*

For \$695.00 you get the PC-EYE™ video digitizer board and IMIGIT™ graphics software. PC-EYE allows you to capture real-life images with an ordinary video camera or VCR and produce them on your personal computer. IMIGIT is an icon-oriented graphics software package which allows you to modify the camera image by adding text, patterns, colors, lines and shapes. By using cut and paste features with multiple video images, you can store images for later retrieval and print images from the screen.

You get this Exciting Tool for integrating video images with graphics created by other software packages like Lotus 1-2-3\*, Graftalk\*, CAD and business presentation packages. Imagine combining a real-life camera image, text and a pie chart generated by Lotus into one picture. It's really as easy as 1, 2, 3.

## IMIGIT Supports . . .

High Resolution - up to 640 x 512 pixels with 16 colors or gray scale (64 with 6-bit PC-EYE). Flexibility - to support the most popular graphics cards and printers for convenient display and hardcopy output. Speed - less than 2/10 of a second to capture an image in the IBM-compatible 320 x 200 mode. All in all, a powerful but easy-to-use package that allows you to develop sophisticated and dramatic graphic presentations.



**CHORUS is the Single Source** for your graphics and imaging needs. Complete solutions in both hardware and software. Call us for other low cost/high performance imaging products such as Dr. Halo\* and Halo\* graphics software; video cameras and accessories; and graphic adapter cards. You can expect prompt delivery, technical support and complete OEM design assistance.

**CALL 1-800 OCHORUS or  
603-424-2900.**

**PC-EYE and IMIGIT are trademarks of  
Chorus Data Systems, Inc.**

\*Dr. Halo and Halo are trademarks of Media Cybernetics, Inc.  
Graftalk is a trademark of Redding Group, Inc.  
Lotus 1-2-3 is a trademark of Lotus Development Corporation.

Circle 59 on inquiry card.

# CHORUS

(continued from page 123)

a constant lower value in the cladding. The *single-mode* fiber (2c) has a step-index profile, but it is distinguished by its much smaller core size and by a smaller difference in index between the core and the cladding.

Light propagation in the step-index multimode fiber is depicted in figure 3. Only rays of light that enter the fiber passing through the longitudinal axis within a certain solid angle, the *angle of acceptance*, are able to travel within the core. Three modes are shown in the figure; in reality, hundreds of discrete modes typically propagate in a single fiber.

Figure 3 also illustrates the major limitation of step-index fibers. The low-order modes, those launched into the fiber at small angles with respect to the axis, travel a shorter ray distance to reach a given point along the fiber than do the high-order modes, those launched at large angles. This effect, called *intermodal distortion*, or "modal time dispersion," constricts the bandwidth of the cable; waves that start out at the same instant arrive out of sync at the other end. It smears out any signal waveforms that have been modulated on the light.

Another area of disturbance, intra-

modal time distortion, is manifested in two ways: as *material dispersion*, resulting from the slightly different indices of refraction that the fiber presents to different wavelengths of light (essentially the same problem that causes chromatic aberration in lenses) and *waveguide dispersion*, resulting from the inherently longer path taken by longer wavelengths, which reflect at more oblique angles with the cladding. Taking into account all these factors, optical fibers are assigned dispersion ratings expressed either in bandwidth—megahertz (MHz) per kilometer—or in time spread—nanoseconds per kilometer.

Graded-index fibers were developed to overcome these limitations. The refractive index changes gradually across the core's diameter to guide the various modes along curved paths, as shown in figure 4. Because the index of refraction is essentially an expression of the speed at which light travels in a material, the gradations of index reduce the delay suffered by the high-order modes: although they zigzag nearer the cladding, they travel more swiftly while in that region and thus do not fall behind the low-order modes, which meander less but travel mainly in the slow lane in the middle of the core.

(These explanations are simplified and leave out consideration of the wave nature of light, which must be taken into account for a full understanding of the processes involved. For rigorous analysis, see reference 8. But ray optics can be applied to all phenomena that are described by the wave equation as long as they satisfy the additional requirement that the light wavelength be short compared to the dimensions of the waveguide.)

There is a way to avoid intermodal distortion altogether. Careful selection of refractive index and core radius can create a waveguide that cuts off all angularly incident modes and enables propagation only straight down the center axis of the fiber. With this major source of disturbance eliminated, single-mode fibers offer far greater usable signal bandwidth.

(continued)

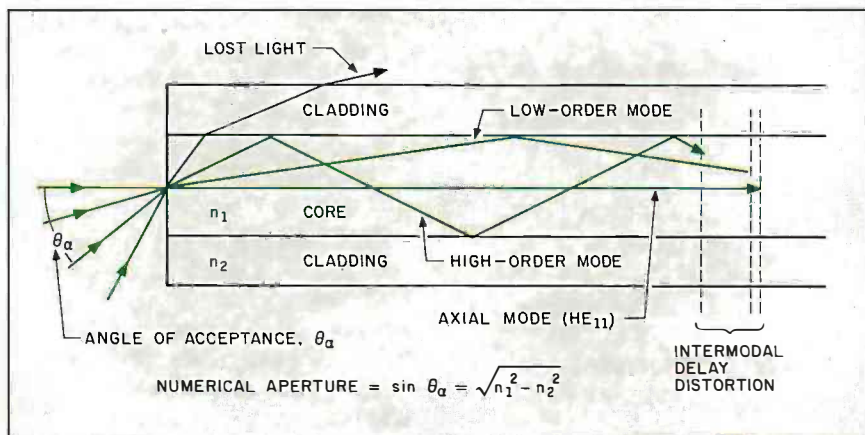


Figure 3: The step-index multimode fiber enables propagation of any ray of light that enters within the angle of acceptance  $\theta_a$ . The numerical aperture is a measure of the fiber's ability to accept light. The high-order modes travel over a longer path than the low-order modes and therefore arrive later at any given point down the cable, causing intermodal delay distortion.

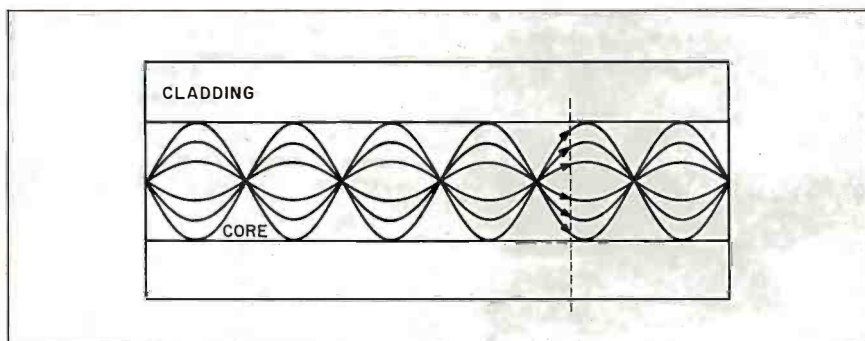


Figure 4: In a graded-index multimode fiber, the rays are conveyed in curved paths. The more sharply curved paths of the high-order modes lie mostly in the low-refraction areas near the cladding, so they propagate faster and arrive at the same time as the low-order modes.

Engineering  
Excellence

CROSSTALK™  
XVI

ROOS

XVI

THE STATE OF THE ART IN  
DATA COMMUNICATIONS  
SOFTWARE

DESIGNED BY

MICROSTUF®

CROSSTALK IS A TRADEMARK OF  
MICROSTUF, INC., ATLANTA, GEORGIA

CROSSTALK IS AVAILABLE FOR  
MOST SMALL BUSINESS  
COMPUTERS

DATE

2/16/84

However, they are much more trouble to install, due to the tiny core, and they must be driven by laser transmitters, making their interface circuitry more complex and expensive than that needed by multimode fibers, which can be driven by light-emitting diodes.

Single-mode fibers are not, however, inherently immune to intramodal delay distortion, but one property of

silica glass provides a convenient means of avoiding it. In the visible spectrum of light, material dispersion causes longer wavelengths to travel faster than shorter ones. But down in the near-infrared region around wavelengths of 1.1 to 1.3 microns, the opposite begins to happen: longer wavelengths begin to travel slower. At some wavelength the material and waveguide dispersion meet and

cancel each other out; this is the *zero-dispersion point* (ZDP). The ZDP occurs naturally in pure silica glass at 1.27 microns. Since in principle single-mode fibers work with a single coherent wavelength, one way to exploit the ZDP is to find a laser that emits light at 1.27 microns.

However, the pursuit of greatest overall efficiency brings in other factors. Usually glass waveguides suffer from losses due to Rayleigh scattering, which occurs because of inevitable density and compositional variation within the glass. Rayleigh scattering lessens as wavelengths grow longer. To take advantage of this lessening, dopant materials can be added to the glass until its ZDP is shifted into the range between 1.3 and 1.6 microns. Happily, many formulations of glass reach their lowest possible absorption in this range. (Below this, molecular thermal scattering becomes a problem.) Some care in manufacture must be taken to avoid impurities in the glass that increase absorption, but this is no longer an excessive task. A typical light-absorption curve for a high-silica fiber is shown in figure 5.

There are two major ways of manufacturing optical fibers. The original technique developed for step-index fibers is the *double-crucible* method. One platinum crucible contains the molten

(continued)

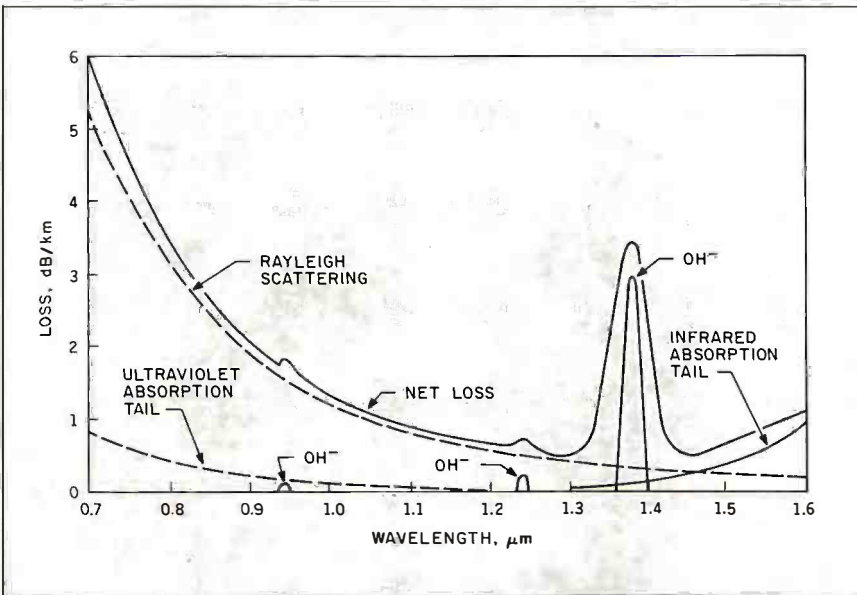



Figure 5: Light absorption in a high-silica (relatively pure) glass fiber. In this region of the curve, the ultraviolet electron-excitation absorption tapers off and the infrared molecular-vibration absorption begins. Light at the wavelengths near the bottom of the curve can be carried for long distances.

Table I: Comparison of the three kinds of optical fibers.

|                                | Step-Index                     | Graded-Index                       | Single-Mode                       |
|--------------------------------|--------------------------------|------------------------------------|-----------------------------------|
| Light source                   | LED or laser                   | LED or laser                       | laser                             |
| Bandwidth                      | wide<br>(but under 200 MHz/km) | very wide<br>(200 MHz to 3 GHz/km) | extremely wide<br>(over 3 GHz/km) |
| Splicing                       | difficult                      | difficult                          | very difficult                    |
| Typical application            | computer<br>data links         | moderate-length<br>telephone lines | telecommunication<br>long lines   |
| Cost                           | least expensive                | more expensive                     | most expensive                    |
| Core diameter<br>(microns)     | 50 to 125                      | 50 to 125                          | 2 to 8                            |
| Cladding diameter<br>(microns) | 125 to 440                     | 125 to 140                         | 15 to 60                          |
| Attenuation<br>(dB/km)         | 10 to 50                       | 7 to 15                            | 0.2 to 2                          |
| Numerical aperture             | 0.22 to 0.48                   | 0.16 to 0.21                       | less than 0.12                    |

# Telecommunications Engineers

## The Engineering Muscle And The Technical Talent To Lead A Telecommunications Revolution... Right Here With Hayes In Atlanta.



We've built a powerful engineering and technical team here at Hayes. It's been our strength and the reason for our success from the very beginning. Our focus has been on recruiting and developing the talent it takes to do more than merely compete, but to lead. The result has been a success story few in the industry can equal.

For those of you who have searched far and wide for just such an environment, where talent is provided the freedom and encouragement to grow, then perhaps it's time to take a good, hard look at Hayes in Atlanta. There's a future in it.

- HARDWARE/MICROPROCESSOR DESIGN ENGINEERS
- SOFTWARE DEVELOPMENT PROGRAMMERS/ANALYSTS
- VLSI/DSP DEVELOPMENT ENGINEERS
- PRODUCT ENGINEERS

Interested, qualified candidates should forward a confidential resume to: **Hayes Microcomputer Products, Inc., Dept. 92-018, 5923 Peachtree Industrial Blvd., Norcross, GA 30092.** An Equal Opportunity Employer, M/F.

Opportunity for  
the here and now.

 **Hayes®**

**Hayes Microcomputer Products, Inc.**

*A single-mode system costs approximately ten times as much as a multimode system.*

glass for forming the fiber core; this crucible is nested inside another that contains the molten glass for the cladding. Both crucibles have drawing nozzles, arranged so that the clad fiber can be drawn from the intersection of the melts. Graded-index fibers are made by depositing materials from a vapor (vapor deposition) on or within a starting tube or cylinder of glass for creating a *preform rod*, in which the varying chemical content at different depths controls a varying index of refraction. The preform rod is then drawn long and thin to achieve the final fiber. Some progress has been made recently in fabricating graded-index fibers more cheaply by a modification of the double-crucible method that employs ion migration.

The characteristics of the three types of fiber-optic waveguide are summarized in table 1. Although single-mode cable has the greatest potential, the multimode types are easier to work with and have cheaper support circuitry. In view of this, multimode types will probably continue to dominate in applications that require less than ultimate bandwidth and efficiency. (Currently a single-mode system costs approximately ten times as much as a multimode system.) But in spite of the costs and the difficulties encountered in working with them, single-mode fiber-optic cables, with their undeniable advantages, are carving out an increasing slice of the long-distance, wideband communication pie.

#### THE PHOTON/ELECTRON CONNECTION

The devices that transmit light into optical-fiber waveguides fall into two main classes: the exotic injection laser diodes (ILDs) and the familiar light-

emitting diodes (LEDs). Possessing high speed, high power, and narrow emission bandwidth, the lasers serve well in applications where long continuous runs of cable carry wide-bandwidth signals. They are essential in single-mode applications. But in multimode installations LEDs can be used at lower cost, particularly where low-loss fibers are used in distances less than 1 kilometer and for data rates under 10 MHz—the kind of conditions existing, for example, in many computer local networks. Both ILDs and LEDs are available in various wavelengths suitable for fiber-optic work, with the 0.85 micron and the infrared 1.3 microns the most popular.

Because an LED usually radiates into a rather broad angle, the efficiency of its coupling to the end of the optical fiber greatly influences the efficiency of the whole link. Fibers with small numerical apertures especially need precision in alignment. But for the installer's convenience, many transmitter LEDs now come in a package with a fiber stub already installed in proper alignment.

Several kinds of optoelectronic devices can be used as the photodetector in a fiber-optic receiver, including standard *p-n* junction photodiodes, PIN (positive-doped, intrinsic, negative-doped) photodiodes, phototransistors, and avalanche photodiodes (APDs). PIN photodiodes are most often used in data-transmission links, even though they provide no direct gain. The undoped intrinsic layer gives the component low capacitance, enabling frequency response up to the gigahertz range, and the 5- to 10-volt bias required is easily provided. Avalanche photodiodes, which give inherent signal gain of 50 to 500, need a reverse-bias potential of hundreds of volts and are sensitive to changes in temperature, so the receiver circuitry must be complex. Standard phototransistors have high capacitance that restricts their response at high frequencies, a particularly undesirable trait in an application wherein the detector bandwidth often governs the bandwidth of the system.

An interesting side effect of the growth of fiber optics has been a resurgence of use in semiconductor fabrication of the long-neglected element germanium. Germanium photodiodes excel in sensitivity in the infrared spectrum, where silicon components are practically useless.

#### IN THE FUTURE

Fiber optics is a new field. Many of its potential applications lie waiting somewhere down the learning curve. The technology is still being stretched to fit new uses. But even so, fiber-optic communication has found a place in today's world.

Fiber-optic cable will likely see increased utilization in computer networks. Its compactness and immunity to electromagnetic interference are attractive to designers of local computer-communication schemes, and the technology will achieve more use as current problems are solved and costs are brought down. In part 2 I'll look at some ways fiber optics may be used with computers. ■

#### REFERENCES

1. Bailey, Dick, ed. "Fiber Optic Data Links, Part 1: The Basics." *Photonics Spectra*, September 1983, page 35.
2. Bailey, Dick, ed. "Fiber Optic Data Links, Part 2: Choosing Fiber Optic Input and Output Devices." *Photonics Spectra*, October 1983, page 41.
3. Bailey, Dick, ed. "Fiber Optic Data Links, Part 3: Factors in Optimizing a Complete System." *Photonics Spectra*, November 1983, page 42.
4. Barnoski, Michael K., ed. *Fundamentals of Optical Fiber Communications*, 2nd ed. New York: Academic Press, 1981.
5. Cherin, Allen H. *An Introduction to Optical Fibers*. New York: McGraw-Hill, 1983.
6. Haavind, Robert. "Future Looks Bright for Guided Wave Optics." *High Technology*, November/December 1981, page 35.
7. Kao, Charles K. *Optical Fiber Systems: Technology, Design, and Applications*. New York: McGraw-Hill, 1982.
8. Marcuse, Dietrich. *Light-Transmission Optics*, 2nd ed. New York: Van Nostrand Reinhold, 1982.
9. RS-458-A: *Standard Optical Waveguide Fiber Material Classes and Preferred Sizes*. New York: Electronic Industries Association Engineering Department, 1984.



# Reserve the world in seconds.



Holidex II<sup>®</sup>, the industry's first bi-modal reservation system, ensures that your room is waiting at over 1700 hotels in more than 50 countries. For reservations just call 800-HOLIDAY.

*A better  
place to be<sup>SM</sup>*



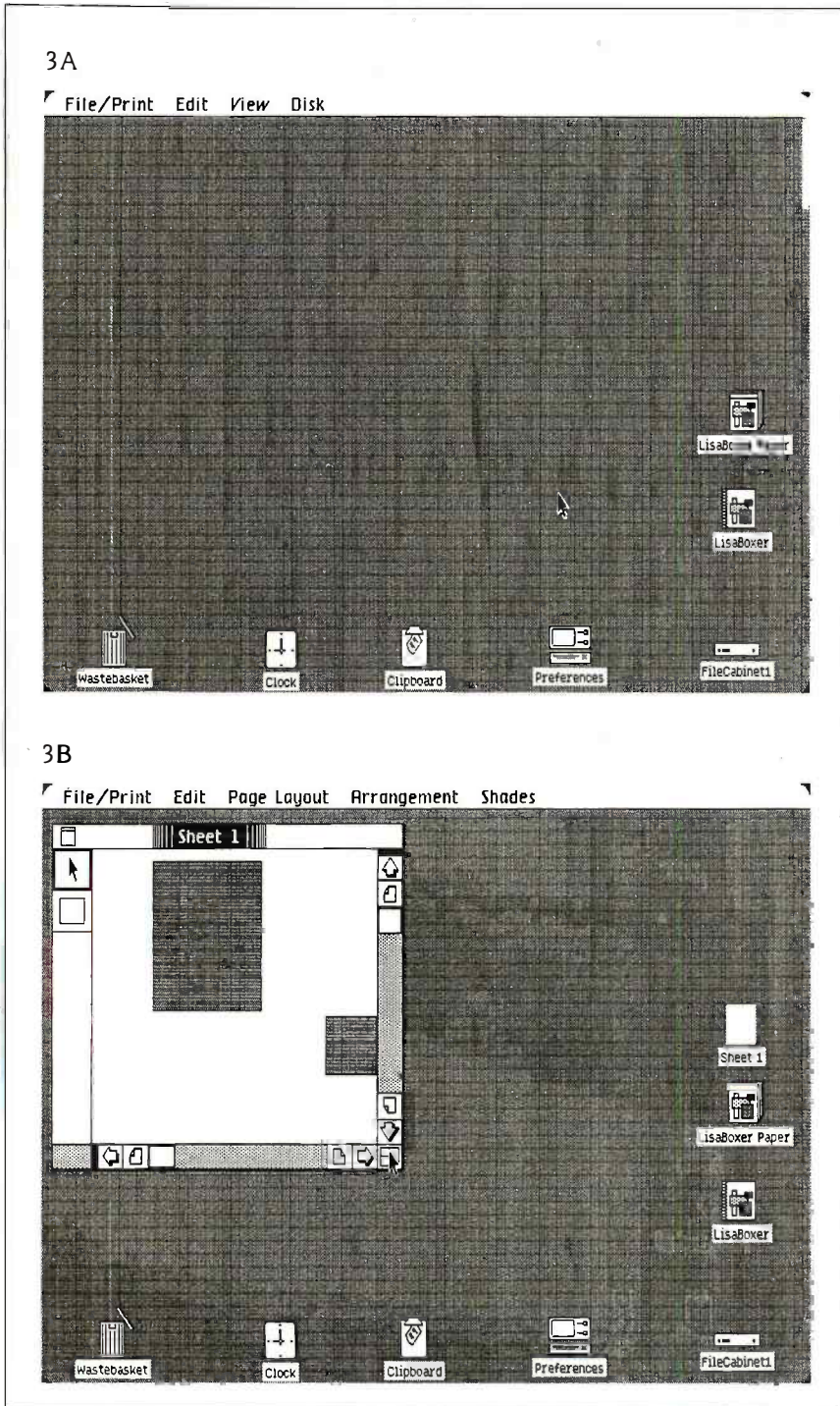


Figure 3: How a new Toolkit/32-based application appears within the desktop environment. Once the application is linked to the Lisa Office System (figure 3a), it becomes visible on the desktop as two icons, a tool (here, Lisa Boxer) and a notepad of paper (Lisa Boxer Paper). When a sheet of paper is torn off (figure 3b), it becomes an open window used to display the application. Here, Lisa Boxer is a simple program (written in five pages of code) that puts two boxes in the window and allows you to move them arbitrarily.

(continued from page 127)

We insert this code into the Toolkit/32 program, compile it, and link it to the Lisa Office System (the software that the Lisa runs to give the desktop-metaphor environment) under the name "Lisa Boxer." When we boot the Lisa Office System, the Lisa Boxer program appears on the desktop as a Lisa Boxer tool icon and, beneath it, a "notepad" of Lisa Boxer "paper" (see figure 3a). When we "tear off" a sheet of Lisa Boxer paper and "open" it, we get a window with two shaded boxes in it (figure 3b).

Now we can see how Toolkit/32 greatly simplifies the software developer's job. We find that we can change the size of the window, as shown in figure 4a; this default behavior results from the predefined Toolkit/32 code. We can also move either of the boxes, as shown in figure 4b; this behavior results from the code we added. If we try to do something that neither the Toolkit/32 code nor our code knows how to do (like selecting a box and giving it the "Gray" command from the Shades menu), the Toolkit/32 program recognizes its inability to execute the command and deactivates the command in the pull-down menu (the computer indicates this by printing the new selection in gray instead of black).

There are literally hundreds of events and interactions that you would have to orchestrate if you were writing a driver program for an application with a sophisticated user interface. Granted, it takes some effort to correctly integrate your code into a software framework like Toolkit/32, but you will still save a lot of lines of code you don't have to design, write, and debug.

## OBJECT-ORIENTED LANGUAGES

Before we can take a closer look at Apple's implementation of a software framework, we must first look at object-oriented languages. If you're familiar with the phrase, you probably associate it with the language Smalltalk, on which BYTE did a special language issue in August 1981. At the

moment, Smalltalk is the best-known object-oriented language.

Most computer languages are *operator-operand languages*—that is, languages in which operators (like “+” and “/”) perform predefined functions on operands (usually numbers). When we execute “5 + 3” in an operator-operand language, the operator “+” adds the operands 5 and 3. This is an orientation so widespread that most of us have trouble understanding a different one. *Object-oriented languages*, on the other hand, present the programming environment as a collection of objects that receive messages; here, when we calculate “5 + 3”, the object “5” receives the message “+3” and knows what to do with it (it adds the two numbers, returning the value 8). Each object has a set of messages (called *methods*) it understands. When a message is passed to an object, the object checks the message against its list of methods. If it finds the method, it executes the associated code; if it does not find the method, it returns a message that says, “I do not understand the message ‘xxx’.”

Objects are grouped into classes, with the possibility that some classes may be contained within others. When this occurs, a member of a class (with some exceptions) understands not only its own methods, but also the methods of its superclass (the class that immediately contains it) and its ancestor classes (any *n*th-generation-removed superclass). (For more details, see “The Smalltalk-80 System,” by members of the Xerox Learning Research Group, August 1981 BYTE, page 36.)

The object-oriented approach is too involved for an environment that manipulates numbers only, but it is very useful in environments that include different number types, windows, graphics, icons, lists, control structures, and other items. The object metaphor can encompass all these (and other) items; this simplifies the language and, therefore, makes the programmer’s job easier. Also, by the careful creation of classes and subclasses, programmers can amplify

(continued)

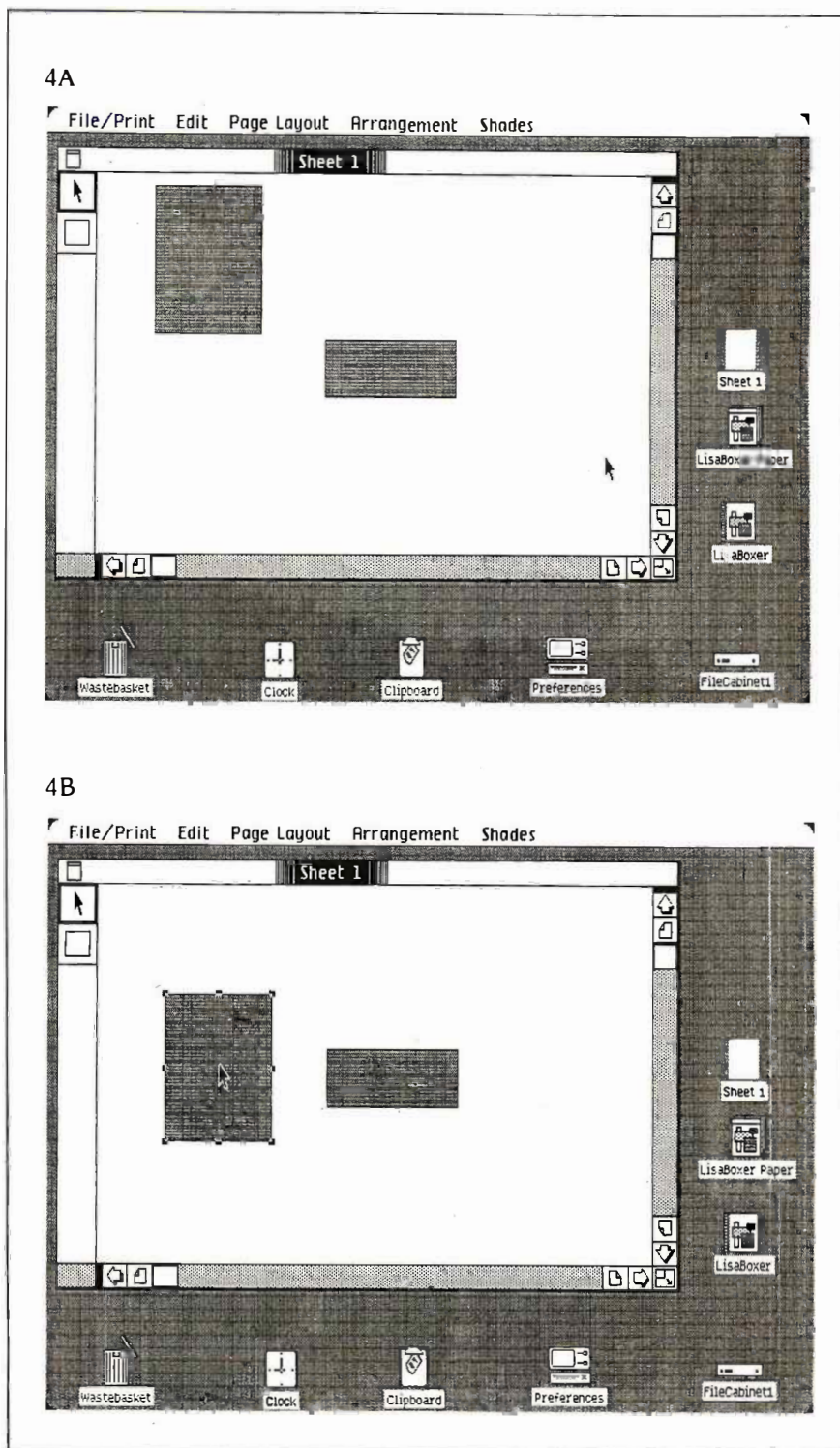


Figure 4: Component of a Toolkit/32-based application’s behavior. Behavior may be specified by the software framework (e.g., changing the size of a window, figure 4a) or the application (moving one box, figure 4b). In only the second case does the programmer have to add code to the software framework to get the desired result; see the text for details.

their programming work by defining useful methods that can be used automatically by objects within a subclass. In this and other ways, object-oriented languages help programmers design and modify extremely large projects. As Bruce Blumberg puts it, "Object-oriented programming will be to the 1980s what structured programming was to the 1970s."

Object-oriented languages differ from operator-operand languages in two other important ways. First, the definition of a given operator in an operator-operand language is given in the code that defines that operation for all possible data types; to add a new data type to such a language, the programmer must add code to the definition of the numerous operators that will deal with that data type and add error-trapping code to all the operators that won't. In an object-oriented language, all such code is

located in one place—the definition of the class—and operations that members of that class don't understand return error messages automatically. In addition, code that was previously written, when compiled with the information defining that new class, will run as is when it sends an old message (operator) to a new object (data type).

A second advantage of the object-oriented language is that it mirrors the subject-verb orientation of some user environments more closely than traditional operator-operand languages. Many software designers have found that the subject-verb orientation (i.e., selecting an item to be worked on, then choosing the action that will be performed on it) makes software easier to understand. For example, in Apple's Lisa Write, Microsoft's Word, and other word-processing programs, you can delete a phrase of text by first

selecting it, then choosing the "delete" operation. You can see that the object-message orientation of an object-oriented language closely parallels the subject-verb orientation of the software itself; this strong parallelism makes the software easier to write and, later, to maintain.

Readers interested in learning more about Smalltalk as an example of an object-oriented language can refer to the August 1981 *BYTE* and to *Smalltalk-80: The Language and Its Implementation*, by Adele Goldberg and David Robson, Reading, MA: Addison-Wesley, 1983.

**PASCAL+ CLASSES = CLASCAL**

The presence of Apple's Larry Tesler in *BYTE*'s Smalltalk issue telegraphed Apple's interest in the language (although we didn't know at the time that it was being researched in rela-

(continued)

# DANA'S COMPUTER DISCOUNT

All Items In Stock ★ Highest Quality - Lowest Prices ★ No Waiting

|                                                                                                                                         |                                                                                                                                                                                                                                       |                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                 |                                                                                                                                 |
|-----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| <p><b>EMPTY PC/XT CASES (New)</b></p> <p>The closest thing to an IBM we've seen—you're sure to be pleased</p> <p><b>**\$99.99**</b></p> |  <p><b>HALF HEIGHT Apple II E &amp; C Compatible</b></p> <p>Slim line - 40 trac w/patch<br/>Single sided 163 K capacity</p> <p><b>\$149.95</b></p> | <p><b>FULL HEIGHT Apple II C &amp; E Compatible</b></p> <p>35 Trac<br/>Single sided 143 K capacity</p> <p><b>\$149.95</b></p>  |  <p><b>TEAC FD55B The Highest Quality!</b></p> <p>Slim line - 40 trac capability<br/>Double sided, double density<br/>Compatible</p> <p><b>\$129.95</b></p> | <p><b>HARD DRIVE 10 MEG (internal) w/Controller CD complete</b></p> <p><b>CHRISTMAS SALE FOR IBM</b></p> <p><b>\$795.00</b></p> |
|-----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|

**Commodore® Compatible Drive \$249.95** | **RAM CHIPS 64K 150 NS \$42.50/set (9 pc)**

**Dana's Discount Computer Buyers Club ★ ★ ★ ★**

- \$12.00 ANNUAL MEMBERSHIP
- \$10.00 CREDIT TOWARD FIRST PURCHASE
- SPECIAL MEMBERSHIP CARD
- MONTHLY SPECIALS FOR MEMBERS ONLY (ID REQ)

**JOIN OUR CLUB AND SAVE**

**130 Watt Power Supply**

Add on or replacement for IBM or compat's



**\$149.95**

**IBM**

Color Grap. CD... 149<sup>95</sup>

DISK Dr. CD..... 139<sup>95</sup>

LMS, Joy Stk..... 19<sup>95</sup>

**HARD DRIVE 10 MEG (External) with card & software**

**\$1095<sup>00</sup>**

**Apple**

|                         |       |
|-------------------------|-------|
| Z80 Card.....           | 49.95 |
| 80 col CD.....          | 59.95 |
| 16K Ram CD.....         | 35.95 |
| Disk Dr. Contr. CD..... | 3995  |
| Parallel Print. CD..... | 2995  |
| LMS Joystick.....       | 1795  |

**HARD DRIVE \$995.00 10 MEG (EXTERNAL) complete/card/software**

**Dana's Computer Discount**

P.O. Box 15485, Santa Ana, CA 92705

ORDERS: 1-800-262-DANA In California: (714) 953-9105

ORDER DESK 8:00 A.M. TO 5:00 P.M.  
PST MON. THRU FRI.

Orders normally shipped within 48 hours.

Product shipped in factory cartons with manufacturer's warranty. Prices & availability subject to change without notice.

International orders accepted with a \$5.00 surcharge for handling, plus shipping charges • We accept Visa, MasterCard, Money Orders, and Certified checks • California residents add 6% sales tax • All prices + Shipping • Satisfaction guaranteed or full refund.

Sanyo, IBM, Apple, Apple II E, and Commodore are all registered trademarks of Eagle, IBM, Apple and Commodore corporations.

# You've flown TWA all over the world. Now the world's on us.

Middle East



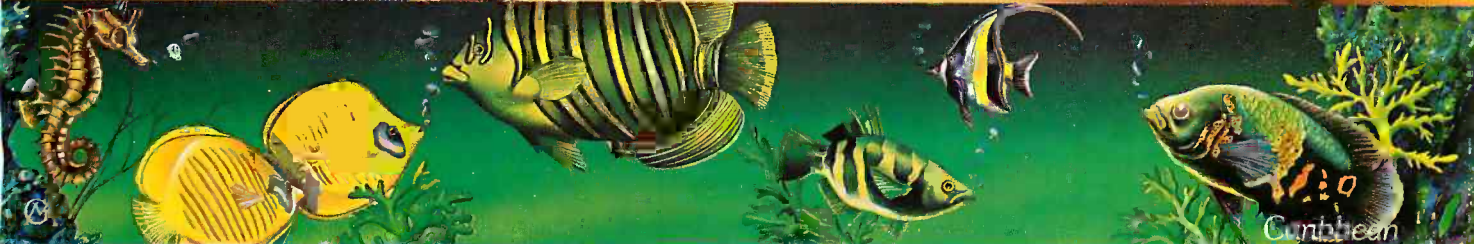
Europe



Australia



South America



Caribbean

## TWA's Frequent Flight Bonus<sup>SM</sup> program. We'll take you almost anywhere your imagination does.

If you had a mile for every business meeting you've flown to, you could be on your way to Europe. Australia. Or almost any other place your heart desires. Free.

As long as you're a member of TWA's Frequent Flight Bonus program. Where you can earn free flights to more than 170 cities throughout the world. Even the only around-the-world award.

And because our program includes Eastern and Qantas Airways, you can even fly to the Caribbean. New Zealand. Or South America.

**We'll upgrade your seat.**

**Without upping the price.**

Once you're a member and have

flown us for a while, we'll also give you a Frequent Flight Bonus Card, which entitles you to free upgrades to TWA's roomy business class on our domestic widebody flights.

Fly with us even more and you'll get a Gold Privilege Card, which upgrades you to business class on overseas flights and First Class on domestic flights (when available). So you can lie back and think about all the miles you're accumulating.

Enroll now by calling your travel agent, TWA or sending in the coupon.

At TWA, we don't just promise you the world. We give it to you.

Sign me up for your program and send me everything I need.

Name \_\_\_\_\_

U.S. Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_

Area code \_\_\_\_\_ Telephone number \_\_\_\_\_

Mail to:  
TWA's Frequent Flight Bonus program  
P.O. Box 767, Murray Hill Station  
New York, NY 10156

You're going to like us



TWA-FB-1166-"FAST"

## TOOLKIT/32 NAMING CONVENTIONS

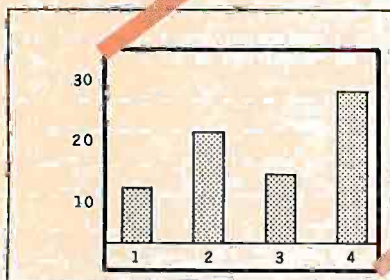
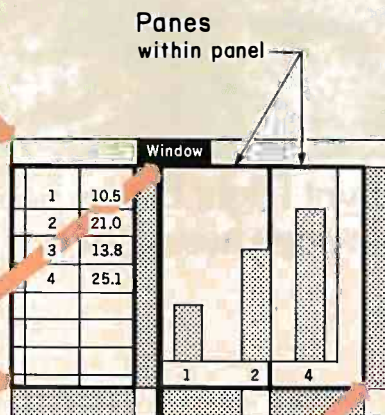
To understand Toolkit/32, you first have to understand several terms that have specific definitions (refer to the figure below). The *window* is the object through which you manipulate data via your application program. This is the same kind of window as is advertised in several desktop-metaphor environments; its size can be changed, it can be moved to any location on the video screen, and it can be "behind" or "in front of" other windows. Underneath the application program, invisible to you, is a data structure, and the purpose of the application program is to give you one or more *views* of the data. The actual data, which is not shown, is a collection of four ordered pairs: (1,10.5), (2,21.0), (3, 13.8), (4, 25.1). The

top view shows the data as a spreadsheet, and the bottom shows it as a graph, but neither is the actual data.

A window (and the application program it represents) can show more than one view. To do this, the application program divides the window into one or more *panes*. Each panel shows part of its corresponding view and can be scrolled independently from any other panel to show any arbitrary region of its view. In many cases, a panel can be broken into *panes*, each of which can be scrolled in one dimension to show different regions of the same view. (Below, note that the right pane of the right panel has been scrolled to show only the fourth bar in the bar graph.)

|   |      |
|---|------|
| 1 | 10.5 |
| 2 | 21.0 |
| 3 | 13.8 |
| 4 | 25.1 |
|   |      |
|   |      |
|   |      |
|   |      |
|   |      |
|   |      |

the View



(another representation of)  
the View

tion to the Lisa). Apple implemented Smalltalk for the Lisa but never released it; "It's too slow," Tesler said, "and its syntax is too different for most people." However, designers at Apple did not lose their enthusiasm for object-oriented languages, especially after they had a taste of the problems that came with the original six Lisa application programs, which were written as standard Pascal programs.

The Toolkit/32 team created Clascal, a superset of Pascal that contains a new data type: classes. By doing so, they created what they thought contained most of the familiarity of Pascal with most of the power of an object-oriented language. The class data type is like the record data type in Pascal. Just as a Pascal RECORD statement defines the record by the fields it has, a Clascal SUBCLASS statement defines a class by the fields and methods it has. Similarly, just as a record is an instance of the record definition, an object is an instance (or member) of a class. Clascal defines one class, TObject. All other classes are subclasses of TObject, and all objects have TObject as an ancestor class. Each object can respond to the methods of its class and those of all its ancestor classes; the only exception to this is that if two of the object's classes and superclasses have the same method, the object uses the one closest to it—this allows a subclass to override the (perhaps inappropriate) methods of one of its ancestor classes.

The definition of a class consists of stating the class's name, the class of which it's a direct subclass, the new fields not inherited from an ancestor class, the functions and procedures that constitute the class's methods, the algorithms that implement those methods, and (optionally) the code that must be executed when the class is created. A class inherits the methods and fields of all ancestor classes unless they are specifically redefined within the class definition. When an object of this class is created, it is associated with a set of

(continued)



# Submarine Engineering. Tomorrow is today at NUSC

The Naval Underwater Systems Center is the Navy's principal research, development, test and evaluation center for submarine warfare and submarine weapon systems. We provide high technology vital to the Navy's tactical and strategic edge in combat systems (sonar, combat control, electromagnetics, underwater weapons and targets, weapon launch and handling), surface ship sonar and undersea ranges.

Engineers and scientists who join the Center's laboratories at Newport, Rhode Island and New Lon-



don, Connecticut, are encouraged to take responsibility almost immediately. They design, develop and test prototypes of these systems and work with private industry on production of the final product.

"I got responsibility right away," says Ronald Jackson, an electronic engineer. "As I showed ability, my responsibility grew. Today, I'm a project engineer."

Through NUSC's liberal education policy, Ron has earned a master's since he joined Newport and is working toward a Ph.D.

Because the Center helps its scientists become expert in other fields, electronic engineer Donna Doane is concentrating on computer software. "I'm doing things people never have done before," Donna says. "I design the project, and I see it to the end—to the final product." Monica Sachs is learning something new each day. "I'm working on weapons systems engineering, a broad subject that allows you to get into several different kinds of engineering. I use my electronic engineering background to understand the other disciplines." And Peter Santiago applies his com-

puter background to quality assurance. "I look for self-gratification in the job, and I get that at NUSC."

We seek graduating and experienced electronic and computer engineers with degrees from accredited colleges and universities. We also need computer scientists with degrees from colleges and universities affiliated with a school of engineering and specializing in scientific and technical applications.

We offer you challenge, freedom to be innovative and creative, and the opportunity to contribute your skills to our national defense.

And the living is good, too! Newport and New London areas are popular for their excellent beaches, fishing and sailing.

We believe we have both the challenge and the opportunity for you. For further information, contact Naval Underwater Systems Center, Personnel Staffing Division, B Newport, Rhode Island 02841 or call (401) 841-3585.



**An Equal Opportunity Employer  
U.S. Citizenship Required**

values for that class's fields; you can think of a field as a private variable each object gets upon its creation.

Listing 1 shows sample code from

the application that created the Lisa Boxer application program described earlier. This segment defines the methods that the objects of the TBox-

View class understand—NEW, Box-With, and Draw— and the code (under the heading CREATION) that executes when the class is created. In this example of code, methods are capitalized and fields are not, and an object and its method are joined with a period—for example, "s.Scan(box)" sends the method Scan to the object s with the object box as an argument; also, braces delineate comments that are included only to explain the surrounding code.

**INTERFACING TO THE STANDARD**

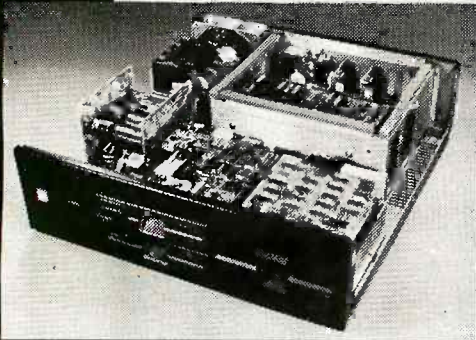
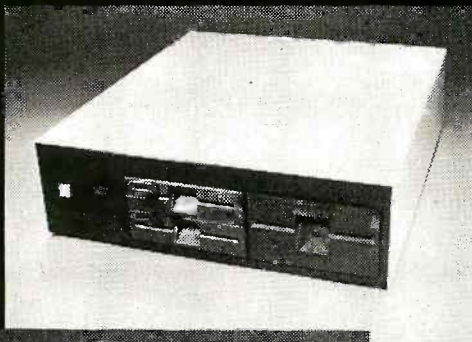
Now we can examine the Standard Application in more detail. The Standard Application is a collection of classes that implement the generic behavior of a standard Lisa application program—that is, all the actions that, because of the previously de-

*(continued)*

Table 1: A partial list of tasks that are taken care of automatically by the Standard Application within Apple's Toolbox/32. Software frameworks present a prepackaged solution to the complicated problem of creating an event-driven, window-based user environment; as such, they decrease the programmer's work by one to two orders of magnitude, thus allowing him or her to create a software application much faster and with a smaller time commitment.

- memory management
- file management
- printing and other I/O
- communication with the desktop environment
- communication with the clipboard (allows different applications to exchange data)
- creation, deletion, activation, deactivation, and size and position change of windows
- multiple panes within a panel
- multiple panels (giving differing views of the data)
- standard scrolling within a pane or panel
- handling of all errors not dealt with by user code
- passing of system events (e.g., mouse movement, keypresses) that the Standard Application cannot handle to user code

**NEW PC MAIN/FRAME**  
FOR S100 BUS OR SINGLE BOARD COMPUTERS



Disk drives & computer boards not included

- Low Price - Model 2210 (shown) \$350\*
- Low Profile - Set display on top, keyboard in front
- Laser/3000 - Modern office styling - Model 3310 \$387\*
- 5 1/4 Winchesters & Floppies - Full or Half
- 4 Card S100 Motherboard and Connectors
- Accomodates I/O Personality Boards
- Hefty Power Supply - S100 and Drive, Controllers
- Multifan, Push-Pull Cooling System
- Multiple EMI Filters
- Switched AC Outlets\*
- INTE/National Power Supply 115/230, 50-60 Hz

\*Call for quantity pricing

Write or call for our brochure which includes our application note:  
"Making micros, better than any ol' box computer."

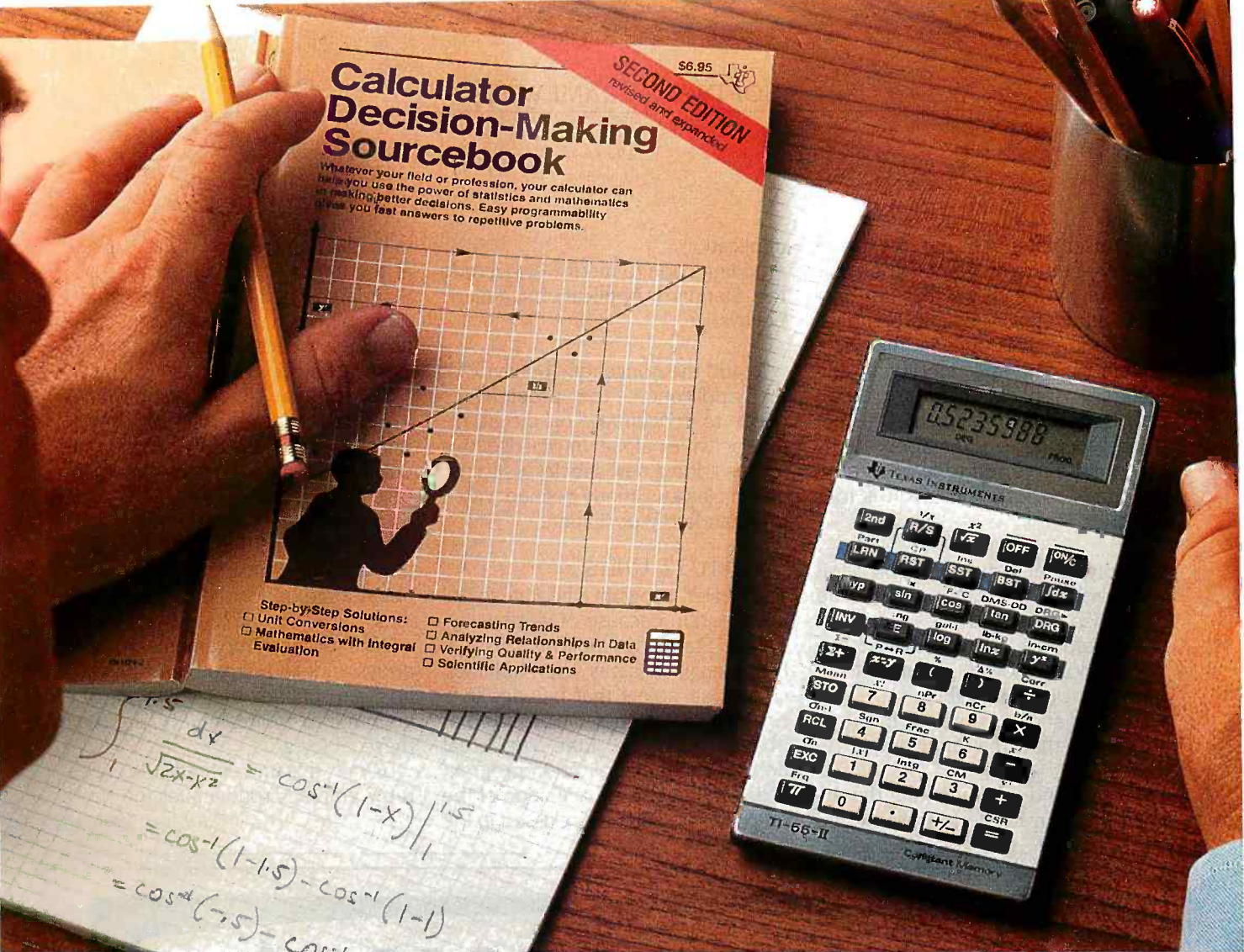


RESEARCH CORPORATION

8620 Roosevelt Ave./Visalia, CA 93291 209/651-1203

We accept BankAmericard/Visa and MasterCard



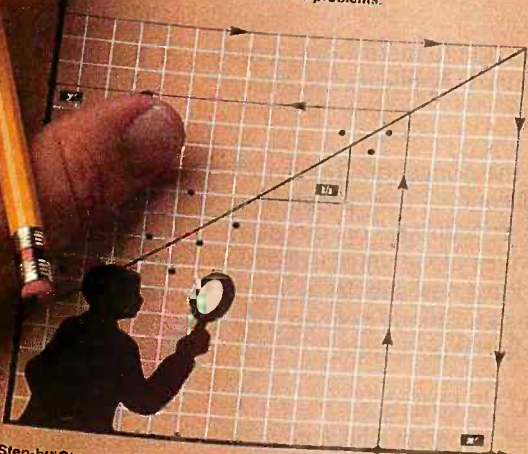


# Calculator Decision-Making Sourcebook

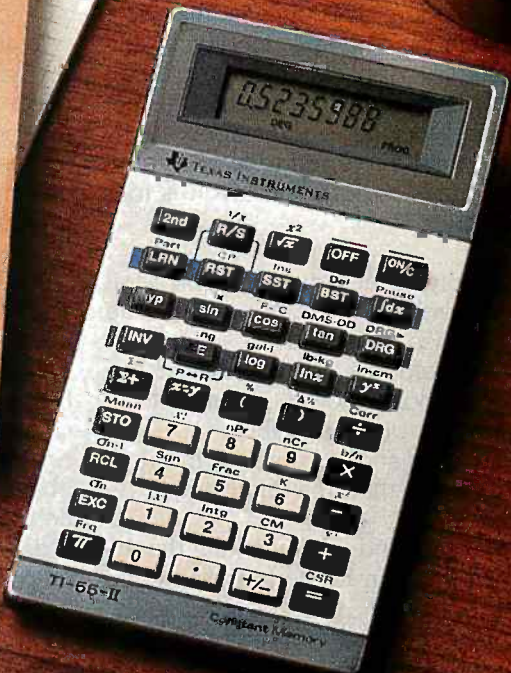
SECOND EDITION  
revised and expanded

\$6.95

Whatever your field or profession, your calculator can help you use the power of statistics and mathematics in making better decisions. Easy programmability gives you fast answers to repetitive problems.



- Step-by-Step Solutions:
- Unit Conversions
  - Mathematics with Integral Evaluation
  - Forecasting Trends
  - Analyzing Relationships in Data
  - Verifying Quality & Performance
  - Scientific Applications



Handwritten mathematical work on a piece of paper:

$$\int \frac{dx}{\sqrt{2x-x^2}} = \cos^{-1}(1-x) \Big|_{1.5}^{1.5}$$

$$= \cos^{-1}(1-1.5) - \cos^{-1}(1-1)$$

$$= \cos^{-1}(-.5) - \cos^{-1}(0)$$

# How the TI-55-II makes short work of long problems.

Whenever you can solve complex problems quickly and accurately, you're ahead of the game. And that's exactly what the TI-55-II does for you. By giving you 112 pre-programmed functions (like definite integrals), it allows you to take short cuts without losing accuracy. You'll accomplish a lot more in less time which means increased efficiency.

With our TI-55-II you can tackle problems you thought could only be solved with higher-priced programmables. You're not only getting the standard slide rule functions but also statistical

capabilities. This way you can work out linear regressions, permutations and combinations, just to name a few.

The TI-55-II also gives you enough programmability to eliminate a lot of repetitive key punching. Our Constant Memory™ keeps programs and data on tap, even when the calculator is turned off. So once you've entered a formula, you can simply put in the variables to get your solution. The Liquid Crystal Display shows your answers in standard, scientific or engineering notations — clearly and precisely.

We also help you get the most

out of your calculator with the Calculator Decision-Making Sourcebook. It gives you step-by-step examples of the best techniques used for solving mathematical, scientific and statistical problems. And we've included a special section on how to program your TI-55-II.

So next time you're facing another time-consuming problem, cut it down to size with the TI-55-II.



## TEXAS INSTRUMENTS

Creating useful products and services for you.

finer user interface, are the same from program to program. Table 1 lists some of the functions that are handled automatically by the Standard Application. This means that programmers who are modifying the Standard Application must provide only code that implements the behavior specific to their applications (this will be referred to later as nongeneric behavior). This involves four activities:

- supplying the Standard Application code with the view or views of the data when requested (for a definition of the word "view" in this context, see the text box "Toolkit/32 Naming Conventions" on page 398)
- creating and maintaining the data structures that the application requires
- defining and implementing the actions that can be performed by the

application

- adding code to modify or override the Standard Application's generic behavior

To add the nongeneric behavior of the application, the programmer needs to concentrate on the above four activities alone. In practice, this means adding new subclasses to the object classes already defined within the Standard Application.

### TOOLKIT/32 UNITS

The "driver" program (I hesitate to call it a program because of its triviality) for the Standard Application is five lines long: it initializes some variables, creates an object that belongs to a class called "process," and sends that object the method "Run." The actual behavior of the application program is determined by the definition of the process class and other classes. In the

following paragraphs, I will take a look at the major units that make up the Standard Application. (The units I refer to here are like Pascal units; the units below each contain related subclass definitions.)

*UObject*: the *UObject* unit defines the class *TObject*, the universal ancestor class of all Clascal objects. This unit handles memory allocation for objects (they are given memory when they are created, and the memory is reclaimed when they are deleted); it also handles object copying and enables some optional debugging facilities.

*UList*: this unit implements dynamic arrays, indexed, linked, and blocked lists, and utilities that allow the programmer to create, modify, and scan these objects.

*UDraw*: this unit extends the Quickdraw graphics routines (at the heart

*(continued)*

## CREATE THE HOME OF THE FUTURE

You can change tomorrow's home entertainment and information systems. As a vital member of RCA Lab's professional team you will find opportunity, challenge and reward.

We're seeking experienced computer and electrical engineering professionals to create the consumer electronics products of the future. You'll need a PhD, MS or BS in Computer Science or Electrical Engineering, or equivalent experience. You'll work in a challenging research environment on projects in graphics hardware and software, interactive video simulation, applications software development, microprocessor-based hardware/software design, and VLSI design of graphics and audio processors. You'll

use the latest development tools, including powerful graphics and CAD/CAE systems, and networked VAXES, Suns, and Apollos.

We offer highly competitive salaries, comprehensive benefits and an ideal Princeton location that combines a rural setting with the nearby attractions of New York City and Philadelphia. Your role in creating the home of the future can begin today by sending your resume to:

**B. Palmer**  
**RCA Laboratories**  
**David Sarnoff Research Center**  
**P.O. Box 432**  
**Department IW**  
**Princeton, NJ 08540**

Equal Opportunity Employer

**RCA**  
**Laboratories**



**One Of A Kind.**

**FINALLY! MAIL ORDER SERVICE YOU CAN DEPEND ON!**



**BUSINESS SOFTWARE**

Now **you** can take advantage of the same personalized service enjoyed by America's largest corporations . . . at the same low prices!

**PROKEY 3.0  
92**

**WORDSTAR  
PROPAK  
317**

**SYMPHONY  
449**

**OPEN  
ACCESS  
349**

**WORD  
PERFECT  
265**

**SUPER  
CALC 3  
199**

**HARVARD  
PROJECT  
MGR. 299**

**MULTIMATE  
259**

**CROSS  
TALK  
98**

**LOTUS 1-2-3  
299**

|                                                                  |                                                                                                             |                                                                                                                         |                                                                                                                                                           |                                                                                     |
|------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| <b>Advanced Data Institute</b><br>Aladin 595 399                 | <b>Digital Marketing</b><br>Writers Pak 295 199<br>Footnote 99 84<br>Datebook II 295 179<br>Notebook 150 98 | <b>Lexisoft</b><br>Spellbinder 495 239                                                                                  | <b>Microsoft</b><br>Multiplan 250 139<br>Basic Interpreter 350 249<br>Word/Mouse 475 319<br>Chart (Mac) 125 99<br>Cash Plan (IBM) 150 99                  | <b>Perfect Software</b><br>Perfect Writer 349 218<br>Perfect Writer/Speller 399 298 |
| <b>Alpha Software</b><br>Data Base Manager II 295 179            | <b>Fox &amp; Geller</b><br>dGraph or Quickcode 295 164<br>dUtil 99 58                                       | <b>Lifetree</b><br>Volkswriter Deluxe 295 169                                                                           | <b>Monogram</b><br>Dollars and Sense (IBM) 179 149<br>Dollars and Sense (Mac) 149 119                                                                     | <b>Peter Norton</b><br>Norton Utilities 80 52                                       |
| <b>ATI</b><br>Training WordStar 75 45<br>Training dBase II 75 45 | <b>Fox Research</b><br>10 Base 495 399<br>10 Net 695 499                                                    | <b>Living Video Text Inc</b><br>Think Tank (IBM) 195 149<br>Think Tank (Apple) 150 109                                  | <b>Oasis</b><br>Word Plus 150 105<br>Punctuation and Style 150 95                                                                                         | <b>Prentice-Hall</b><br>Execuision 395 299                                          |
| <b>Axel Johnson</b><br>AutoCode 195 139                          | <b>Funk</b><br>Sideways 60 45                                                                               | <b>MDBS</b><br>Knowledgeman 500 299                                                                                     | <b>Pacific Data Systems</b><br>Money Track 295 219                                                                                                        | <b>Select Information Systems</b><br>Select Word Processor 295 199                  |
| <b>CDEX</b><br>Advanced Lotus 1-2-3 70 45                        | <b>Heritage</b><br>Smart Key II 90 79                                                                       | <b>Micropro</b><br>WordStar 495 225<br>SpellStar 150 99<br>CorrectStar 250 175<br>MailMerge 250 125<br>InfoStar 495 248 | <b>Peachtree</b><br>Peachtext 5000 425 185<br>Calendar Mgmt 195 165<br>Decision Manager 625 495<br>Business Graphics System 295 219<br>Peachpak 4 395 238 | <b>Sorcim</b><br>SuperCalc 2 295 154                                                |
| <b>Chang Labs</b><br>Rags to Riches Ledger 99 79                 | <b>Humansoft</b><br>DBPlus 125 84                                                                           | <b>Microrim</b><br>R Base 4000 495 310<br>Extended Report Writer 150 119<br>Clout 195 159                               | <b>Tylog</b><br>dBase Window 249 155                                                                                                                      | <b>Visicorp</b><br>ViciCalc IV 250 159                                              |
| <b>Condor</b><br>Condor 3 650 259                                | <b>IUS</b><br>Easy System II 395 184<br>General Ledger 595 319<br>Accounts Payable 595 319                  |                                                                                                                         | <b>Warner Software Inc.</b><br>The Desk Organizer 295 239                                                                                                 | <b>Woolf Systems</b><br>Move It 150 85                                              |

We can't fit all of our huge inventory in this ad, so please call for products you don't see here.

**CALL FOR OUR FREE CATALOG**

**TO ORDER CALL TOLL-FREE:**

**(800) 235-3020 (USA)**

**(800) 235-3021 (CA)**

**(415) 382-9085**



**TERMS:**

- Call for shipping charges and support policies.
- Full guarantee against manufacturers defects
- Allow 3 weeks for checks to clear
- Prices may change
- Call for availability
- **NO CASH REFUNDS!** Due to our low prices, **ALL SALES FINAL.**

- SAME DAY SHIPMENT ON MOST ORDERS
- Prompt UPS service
- Authorized Purchase orders accepted
- Dealer, institutional and quantity discounts available
- No surcharge for credit card purchases
- VISA & Mastercard accepted
- COD

of Lisa's graphics capabilities) to use 32-bit coordinates instead of Quickdraw's 16-bit coordinates; this eliminates possible document-size problems that could arise from using 16-bit coordinates. UDraw is used for drawing in a view.

UABC: the "ABC" stands for application-base classes. UABC contains most of the classes that define the standard behavior. Because of this, programmers will spend most of their time creating subclasses of UABC to implement the application's non-generic behavior.

### INSIDE UABC

We will now take a brief look at which classes within UABC are usually modified and how those modifications create the application program's non-generic behavior.

The methods of the TProcess class are those methods (or actions) that

are specific to the application but are called every time the application executes. Every Toolkit/32 application creates only one process object, which implements the main program loop of the application. An application almost always follows this loop: get an event (e.g., menu selection, mouse movement, keypresses), process it by giving it to an object that understands what to do with it, and wait for the next event. The process object also handles error and warning messages and the procedure for ending the application.

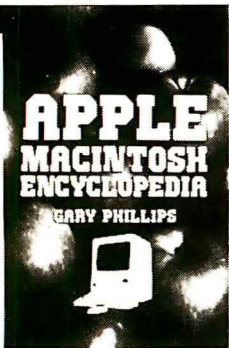
An application creates one object from the ancestor class TDocManager for each document icon or open window that is associated with the application. This descendant object controls the interface to all disk files that define the document, and it manages the memory used by the document.

Objects descended from the TView

class define any views needed by the application—one object for each view the application uses. The view shows the entire representation of the application's data, interpreted as the view is defined to show it. A panel object (described below) asks a view object for the view, but it is the panel object's responsibility to draw the part that is to be visible (this is one of the things the Standard Application code usually does automatically). Obviously, one of the programmer's main responsibilities is to create the code that implements the view.

Whenever the user selects an action to be performed (usually by choosing a selection from a pull-down menu), the application creates an object that is a descendant of the TCommand class and gives it the message "Perform," which causes the object to try to execute itself. Most actions should

(continued)

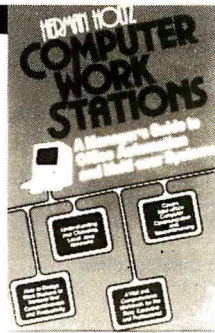


### Apple Macintosh Encyclopedia

Gary Phillips and Donald J. Scellato

This is a unique alphabetically arranged encyclopedia with practical entries on every function, command, problem or application the beginner or advanced user needs to know to get the most from the Macintosh. Written by an acclaimed expert—and the most up-to-date book on the Macintosh available.

A Chapman & Hall, New York book  
280 pp. October  
0-412-00671-5 #9056  
\$19.95/paper



### Computer Work Stations

The Manager's Guide to Office Automation and Multi-User Systems

Herman Holtz

In this book, Herman Holtz, a highly successful author and consultant, answers such basic questions as—Are work stations right for your office? Can they increase your competitiveness? How do you identify your needs? What systems are available?

A Chapman & Hall, New York book  
280 pp. December  
0-412-00711-8 #9004  
\$24.50 cloth

## Books for the professionally-motivated computer user...

### Computer Graphics and Applications

Dennis Harris

Elementary and up-to-date, this introduction to the principles and many exciting applications of computer graphics covers the hardware currently available, and describes basic 2-D and 3-D software techniques. It covers a wide range of applications with suggestions for real projects and four complete microcomputer case studies involving games, calligraphy and computer aided learning.

A Chapman & Hall, New York book  
c. 220 pp. September  
0-412-25090-X #9108  
\$19.95 paper  
0-412-25080-2 #9107  
\$39.95 cloth

### THE NEW ENHANCED IBM PC jr. Encyclopedia

Gary Phillips

Using the same format as the Apple Macintosh Encyclopedia, the IBM PC jr. Encyclopedia incorporates the latest additions and modifications to the IBM PC jr. home computer, including the new professional keyboard that has been called "a stroke of genius" by an expert, a greatly enlarged memory and the truly impressive list of peripherals that bring junior close to the performance level of its more expensive senior, IBM PC.

A Chapman & Hall, New York book  
280 pp. January 1985  
0-412-00681-2 #9055  
\$19.95 paper



**Chapman & Hall**  
IN ASSOCIATION WITH METHUEN, INC.  
733 Third Avenue, New York 10017  
(212) 922-3550

# Your Gateway to Artificial Intelligence

GOLDEN  
COMMON  
LISP



IBM  
Personal  
Computer

## Gold Hill Computers brings the language of Artificial Intelligence to Your Personal Computer.

You know you want to do more with Artificial Intelligence. Two problems have held you back: the expense of the hardware and the scarcity of LISP programmers. *But no longer.* GOLDEN COMMON LISP® makes it possible for you to learn and use LISP on your personal computer. You will know the excitement of expert systems, intelligent data access, and smart programs.

COMMON LISP is the new LISP standard developed by researchers from universities and corporations such as CMU, MIT, Stanford, UC Berkeley, Digital, LMI, Symbolics, and Texas Instruments. GOLDEN COMMON LISP is the right LISP for you because it is based on COMMON LISP. Programs you develop using GOLDEN COMMON LISP on your personal computer will run in the COMMON LISP environments of larger, more expensive machines.

With GOLDEN COMMON LISP, every programmer becomes a LISP programmer. GOLDEN COMMON LISP comes with the LISP Explorer™, an interactive instructional system developed by Patrick H. Winston and San Marco Associates. The San Marco LISP Explorer guides you through the steps of LISP programming and makes the full range of LISP's power accessible to both novices and experienced programmers. The new second edition of the classic LISP textbook by Winston and Horn is also included.

GOLDEN COMMON LISP comes complete with the intelligent GMACS

editor (based on EMACS), on-line documentation of all LISP and GMACS functions, a comprehensive user manual, and program debugging tools. In short, GOLDEN COMMON LISP comes with everything you need to program in LISP. Features of GOLDEN COMMON LISP for advanced users include co-routines for multitasking, macros for code clarity, streams for I/O, closures for object-centered programming, and multiple-value-returning functions for efficiency.

### *GOLDEN COMMON LISP—the intelligent path to Artificial Intelligence.*

GOLDEN COMMON LISP (GCLISP™) requires an IBM PC, PC XT, or IBM PC compatible running PC-DOS 2.0. 512K bytes of memory are recommended for program development. A version of GCLISP for the DEC Rainbow is also available. The package includes:

- an intelligent GMACS editor
- program development tools
- the San Marco LISP Explorer
- the new 2nd edition of *LISP* by Winston and Horn
- the *COMMON LISP Reference Manual* by Guy Steele
- on-line documentation of all GCLISP and GMACS functions
- the GOLDEN COMMON LISP Users' Guide and Reference Manual

ORDER GCLISP TODAY using the coupon below. Or call our Customer Service Department at:

**(617) 492-2071**

|                                                                                                                                                       |                    |                       |             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------------|-------------|
| Gold Hill Computers<br>Customer Service<br>163 Harvard Street<br>Cambridge, MA 02139                                                                  |                    | B10-84                |             |
| Name _____                                                                                                                                            |                    |                       |             |
| Organization _____                                                                                                                                    |                    |                       |             |
| Address _____                                                                                                                                         |                    |                       |             |
| Phone _____                                                                                                                                           |                    | Today's Date _____    |             |
| Type of computer _____                                                                                                                                |                    |                       |             |
| <input type="checkbox"/> Enclosed is a check to Gold Hill Computers for GCLISP.                                                                       |                    |                       |             |
| <input type="checkbox"/> Please bill my <input type="checkbox"/> MasterCard <input type="checkbox"/> VISA card.                                       |                    |                       |             |
| Card # _____                                                                                                                                          |                    | Expiration Date _____ |             |
| Signature _____                                                                                                                                       |                    |                       |             |
| Quantity                                                                                                                                              | Description        | Unit Price            | Total Price |
|                                                                                                                                                       | GOLDEN COMMON LISP | \$495.00              |             |
| Subtotal                                                                                                                                              |                    |                       |             |
| MA residents add 5% Sales Tax                                                                                                                         |                    |                       |             |
| Total Amount                                                                                                                                          |                    |                       |             |
| University purchasers should inquire about our educational discount. We pay shipping on all credit card and pre-paid orders within the United States. |                    |                       |             |
| <input type="checkbox"/> Please send me more information about GCLISP.                                                                                |                    |                       |             |

G O L D H I L L C O M P U T E R S

163 Harvard Street, Cambridge, Massachusetts 02139

GOLDEN COMMON LISP is a registered trademark of Gold Hill Computers. GCLISP is a trademark of Gold Hill Computers. The LISP Explorer is a trademark of San Marco Associates. LISP is copyrighted by Addison-Wesley Publishing Company, Inc. The *COMMON LISP Reference Manual* is copyrighted by Digital Equipment Corporation. Rainbow is a trademark of Digital Equipment Corporation. IBM is a registered trademark of International Business Machines.

Circle 420 on inquiry card.

# General DataComm beats Hayes for accuracy.



# And we can prove it.

We put our 1200 bps modem to the critical test. We stacked it up against Hayes, one of the "smart" modems.

## The Performance

Hundreds of phone calls were carefully monitored, analyzed, and verified by telecommunications engineers. After exhaustive testing, the results were conclusive: when line quality was good, our modem was one and a half times more accurate than Hayes. When line quality was bad, however, our modem was up to ten times more accurate. And when line quality was really bad, their error rate shot up to as much as 100 times ours! The errors ranged from misspelled words to incorrect numbers. The implications for modern business are understandably serious.

## The Reliability

Then we went inside and did a component count. The final score: Hayes 252, us 155. This can be viewed two ways: Either Hayes has a 60% better chance of developing part failure, or our modem has a 60% better chance of delivering higher reliability.

Eliminating operator risk is as important to us as eliminating errors. With our modem there's virtually no risk of electrical damage because there are no internal switches to deal with. General DataComm modems automatically select all call parameters.

## The Company

The General DataComm intelligent modem is the newest product of a company that has been designing data communication systems for 15 years. A company whose customer list is a "Who's Who" of international business. Most of the Bell operating companies, and other telephone companies in the U.S. and Canada. Major banks. Brokerage firms. And many of the Fortune "500."

We build multiplexers, modems, local area and digital network products, and the most complete networking systems on the market. Now we're applying the technology that won the respect of big business and Bell to the personal computer market. With a line of 300 and 1200 bps modems and our own communications software.

The General DataComm modem. We put it to the critical test. Now it's ready for the ultimate test. Yours. To find the dealer nearest you, contact the Personal Computer Products Dept., (203) 574-1118. General DataComm, Middlebury, CT 06762-1299.

Circle 162 on inquiry card.

 **General DataComm**

**The best connections in the business.**



**Fill your IBM XT or Portable's half-size expansion slot with the only 1200 baud internal modem designed for it: The Ven-Tel Half Card™. Under \$500 from MTI.**

The Half Card™ includes the most popular communications software, Crosstalk XVI from Microstuf.

This same modem also works in the IBM PC, the Compaq, and the Panasonic Senior Partner.

MTI is an authorized distributor for Ven-Tel. And we honor Visa and MasterCard. Whether you buy, lease or rent, MTI is the one source for all the computer and data communications equipment, applications expertise and service you'll ever need. At great prices. Call us.



A DUCOMMUN SUBSIDIARY

**Computer & Data Communications Equipment Sales / Leasing / Service / Systems Integration**

DEC, Intel, Texas Instruments, Hewlett-Packard, Dataproducts, Diablo, Lear Siegler, Esprit, C.Itoh, Racal-Vadic, MICOM, Ven-Tel, Develcon, PCI, U.S.Design, Digital Eng., Cipher, MicroPro, Microsoft, Polygon & Select.

|                                                                  |                                      |                                              |                                                                            |
|------------------------------------------------------------------|--------------------------------------|----------------------------------------------|----------------------------------------------------------------------------|
| <b>New York:</b><br>516/621-6200<br>718/767-0677<br>518/449-5959 | <b>New Jersey:</b><br>201/227-5552   | <b>Ohio:</b><br>216/464-6688<br>513/891-7050 | <b>California:</b><br>818/883-7633<br><b>Outside N.Y.:</b><br>800/645-6530 |
|                                                                  | <b>Pennsylvania:</b><br>412/931-9351 |                                              |                                                                            |

**SOFTWARE FRAMEWORKS**

*TWindow, TPanel, and TPane are classes that define the behavior of windows, panels, and panes.*

be implemented so that they first change the view but not the underlying data; this allows the "Undo" message to work in most cases. If "Undo" is not the next message sent, the program automatically executes a method called "Commit," which makes the changes already shown in the view to the data itself. Each panel of the application has an object descended from the TSelection class; this selection object can handle messages and manipulate whatever objects, if any, are associated with that panel. When a command object executes itself, it gives itself to the selection object associated with the active panel.

TWindow, TPanel, and TPane are classes that define the behavior of windows, panels, and panes. Their behavior, already defined by the Standard Application, does not usually need to be changed by the programmer; each panel will ask a view object for the view and will display the appropriate part as part of its generic behavior.

**COMMENTARY**

The software framework approach is an extremely useful one for programmers who want to develop sophisticated applications but who don't have the resources (or patience) to write the extremely complicated code that will bring it up in an interactive user environment. The Apple Lisa group has developed the Toolkit/32 system described in this article. The Microsoft "window" device under MS-DOS 2.0 works similarly for MS-DOS-based software. (According to Scott McGregor of Microsoft, his company has developed a "Microsoft Windows Toolkit" for software developers that

*(continued)*



**New Release**

One user told us that, compared to other 8-bit C Compilers, Eco-C's "floating point screams". True. But, Release 3.0 has a number of improvements in other areas, too:

New optimizers with speed improvements of up to 50 percent over earlier releases!

New Compiler-time switches for greater flexibility.

A standard library with 120 pre-written functions.

Expanded error checking with over 100 possible error messages in English including multiple, non-fatal errors.

Improved, easy-to-read user's manual.

The Eco-C Compiler supports all data types (except bit-fields) and comes with MACRO 80 and the **C Programming Guide** for \$250.00. An optional, high-speed assembler and linker is available for an additional \$75.00. Eco-C requires a Z80 CPU, CP/M, and 56K of free memory. To order, call



6413 N. College Ave. • Indianapolis, IN 46220  
(317) 255-6476



Eco-C (Ecosoft), CP/M (Digital Research), Z80 (Zilog), MACRO 80 (Microsoft)

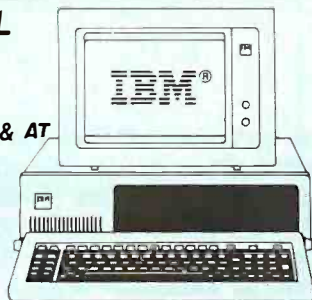


# COMPUTER HUT™

COMPARE  
OUR  
SERVICE & PRICE!

## SPECIAL OF THE MONTH

IBM-PC, XT & AT  
CALL FOR  
PRICE



### DISK DRIVES

|                                  |       |
|----------------------------------|-------|
| <b>Tandon</b> TM100-2 DS/DD      | \$185 |
| <b>MATSUSHITA</b> JA 551         | \$159 |
| <b>TEAC</b> FD-55B Slimline      | \$169 |
| <b>SHUGART</b> SA-455 half-high  | CALL  |
| <b>MAYNARD</b> WS1/WS2/WS3       | CALL  |
| <b>SYSGEN</b> — Hard disk & Tape | CALL  |

### ME MAYNARD ELECTRONICS

|                             |           |
|-----------------------------|-----------|
| Floppy Disk Controller      | \$129     |
| FDC w/Par. Port or Ser Port | \$179/189 |
| SANDSTAR SERIES             | CALL      |

### QUADRAM

|                          |      |
|--------------------------|------|
| Quadboard expand to 384K | CALL |
| Quadcolor I & II         | CALL |

### AST RESEARCH

|                               |       |
|-------------------------------|-------|
| MegaPlus II 4-Funct 64K + s/w | \$269 |
| 6-Pack 5-Funct 64K + s/w      | \$269 |
| I/O Plus                      | \$129 |
| MonoGraphPlus                 | CALL  |

|            |      |
|------------|------|
| <b>STB</b> | CALL |
|------------|------|

### MICROLOG

|                  |       |
|------------------|-------|
| Baby Blue        | \$359 |
| Baby Blue II 64K | \$469 |

### GRAPHICS BOARDS

|                 |       |
|-----------------|-------|
| <b>TECMAR</b>   |       |
| Graphics Master | \$489 |

|                           |       |
|---------------------------|-------|
| <b>HERCULES</b>           |       |
| Hi Res Mono Graphics      | \$335 |
| Color Graphics w/Par Port | CALL  |

### PC+ PRODUCTS

|                                                 |       |
|-------------------------------------------------|-------|
| COLORPLUS 640x200,<br>16-Color w/Par Port + s/w | \$389 |
|-------------------------------------------------|-------|

### PARADISE

|                      |       |
|----------------------|-------|
| Modular Graphics     | CALL  |
| EVEREX Graphics Edge | \$395 |

### MODEMS



|                  |       |
|------------------|-------|
| Smartmodem 1200  | \$489 |
| Smartmodem 1200B | \$419 |

### BIZCOMP

|                    |       |
|--------------------|-------|
| PC Intellimodem    | \$359 |
| PC Intellimodem-ST | \$359 |

|                         |      |
|-------------------------|------|
| <b>NOVATION, ANCHOR</b> | CALL |
|-------------------------|------|

### PRINTERS

#### EPSON

|      |      |        |      |
|------|------|--------|------|
| FX80 | CALL | FX100  | CALL |
| RX80 | CALL | LQ1500 | CALL |

#### brother

|            |       |       |       |
|------------|-------|-------|-------|
| HR-15 Par. | \$399 | Ser.  | \$399 |
| HR-25      | \$649 | HR-35 | CALL  |

#### DYNAX

|            |       |      |       |
|------------|-------|------|-------|
| DX-15 Par. | \$399 | Ser. | \$399 |
|------------|-------|------|-------|

#### C-ITOH

|                  |        |
|------------------|--------|
| PROWRITER        | CALL   |
| STARWRITER F-10P | \$1095 |

#### STAR MICRONICS

|            |       |       |       |
|------------|-------|-------|-------|
| Gemini 10X | \$269 | 15X   | \$389 |
| Radix      | CALL  | Delta | CALL  |

#### OKIDATA

|     |        |     |        |
|-----|--------|-----|--------|
| 84P | CALL   | 84S | CALL   |
| 92P | BEST   | 92S | BEST   |
| 93P | PRICES | 93S | PRICES |

#### NEC

|      |        |      |        |
|------|--------|------|--------|
| 3510 | \$1375 | 7730 | \$1895 |
| 3530 | \$1375 | 2030 | \$749  |
| 3550 | \$1495 | 2050 | \$795  |

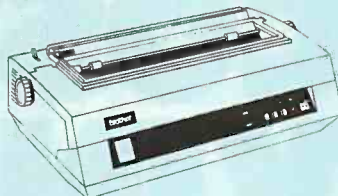
#### TOSHIBA

|       |        |       |       |
|-------|--------|-------|-------|
| P1351 | \$1399 | P1340 | \$839 |
|-------|--------|-------|-------|

#### DAISYWRITER

|                   |       |
|-------------------|-------|
| 2000 w/48K Buffer | \$995 |
|-------------------|-------|

|                     |      |
|---------------------|------|
| <b>DATAPRODUCTS</b> | CALL |
|---------------------|------|



**ANY PRODUCT NOT  
LISTED? CALL**

### COMPUTERS



|               |      |
|---------------|------|
| <b>SANYO</b>  | CALL |
| <b>COMPAQ</b> | CALL |

### MONITORS

#### AMDEK

|            |       |      |       |
|------------|-------|------|-------|
| Video 300G | \$135 | 300A | \$145 |
| Video 310A |       |      | \$179 |

#### PGS

|                         |        |
|-------------------------|--------|
| HX12 Hi Res RGB monitor | BEST   |
| MAX-12 Hi Res Mono      | PRICES |
| SR-12 Super Hi Res RGB  |        |



### SOFTWARE

|                      |       |
|----------------------|-------|
| Volkswriter Delux    | \$169 |
| R:Base 4000          | \$279 |
| Clout                | \$119 |
| Extended Rep. Writer | \$99  |
| PFS: File            | \$89  |
| PFS: Graph           | \$89  |
| PFS: Write           | \$89  |
| PFS: Proof           | \$69  |
| PFS: Report          | \$79  |
| Multimate            | \$289 |
| WordPerfect          | \$269 |

#### MICROSOFT

|         |       |            |       |
|---------|-------|------------|-------|
| Word    | \$239 | with mouse | \$299 |
| Project | \$159 | Chart      | \$159 |

|              |      |
|--------------|------|
| <b>LOTUS</b> | CALL |
|--------------|------|

|            |      |           |      |
|------------|------|-----------|------|
| d:Base III | CALL | Framework | CALL |
|------------|------|-----------|------|

|                             |      |
|-----------------------------|------|
| <b>STAR</b> — Acct. Partner | CALL |
|-----------------------------|------|

|                   |       |
|-------------------|-------|
| WordStar Pro. Pak | CALL  |
| Harvard Proj Mgr  | \$269 |
| Electric Desk     | \$229 |

## CANADIAN COMPUTER HUT AUTHORIZED DEALER

### MICROCONTEXT INC.

5253 Ave Du Parc  
Montreal Que H2V4P2.

**(514) 279-5114**

Published Prices are for U.S.A. Only  
Please call for Canadian Prices

## EAST COAST

### COMPUTER HUT OF NEW ENGLAND INC.

101 Elm St. Nashua, NH 03060

**(603) 889-0666**

For Orders Only — (800) 525 5012



## MID-WEST

### COMPUTER HUT INC.

524 S. Hunter  
Wichita, Kansas 67207

**(316) 681-2111**

For Orders Only — (800) 572 3333

All products usually in stock for immediate shipment and carry full manufacturers' warranty. Price subject to change — this ad prepared two months in advance. You get the lowest price. We honor personal checks — allow 10 days to clear. COD up to \$300 add 2%. Visa, MasterCard add 2%. For shipping & insurance add 2% or \$5.00 min. for small items and \$10 min for monitors, printers, etc. We accept company checks and P.O.'s from Fortune 1000 Companies.

IBM is a trademark of IBM Corp.

Return authorization and order status call information line

Circle 78 on inquiry card.

124

is "identical in concept to Toolkit/32"; however, details of this were not available when this was written.)

Clascal shows great promise for extending programmer productivity when used in large projects. One question comes to mind, though: Is the software it creates fast enough? Bruce Blumberg of Apple Computer said that Clascal is "about 10 times faster than Smalltalk and only 10 percent slower than Pascal." Given that the original Lisa applications were written in Pascal and that the recently released enhanced packages added some machine-language code to speed them up, the above statement is of little comfort. We'd all better wait until the first Toolkit/32-based application programs can be examined before forming a final opinion on Clascal.

I must add to this enthusiastic description of Toolkit/32 the fact that,

although it saves the programmer tremendous amounts of time, the Clascal class orientation does take some getting used to. Although a novice Clascal programmer takes about a month, according to Apple, to begin to understand Clascal well enough to take advantage of it, it still saves time in the long run to develop Toolkit/32-based application programs.

To conclude, I must make two sets of observations. First, the software framework orientation represents a subtle but important change in how we look at developing an application program—in changing the programmer's task from writing a program to writing subroutines, it clearly delineates the program's generic behavior from the nongeneric and allows the programmer to concentrate on the latter. Second, Toolkit/32 implements the software framework in an interesting and powerful way. Clas-

cal encourages the programmer to factor out common characteristics, which are embodied in high-level classes from which much code is derived. Apple has already done this with the Toolkit/32's Standard Application code, thus allowing the programmer to write code that inherits a lot of structure and power from the previously defined ancestor classes. In any case, software frameworks may be one answer to the problem of creating sophisticated programs quickly and inexpensively. ■

*[Editor's note: As this article was going to press, Larry Tesler of Apple told us that the Toolkit/32 product was being made available to any Lisa owner (for details, write to the Software Resource Center, Mail Stop 2-P, Apple Computer, 20525 Mariani Ave., Cupertino, CA 95014). In addition, Apple is considering creating a similar product for use by Macintosh software developers.]*

# SHARE THE COST OF LIVING.

**GIVE TO THE AMERICAN CANCER SOCIETY.** 

THIS SPACE CONTRIBUTED AS A PUBLIC SERVICE.

# FX-80 WORDSTAR SUPERSCRIPTS

BY MICHAEL H. GOLDBAUM

SCIENTIFIC ARTICLES and other documents often require the use of superscripts or subscripts. The popular WordStar program, when used with the Epson FX-80 dot-matrix printer, ordinarily cannot use the superscript and subscript print modes (see reference 1), though it is possible to patch WordStar to generate these modes in the PC-DOS operating system (see reference 2).

There is, however, a simple method to produce superscript and subscript printing on the FX-80 without patching the WordStar program. Further, in this method, the WordStar commands work in standard fashion, and the printed characters are displaced upward or downward as they would be with a daisy-wheel or thimble printer.

Under ordinary circumstances of printing with the FX-80, the WordStar commands  $\wedge T$  (for superscript) or  $\wedge V$  (for subscript) do not function prop-

erly. That is, if the line containing the toggles is "boxed in" with other lines immediately above and below (as in a single-spaced block of text), the superscripting and subscripting will not occur. On the other hand, if there is no line above or below the line containing these commands, superscripts

are displaced upward a full line, and subscripts are displaced downward a full line. Neither of these modes of behavior is particularly satisfactory. But you can use the characteristics of the latter to trick the Epson printer into producing single-spaced text while

(continued)

Table 1: WordStar dot-command alterations. The left margin ( $\wedge OL$ ), right margin ( $\wedge OR$ ), and page offset (.PO) need not change.

|  | Dot Command          | Default Setting | New Setting                          |
|--|----------------------|-----------------|--------------------------------------|
|  | .PL Paper length     | 66 lines        | 198 (66 x 3)                         |
|  | .MT Margin at top    | 3 lines         | 0 (printing starts 1 inch below top) |
|  | .MB Margin at bottom | 8 lines         | 33 ((8 + 3) x 3)                     |
|  | .FM Footing margin   | 2 lines         | 6 (2 x 3).                           |

Table 2: If you use headings, you should make room for the heading line by altering the dot command as shown below.

|  | Dot Command          | Default Setting | New Setting      |
|--|----------------------|-----------------|------------------|
|  | .PL Paper length     | 66 lines        | 198              |
|  | .MT Margin at top    | 3 lines         | 6 ((3 - 1) x 3)  |
|  | .MB Margin at bottom | 8 lines         | 27 ((8 + 1) x 3) |
|  | .HM Heading margin   | 2 lines         | 6 (2 x 3)        |
|  | .FM Footing margin   | 2 lines         | 6 (2 x 3).       |

.....  
Michael H. Goldbaum, M.D. (225 Dickinson St., H898, San Diego, CA 92103), is associate professor of ophthalmology at the University of California and Veterans Administration Medical Center.

**TOUGH LOCAL NETWORK PROBLEM:**

"How can our department get our six computers and three printers to work together efficiently? We also want to be able to access outside data services and our future company LAN."

**SIMPLE NETWORK SOLUTION: NetCommander**

NetCommander is a smart, small Local Area Network manager. It lets you link from four to 40 computers and peripherals — in any mix of models and makes. A 50K buffer (expandable to 250K) makes sure that productivity is high — keeping fewer printers humming — while computer and PC users do their thing, without waiting for a printer, modem, or shared disk. Those devices can be specified with names defined by users — and allocated on the basis of availability and capability. And NetCommander handles multiple protocols and different baud rates simultaneously — without modifications to hardware or software. It will also tie into your company's LAN. The latest in a family of products in use since 1979, NetCommander is a smart, small, efficient network manager.

For more information, call or write:

**NetCommander**

Digital Products Inc. • The Simple Network Solution Company  
600 Pleasant Street • Watertown, MA • 02172  
(617) 924-1680 • Outside Mass., call 1-800-243-2333  
And check out our 30-day trial evaluation.

**APPLICATION NOTE**

it perceives the text as being triple-spaced. The superscript and subscript commands will displace the enclosed characters one-third line space up or down, respectively. You accomplish this by setting the WordStar program to triple space and setting the Epson printer to one-third line space.

**WORDSTAR SETTINGS**

For ease of entry and editing, you can type in your text in the normal format. When you've completed the document, set the line spacing at  $\sim$ OS3 and reformat each paragraph with the command  $\sim$ B. You will need to add two line spaces ( $\sim$ N) between paragraphs to maintain triple space between paragraphs. Also, the default settings of the dot commands for paper length and margins will not produce the proper page format, so you must place dot commands at the beginning of the document to triple the default values and to compensate for the Epson FX-80 starting one inch from the top of the page (table 1).

**EPSON FX-80 SETTINGS**

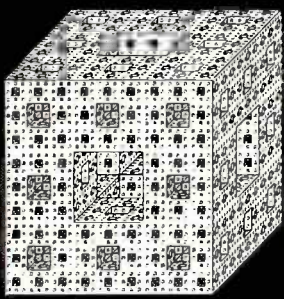
The line spacing for the FX-80 is set by means of an ESC A sequence in BASIC and is expressed in multiples of  $\frac{1}{2}$  inch. The default line spacing is 6 lines per inch. Each line is thus  $\frac{1}{6}$  inch, to an actual setting of  $\frac{1}{2}$ . We want the new line spacing to be  $\frac{1}{2}$  the normal, or 18 lines per inch, for a new setting of  $\frac{1}{2}$ . So, prior to printing, reset the spacing with the following BASIC sequence (ESC A line space setting for  $\frac{1}{2}$  where  $n=4$ ):

```
10 LPRINT CHR$(27);"A";CHR$(4);
```

This combination of triple-spaced text formatting and 18-lines-per-inch printing produces output of 6 lines per inch (single space) with superscript and subscript appropriately displaced. ■

**REFERENCES**

1. Stevenson, Charles. "Does Your Printer Work with WordStar?" *BYTE*, September 1983, page 411.
2. Wallace, Neil G. "Full Use of the Epson MX-80 Under WordStar." *BYTE*, May 1983, page 203.

**WALTZ LISP** (TM)

The one and only **adult** Lisp system for CP/M users.

Waltz Lisp is a very powerful and complete implementation of the Lisp programming language. It includes features previously available only in large Lisp systems. In fact, Waltz is substantially compatible with *Franz* (the Lisp running under *Unix*), and is similar to *MacLisp*. Waltz is perfect for Artificial Intelligence programming. It is also most suitable for general applications.

**Much** faster than other microcomputer Lisps. • Long integers (up to 611 digits). Selectable radix • True dynamic character strings. Full string operations including fast matching/extraction. • Flexibly implemented random file access. • Binary files. • Standard CP/M devices. • Access to disk directories. • Functions of type lambda (expr), nlambda (fexpr), lexpr, macro. • Splicing and non-splicing character macros. • User control over all aspects of the interpreter. • Built-in prettyprinting and formatting facilities. • Complete set of error handling and debugging functions including user programmable processing of undefined function references. • Virtual function definitions. • Optional automatic loading of initialization file. • Powerful CP/M command line parsing. • Fast sorting/merging using user defined comparison predicates. • Full suite of mopping functions, iterators, etc. • Assembly language interface. • Over 250 functions in total. • The best documentation ever produced for a micro Lisp (300+ full size pages, hundreds of illustrative examples).

Waltz Lisp requires CP/M 2.2, Z80 and 48K RAM (more recommended). All common 5" and 8" disk formats available.

**PRO CODE** (TM)  
INTERNATIONAL

15930 SW Colony Pl.  
Portland, OR 97224

Unix® Bell Laboratories.  
CP/M® Digital Research Corp.

**Version 4.4**

(Now includes Tiny Prolog  
written in Waltz Lisp.)

**\$169\***

\*Manual only: \$30 (refundable with order). All foreign orders: add \$5 for surface mail, \$20 for airmail. COD add \$3. Apple CP/M and hard sector formats add \$15.

Call free **1-800-LIP-4000** Dept. #12  
In Oregon and outside USA call 1-503-684-3000

QUARK ANNOUNCES  
a clever way to store more than sixty-five floppies.

QC10™



A 10MB hard disk  
for the Apple IIc, Apple IIe,  
Apple III and Macintosh.

Quark's new QC10 hard disk lets you store the contents of more than sixty-five floppies. Even if you're using an Apple IIc. Which means you can have the equivalent of nearly five thousand pages of information ready for instant retrieval.

You'll have room for dozens of programs. From complex accounting software to sales analysis tools. With space left over for your answer to *War and Peace*.

And because there's a distinction between those who need to know and those who want to know, QC10 lets you create password-protected "volumes" of any size you choose. So you can segment your data to suit your particular needs, and protect sensitive information.

Plus, if you have an Apple IIc or Macintosh—or a 128K Apple IIe with Apple's Duodisk dual disk drive—QC10 *requires no accessories*.\* The drive simply plugs into the disk drive port. Two special switches let you set your QC10 for whatever computer you use.

And when you add Quark's Catalyst™ program selector, you can automatically load even copy-protected ProDOS

programs on QC10.\*\* And switch between applications with a simple keystroke sequence. So you won't have to change floppies when you need to change programs.

Best of all, QC10 has a suggested retail price of only \$1,995. So ask for a demonstration today. Just call toll-free, 1 (800) 543-7711, for the name of the Quark dealer nearest you.

**Quark**™  
PERIPHERALS

A Quark Company

QC10 is a trademark of Quark Peripherals, Inc. Quark and Catalyst are trademarks of Quark Incorporated. Apple, ProDOS and Duodisk are registered trademarks of Apple Computer, Inc. Macintosh is a trademark licensed to Apple Computer by McIntosh Laboratories, Inc.

\*If you do not have a Duodisk, or use an Apple III, a special cable is available. See your dealer for details.

\*\*Catalyst works on the Apple IIc, IIe and Apple III. It is not compatible with Macintosh.

Photography by Barbara Kasten

Circle 321 on inquiry card.



"THE SYSTEMS I BUY TODAY  
HAVE TO BE AROUND TOMORROW  
OR I WON'T BE."



# SEE LANIER.

The Business System™ 5000. It's versatile. Expandable. A network that links workstations and keeps information flowing quickly. Smoothly. And it's backed by customer training and service

second to none. High technology? Absolutely. Lanier is now part of Harris Corporation, a world leader in Information Technology.

For a demonstration, call us at 800-241-1706.\* Or send the coupon. Today.

**FOR YOUR INFORMATION,  
WE'RE NOW PART OF HARRIS.**

\*In Georgia call 404-321-1244 collect.

Lanier, A Harris Company—Electronic Office Systems Division  
SEE LANIER. For the Business System™ 5000 network. For a demonstration, circle # 221

Electronic Office Systems Division  
1700 Chantilly Drive, N.E.  
Atlanta, GA 30324

**LANIER**  
A Harris Company

Name \_\_\_\_\_

Firm \_\_\_\_\_ Title \_\_\_\_\_

Address \_\_\_\_\_

County \_\_\_\_\_ Phone \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

 **HARRIS**

Nov. '84, Byte 4 75 HKI

# B·O·O·K·S R·E·C·E·I·V·E·D

ADVANCED DBASE II USER'S GUIDE, Adam B. Green. Englewood Cliffs, NJ: Prentice-Hall, 1984; 260 pages, 21.5 by 27.8 cm, softcover, ISBN 0-13-011271-2, \$29.

THE AI BUSINESS, Patrick H. Winston and Karen A. Prendergast, eds. Cambridge, MA: The MIT Press, 1984; 336 pages, 15.8 by 23.5 cm, hardcover, ISBN 0-262-23117-4, \$15.95.

THE APPLE IIc BOOK, Bill O'Brien. New York: Bantam Books, 1984; 288 pages, 15.3 by 22.8 cm, softcover, ISBN 0-553-34149-9, \$12.95.

APPLE IIc USER GUIDE, Gary Phillips and Donald Scellato. Bowie, MD: Brady Communications Co., 1984; 384 pages, 17.8 by 23.5 cm, softcover, ISBN 0-89303-307-3, \$14.95.

APPROACHES TO PROTOTYPING, R. Budde, K. Kuhlenkamp, L. Mathiassen, and H. Züllighoven, eds. New York: Springer-Verlag, 1984; 470 pages, 16.8 by 24.3 cm, softcover, ISBN 0-387-13490-5, \$23.

THE ART OF COMPUTER CONVERSATION, Brian R. Gaines and Mildred L. G. Shaw. Englewood Cliffs, NJ: Prentice-Hall, 1984; 224 pages, 17.5 by 23.3 cm, softcover, ISBN 0-13-047332-4, \$16.95.

BABBAGE'S CALCULATING ENGINES, Volume 2 in the Charles Babbage Institute Reprint Series for the History of Computing, Henry Prevost Babbage. Los Angeles and San Francisco, CA: Tomáš Publishers, 1982; 402 pages, 22.3 by 28.5 cm, hardcover, ISBN 0-938228-04-8, \$45.

BASIC PROGRAMMING FOR THE VAX AND PDP-II, George Diehr, Terry Barron, and Thomas Munro. New York: John Wiley & Sons, 1984; 494 pages, 21.3 by 27.8 cm, softcover, ISBN 0-471-86817-5, \$19.95.

BEGINNING MICRO-PROLOG, 2nd revised ed., Richard Ennals. New York: Harper & Row, 1984; 208 pages, 18.5 by 23.5 cm, softcover, ISBN 0-06-669000-5, \$15.95.

THE BEST OF COMMODORE 64 SOFTWARE, Thomas Blackadar. Berkeley, CA: Sybex, 1984; 192 pages, 15 by 22.8 cm, softcover, ISBN 0-89588-194-2, \$12.95.

THE BEST OF CP/M SOFTWARE, John D. Halamka. Berkeley, CA: Sybex, 1984; 272 pages, 17.5 by 22.8 cm, softcover, ISBN 0-89588-100-4, \$14.95.

THE BEST OF IBM PC SOFTWARE, Stanley R. Trost. Berkeley, CA: Sybex, 1984; 382 pages, 17.8 by 22.8 cm, softcover, ISBN 0-89588-104-7, \$16.95.

BETTER RÉSUMÉS FOR COMPUTER PERSONNEL, Adele Lewis and Berl Hartman. Woodbury, NY: Barron's, 1984; 224 pages, 19.8 by 27.8 cm, softcover, ISBN 0-8120-2860-0, \$6.95.

BRAIN TICKLERS, Apple II/IIe ed., Mark A. Spikell and Stephen L. Snover. Englewood Cliffs, NJ: Prentice-Hall, 1983; 192 pages, 17.3 by 23.3 cm, 3-ring binder, ISBN 0-13-081026-6, \$39.95. (Includes *Mathematical Problem-Solving with the Microcomputer* and floppy disk for both books.)

BUSINESS GRAPHICS FOR THE IBM PC, Nelson Ford. Berkeley, CA: Sybex, 1984; 288 pages, 17.8 by 22.8 cm, softcover, ISBN 0-89588-124-1, \$18.95.

THE COMING COMPUTER INDUSTRY SHAKEOUT, Stephen T. McClellan. New York: John Wiley & Sons, 1984; 368 pages, 16.8 by 24.3 cm, hardcover, ISBN 0-471-88063-9, \$19.95.

THE COMMODORE 64 MUSIC MASTER, James Vogel and Nevin B. Scrimshaw. Cambridge, MA: Birkhäuser Boston, 1983; 144 pages, 15.3 by 23.5 cm, softcover, ISBN 0-8176-3179-8, \$29.95. (Includes cassette.)

COMPAQ USER'S HANDBOOK, Staff of Weber Systems Inc. Cleveland, OH: Weber Systems, 1984; 352 pages, 15 by 22.8 cm, softcover, ISBN 0-938862-11-1, \$15.95.

THE COMPLETE APPLE CP/M, Steven Frankel. Reston, VA: Reston Publishing, 1984; 256 pages, 17.3 by 23.3 cm, softcover, ISBN 0-8339-0800-3, \$15.95.

THE COMPLETE SOFTWARE MARKETPLACE, Roger Hoffman. New York: Warner Books, 1984; 256 pages, 20.5 by 23.3 cm, softcover, ISBN 0-446-38024-5, \$17.95.

THE COMPUTER DATA AND DATABASE SOURCE BOOK, Matthew Lesko. New York: Avon Books, 1984; 944 pages, 15 by 22.5 cm, softcover, ISBN 0-380-86942-X, \$14.95.

COMPUTER OLYMPICS, Stephen Manes and Paul Somerson. New York: Scholastic, 1984; 174 pages, 20.3 by 27.8 cm, softcover, ISBN 0-590-33176-0, \$4.95.

COMPUTER OPTIMIZATION TECHNIQUES, revised ed., William C. Conley. Princeton, NJ: Petrocelli Books, 1984; 256 pages, 16.3 by 24 cm, hardcover, ISBN 0-89433-213-9, \$29.95.

COMPUTERS—NEW OPPORTUNITIES FOR THE DISABLED, Harold Remmes. New York: Pilot Books, 1984; 32 pages, 14 by 21.5 cm,

softcover, ISBN 0-87576-114-3, \$3.50.

COORDINATED COMPUTING, Robert E. Filman and Daniel P. Friedman. New York: McGraw-Hill, 1984; 276 pages, 17 by 24 cm, hardcover, ISBN 0-07-022439-0, \$32.95.

CREATIVE BUSINESS APPLICATIONS WITH DBASE II, Nelson T. Dinerstein. Glenview, IL: Scott, Foresman and Co., 1984; 158 pages, 19 by 23.5 cm, softcover, ISBN 0-673-15957-4, \$15.95.

A CRITIC'S GUIDE TO SOFTWARE FOR IBM PC AND PC-COMPATIBLE COMPUTERS, 1984 Update, Phillip I. Good. Radnor, PA: Chilton Book Co., 1984; 310 pages, 18.3 by 22.8 cm, softcover, ISBN 0-8019-7538-7, \$14.95.

DIGITAL SIGNAL PROCESSING SOFTWARE, L. Robert Morris. Ottawa, Canada: Digital Signal Processing Software Inc., 1984; 500 pages, 22 by 28 cm, spiral-bound, ISBN 0-9691375-0-8, \$249. (Includes floppy disk.)

EASY PROGRAMMING WITH THE TI-99/4A, Richard Guenette and James Vogel. Cambridge, MA: Softext, 1984; 208 pages, 16 by 23.3 cm, softcover, ISBN 0-8176-3175-5, \$24.95. (Includes cassette.)

EASYWRITER II SYSTEM MADE EASIER, Leo J. Scanlon. Englewood Cliffs, NJ: Prentice-Hall, 1984; 144 pages, 18.3 by 24 cm, hardcover, ISBN 0-13-223587-0, \$12.95.

FEEDBACK SHIFT REGISTERS, Christian Ronse. Lecture Notes in Computer Science #169. New York: Springer-Verlag, 1984; 146 pages, 16.5 by 24.3 cm, softcover, ISBN 0-387-13330-5, \$9.

FIRE IN THE VALLEY: THE MAKING OF THE PERSONAL COMPUTER, Paul Freiberger and Michael Swaine. Berkeley, CA: Osborne/

.....  
*THIS IS A LIST of books recently received at BYTE Publications. The list is not meant to be exhaustive, its purpose is to acquaint BYTE readers with recently published titles in computer science and related fields. We regret that we cannot review or comment on all the books we receive; instead, this list is meant to be a monthly acknowledgment of these books and the publishers who sent them.*

(continued)



Dear Smith-Corona,

Imagine sending an important letter printed on a dot matrix printer.

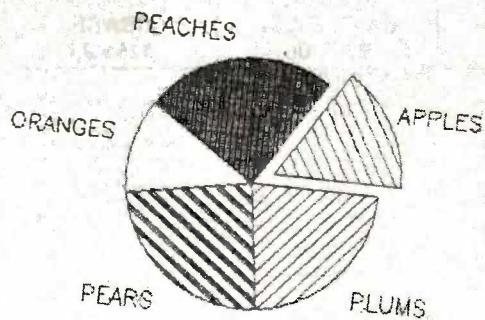
"Impossible," I would have said before. "Impeccable," I say, now that I've bought your new dot matrix.

A dot that has two kinds of printout (graphics and text) for very little shell-out. That's impressive. And so very practical. A "two-in-one" fast dot. One that does everything I used to use two to do.

I was going to call you to congratulate you on your ingenious dot. But then I thought, and decided a letter would be more perfect.

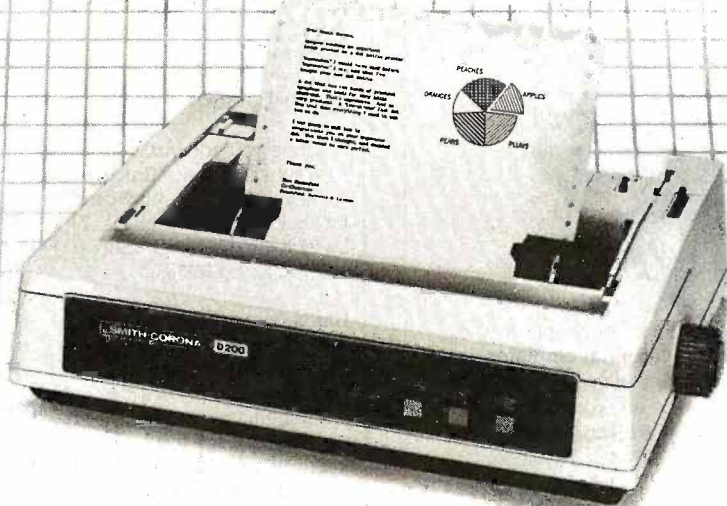
Thank you,

Ron Rosenfeld  
Co-Chairman  
Rosenfeld, Sirowitz & Lawson



# At last, dot plus dash for very little cash.

The dot matrix printer with superb quality correspondence plus high-speed graphics. For under \$800.



Besides all the super high-speed graphics you expect, what else can you do with the Smith-Corona dual-interface D-200 dot matrix printer? You can print at a speed of 120 CPS (that's dash), with 80 characters per line. And you can write with quality. You can even use computer paper or letterhead with a removable tractor feed, which comes as standard equipment.

You can italicize to make a point. Emphasize to point out a good idea. Emphasize and italicize to make a point about a good idea. Enlarge if it's a big idea. Then subscript or superscript to make it all add up.

It's easy to see why so many people think a Smith-Corona printer is the one and only dot.

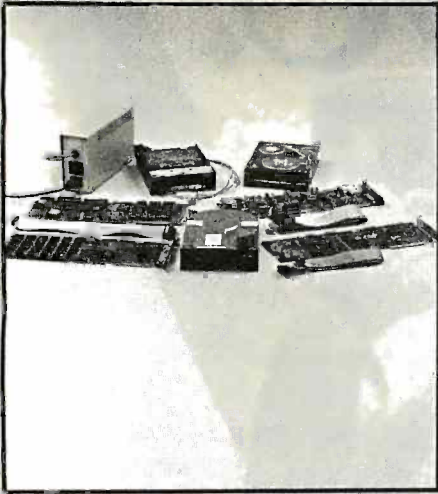




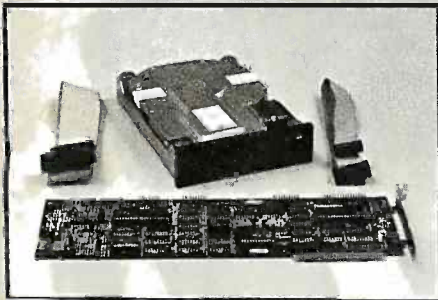
# For IBM PC Add-On Products.. We Set the Standard in Prices!

Superior quality products and services at lowest prices.

Look at what we have to offer, before you buy any add-on products for your PC.

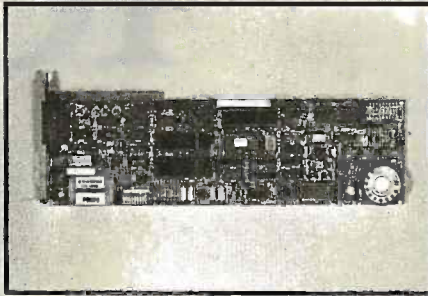


**QIC-01.** 10 MB internal hard disk subsystem at **\$725.00.**



Our half-height 10 MB hard disk comes complete with controller, cables, drive and easy to follow instructions. It fits inside one of your floppy slots and draws same amount of current as a floppy. It is compatible with DOS 2.0, 2.1 and 3.0 without any patches. In fact, you can simply boot up from the hard disk. This is the same disk you see advertised for hundreds of dollars more.

**QIC-03.** 300/1200 baud internal modem. **\$275.00.**



This auto dial/auto answer plug-in modem lets your PC talk to the world with reliable and easy operation. It is FCC certified, Bell 103/212 compatible as well as fully Hayes compatible. You can run all the popular communication programs as well as our superior QIC Com software program.

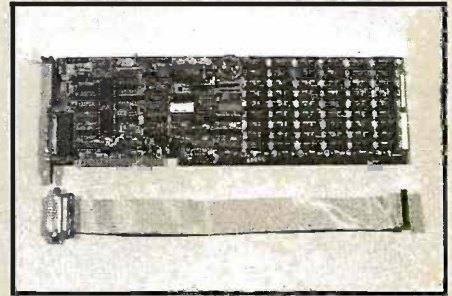
Our QIC-Com software program provides phone list management as well as powerful file transfer capabilities. You can even run any DOS programs such as WordStar concurrently without having to disconnect your line. Priced at \$45.00, it is an offer you don't want to miss.

**QIC-04.** Half-height floppy. **\$129.00.**



This half-height floppy is the quietest drive on the market. It draws the least amount of current and is compatible with your PC's floppy controller card. It's double sided, double density.

**QIC-05.** Five function card. **\$199.00** (64 K RAM Set \$36.00).



Our five function card includes memory expansion from 0 to 384K, one serial port, one parallel port, one game port and one battery back-up clock calendar. RAM disk, print spooler and clock utilities are included too.

**QIC-06.** Color/Mono display card coming soon...

#### One Year Guarantee

No Risk. All our products are guaranteed for one year. And remember, if for any reason, you are not completely satisfied within 30 days, you can return it for a full refund. Check out our competition and find out which is best. We know better.

**CALL US TODAY AT  
408-942-8086**

**QIC RESEARCH**  
INCORPORATED

528 Valley Way  
Milpitas, CA 95035

# TOGETHER, STOPPING YOU.



# THERE'S NO

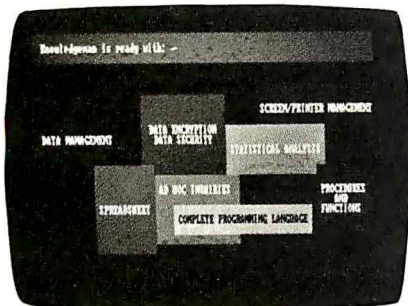
## KnowledgeMan™ and You. The possibilities are endless.

To succeed in business, you need a partner that's fast, flexible, intelligent and easy to work with. A partner that can help turn your big ideas into well-conceived reality. One that gives you the support you need to make critical decisions confidently.

No partner can give you more of what you need than KnowledgeMan, the knowledge management software from MDBS.

## A powerful partner.

KnowledgeMan helps you manage more knowledge, in more ways, than ordinary software. It can help you make better decisions on just about everything from production scheduling to market



forecasting. KnowledgeMan and its optional components offer data management, spreadsheet analysis, statistical analysis, text processing, forms management, business graphics, programming and more.

The key to KnowledgeMan's versatility is its exclusive synergistic integration, allowing you to accomplish your computing needs within one program. Unlike other software, there's no need to exit one function before entering another. The result: different kinds of processing can be intermingled. Quickly and easily.

## A partner that speaks your language.

For all of its power and sophistication, KnowledgeMan is remarkably simple to understand. Even a beginner can start putting KnowledgeMan to work in minutes. With a single query, you can obtain related data from unlimited multiple tables. You can even teach KnowledgeMan to understand your own jargon.

## A partner that helps you along.

The on-line HELP facility allows you to draw on 6800 lines of helpful information organized into 380 screens. If you have a problem or question, KnowledgeMan allows you to access the pertinent HELP screen immediately. Each screen is carefully designed to provide a quick reference guide to KnowledgeMan commands.

## A partner that gives you room to grow.

Ordinary software packages can be frustratingly easy to outgrow. Not KnowledgeMan. Each KnowledgeMan component has more power than you'll probably ever need—far more than conventional integrated programs. With KnowledgeMan, you don't sacrifice capability, capacity or convenience. So with KnowledgeMan, you spend your time solving problems—not trying to overcome software limitations.

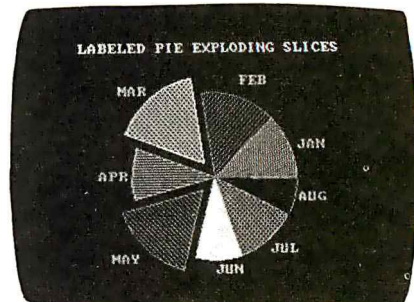
## A partner that protects your interests.

KnowledgeMan offers sophisticated security features. Unauthorized access to data is next to impossible, thanks to password checking, thousands of access code combinations and data encryption.

So your secrets are safe with KnowledgeMan.

## A partner you can build on.

To add yet another dimension to KnowledgeMan's capabilities, you can get fully-integrated options like K-Graph, an extensive business graphics facility that



lets you plot information in a variety of colorful graphs, charts and diagrams. For text processing, the K-Text option lets you incorporate data into written documents quickly and easily. Or, create highly-polished, full-color customized forms with K-Paint, our forms painting option. To short-cut the keyboard, put the K-Mouse option to work.

## A partner you should get to know better.

To see KnowledgeMan in action, visit your dealer. Or contact Micro Data Base Systems, Inc., P.O. Box 248, Lafayette, IN 47902, (317) 463-2581, Telex: 209147 ISE UR.

It may be the beginning of a long, successful partnership.

*Current version is 1.07 as of 9/10/84. KnowledgeMan, K-Graph, K-Paint, K-Text, and K-Mouse are trademarks of Micro Data Base Systems, Inc. MDBS is a registered trademark of Micro Data Base Systems, Inc.*

**KNOWLEDGE  
man**

The Knowledge Management Software from MDBS

# LOWEST PRICE



C.O.D.  
Welcome

# HIGHEST QUALITY

**\*\* 6 MONTH WARRANTY \*\***

- \* Apple II+, IIE Compatible Drive-Belt **109/ea**
- \* Apple II+, IIE Compatible Drive **149/ea**
- \* Apple IIC Compatible Drive **159/ea**
- \* Apple II R. F. Modulator **9.90/ea**
- \* IBM Compatible Drive **129/ea**
- \*\* And lots more **Call**

**\*\* Special Price Available to Dealers—  
Please Call**

**Tel.: (408)-943-1599 or (408)-943-1624**



**DISTAR, INC.**

2290 Ringwood Ave., Unit F  
San Jose, CA 95131

## a message to our subscribers

From time to time we make the BYTE subscriber list available to other companies who wish to send our subscribers material about their products. We take great care to screen these companies, choosing only those who are reputable, and whose products, services, or information we feel would be of interest to you. Direct mail is an efficient medium for presenting the latest personal computer goods and services to our subscribers.

Many BYTE subscribers appreciate this controlled use of our mailing list, and look forward to finding information of interest to them in the mail. Used are our subscribers' names and addresses only (no other information we may have is ever given).

While we believe the distribution of this information is of benefit to our subscribers, we firmly respect the wishes of any subscriber who does not want to receive such promotional literature. Should you wish to restrict the use of your name, simply send your request to the following address.

BYTE Publications Inc.  
Attn: Circulation Department,  
70 Main St., Peterborough, NH 03458

## BOOKS RECEIVED

244 pages, 15.8 by 23.3 cm. softcover, ISBN 0-8176-3178-X. \$29.95. (Includes cassette.)

AN INTRODUCTION TO PROGRAMMING THE ATARI 600/800 XL. R. A. and J. W. Penfold. London, England: Bernard Babani Ltd., 1984; 128 pages, 11 by 17.8 cm. softcover, ISBN 0-85934-118-6. £1.95.

LEGAL CARE FOR YOUR SOFTWARE. International ed., Daniel Remer. Berkeley, CA: Nolo Press, 1984; 292 pages, 21.3 by 27.5 cm. softcover, ISBN 0-917316-85-1. \$24.95.

LISP: A GENTLE INTRODUCTION TO SYMBOLIC COMPUTATION. David S. Touretzky. New York: Harper & Row, 1984; 400 pages, 18.8 by 23.5 cm. softcover, ISBN 0-06-046657-X. \$18.95.

LOTUS 1-2-3 AT WORK. Thomas Cain and Nancy Woodard Cain. Reston, VA: Reston Publishing, 1984; 368 pages, 17.8 by 23.5 cm. softcover, ISBN 0-8359-5227-4. \$16.95.

MACRO II PROGRAMMING. C. C. Zammit. Philadelphia, PA: Heyden & Son, 1984; 132 pages, 18.5 by 24.5 cm. softcover, ISBN 0-85274-769-1. \$19.

MATHEMATICAL PROBLEM-SOLVING WITH THE MICROCOMPUTER. Stephen L. Snover and Mark A. Spikell. Englewood Cliffs, NJ: Prentice-Hall, 1982; 208 pages, 17.3 by 23.3 cm. softcover, ISBN 0-13-561811-8. \$8.95. (Disk included.)

MICRO INTERFACING CIRCUITS. Book I. R. A. Penfold. London, England: Bernard Babani Ltd., 1984; 112 pages, 11 by 17.8 cm. softcover, ISBN 0-85934-105-4. £1.95.

NATURAL LANGUAGE COMMUNICATION. Leonard Bolc, ed. New York: Springer-Verlag, 1984; 340 pages, 17 by 24.5 cm. hardcover, ISBN 0-387-13478-6. \$31.

NUMERICAL ANALYSIS. H. R. Meck. Englewood Cliffs, NJ: Prentice-Hall, 1984; 224 pages, 17.3 by 23.3 cm. softcover, ISBN 0-13-626631-2. \$14.95.

101 QUESTIONS ABOUT DBASE II. Software Application Guide. Julie Ing and Bill Fletcher.

Englewood Cliffs, NJ: Prentice-Hall, 1984; 232 pages, 15 by 23 cm. softcover, ISBN 0-13-634890-4. \$19.95.

ON-LINE SYSTEMS DESIGN AND IMPLEMENTATION (USING COBOL AND COMMAND LEVEL CICS). Charles J. Kacmar. Reston, VA: Reston Publishing, 1984; 416 pages, 18.3 by 24.3 cm. hardcover, ISBN 0-8359-5231-2. \$26.95.

A PARALLEL PIPELINE COMPUTER ARCHITECTURE FOR SPEECH PROCESSING. Vassilios John Georgiou. Ann Arbor, MI: UMI Research Press, 1984; 128 pages, 15.8 by 23.5 cm. hardcover, ISBN 0-8357-1524-8. \$34.95.

PORTER'S PROGRAMS FOR THE COMMODORE 64. Kent Porter. New York: New American Library, 1984; 156 pages, 13.3 by 20.3 cm. softcover, ISBN 0-451-82090-8. \$6.95.

PORTER'S PROGRAMS FOR THE IBM PCjr. Kent Porter. New York: New American Library, 1984; 176 pages, 13.3 by 20.3 cm. softcover, ISBN 0-451-82088-6. \$6.95.

THE POWER OF: STEP BY STEP THROUGH LOGO TURTLE GRAPHICS. Ann Rosé. Englewood Cliffs, NJ: Prentice-Hall, 1983; 48 pages, 21.3 by 27.5 cm. softcover, ISBN 0-13-846635-1. \$6.95.

A PRACTICAL INTRODUCTION TO MICROPROCESSORS. R. A. Penfold. London, England: Bernard Babani Ltd., 1984; 96 pages, 11 by 17.8 cm. softcover, ISBN 0-85934-098-8. £1.95.

THE PREPARATION OF PROGRAMS FOR AN ELECTRONIC DIGITAL COMPUTER. Volume I in the Charles Babbage Institute Reprint Series for the History of Computing. Maurice V. Wilkes, David J. Wheeler, and Stanley Gill. Los Angeles and San Francisco, CA: Tomash Publishers, 1982; 216 pages, 16 by 23.5 cm. hardcover, ISBN 0-938228-03-X. \$30.

PRESENTATION GRAPHICS ON THE APPLE MACINTOSH. Steve Lambert. Bellevue, WA: Microsoft, 1984; 286 pages, 18.5 by

(continued)

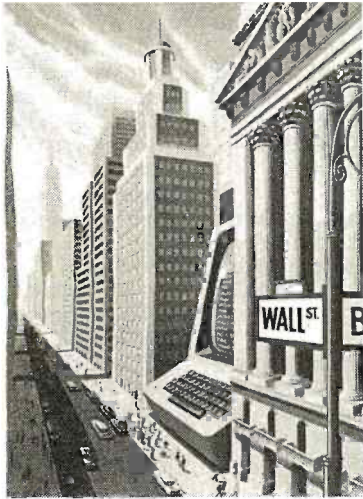
# Announcing 4 New Collector Edition

# BYTE COVERS

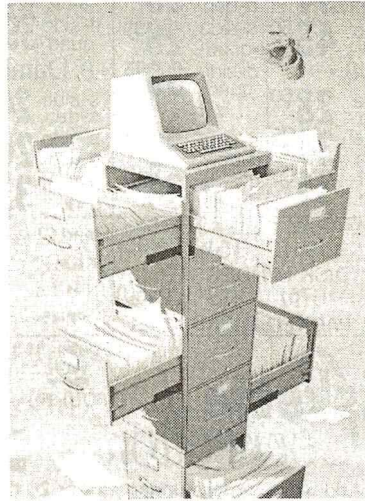
The 4 Byte covers shown below are the newest additions to the Collector Edition Byte Cover series. Each full color print is 11" x 14", including a 1 1/2" border, and is part of an edition strictly limited to 500 prints. Each print is a faithful reproduction of the original Byte painting, printed on museum quality acid free paper, and is personally inspected, signed and numbered by the artist, Robert Tinney. A Certificate of Authenticity accompanies each print.

Collector Edition Prints are carefully packaged flat to avoid bending, and are shipped first class within one week of receipt of order. The price of each print is \$30. All 4 prints are available as a set (Set 21-24) for only \$100.

Other Collector Edition Byte Covers are also available from Robert Tinney Graphics. For a color brochure, or to order one or more of the prints shown, please check the appropriate box in the coupon below.



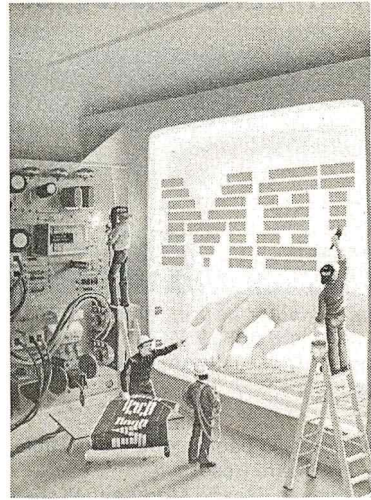
#21 The Wall Street Terminal \$30



#22 "Opening Files..." \$30



#23 The Stacks \$30



#24 Inside IBM \$30

Please send me the following Prints (\$30), or Sets (\$100).

| QTY.                                        | TITLE & PRINT NO. | AMOUNT          |
|---------------------------------------------|-------------------|-----------------|
| _____                                       | _____             | \$ _____        |
| _____                                       | _____             | \$ _____        |
| _____                                       | _____             | \$ _____        |
| postage & handling \$3.00 (Overseas \$8.00) |                   | \$ _____        |
| <b>TOTAL</b>                                |                   | <b>\$ _____</b> |

Please send me your color brochure.

I have enclosed check or money order.

Visa  MasterCard

Card No. \_\_\_\_\_

Exp. Date: \_\_\_\_\_

SHIP MY PRINTS (OR BROCHURE) TO:

Name: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_

State: \_\_\_\_\_ Zip: \_\_\_\_\_

Mail this coupon to:

**robert tinney graphics**  
1864 N. Pamela Drive  
Baton Rouge, LA  
70815

**FOR VISA OR MASTERCARD ORDERS**  
or for more information  
**CALL 1-504-272-7266**  
Daytime or Evenings

# FREE SHIPPING DISKETTES

West Coast "Call"  
1(800) 621-6221

Central & East "Call"  
1(800) 654-4058

Discounts Starting at 3 Box Quantities

|                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>3M</b><br>• 5 1/4"<br>s-side 17 <sup>95</sup><br>d-den. 23 <sup>95</sup><br>d-side 27 <sup>50</sup><br>d-den. 33 <sup>95</sup><br>quad<br>• 8"<br>s-side 21 <sup>50</sup><br>s-den. 26 <sup>00</sup><br>s-side 31 <sup>50</sup><br>d-den. 31 <sup>50</sup> | <b>Dysan</b><br>• 5 1/4"<br>s-side 22 <sup>95</sup><br>d-den. 30 <sup>50</sup><br>d-side 34 <sup>50</sup><br>d-den. 45 <sup>50</sup><br>quad<br>• 8"<br>s-side 28 <sup>50</sup><br>s-den. 30 <sup>95</sup><br>s-side 34 <sup>95</sup><br>d-den. 34 <sup>95</sup> | <b>maxell</b><br>3 1/2" CALL<br>• 5 1/4"<br>s-side 19 <sup>95</sup><br>d-den. 25 <sup>95</sup><br>d-side 28 <sup>95</sup><br>quad 36 <sup>95</sup><br>• 8"<br>s-side 31 <sup>95</sup><br>d-den. 34 <sup>95</sup><br>d-side 34 <sup>95</sup> | <b>Verbatim</b><br>• 5 1/4" Datalife<br>s-side 18 <sup>95</sup><br>d-den. 24 <sup>95</sup><br>d-side 30 <sup>95</sup><br>d-den. 39 <sup>95</sup><br>quad<br>• 8" Datalife<br>s-side 24 <sup>75</sup><br>d-den. 26 <sup>95</sup><br>s-side 31 <sup>95</sup><br>d-den. 31 <sup>95</sup> |
| <b>3M</b><br>DC100A...13 <sup>95</sup><br>DC300A...18 <sup>40</sup><br>DC300XL 20 <sup>25</sup><br>DC600A...24 <sup>45</sup>                                                                                                                                  | <b>AMARAY MEDIA MATE</b><br>(3 1/2"...1195) (5 1/4"...1195)<br><b>DISK MINDERS</b><br>(5 1/4"...1675) (8"...2150)                                                                                                                                                | <b>Head Cleaners</b><br>Kits...520<br><b>Refills...955</b><br><b>Analyzers 2500</b>                                                                                                                                                         |                                                                                                                                                                                                                                                                                       |

Diskettes  
10/Box

the **Diskette Connection**<sup>™</sup>

Dealer Inquiries  
Welcomed

1(800) 654-4058

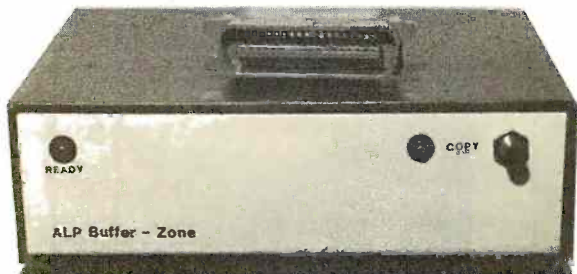


OKLAHOMA  
& NEVADA



UP's Delivery Only, Add 3<sup>95</sup> on orders under 35<sup>95</sup> or 20 disk.

## PRINTER BUFFER FOR LESS THAN \$160



Tying up your computer to print data is a waste of time and resources. Enter the BUFFER ZONE. The ZONE is a printer buffer that works with virtually any PARALLEL/CENTRONICS Printer/Computer.

### FEATURES:

- 64K RAM • Stores 35 pages • Includes cable
- Recopy • Hardware Reset
- Connect in series to expand storage (64K+64K+....)

Best of all, the price won't keep you waiting. \$154.95 complete. It carries a 10-day money-back guarantee if for any reason you want to return it.

To order or for information, circle reader service number or write:

### ALP ELECTRONICS

P.O. Box 4346  
Santa Clara, CA 95054-0346  
(408) 748-1894

Send money order or check (2 weeks to clear) payable to ALP Electronics. Please add \$5.00 for S&H. CA residents please add appropriate sales tax.

## BOOKS RECEIVED

23.5 cm, softcover, ISBN 0-914845-11-X, \$18.95.

22.8 cm, softcover, ISBN 0-915805-00-6, \$9.95.

THE PROGRAMMER'S NOTEBOOK, James Edward Keogh. New York: Simon & Schuster, 1984; 256 pages. 15.3 by 23.3 cm, softcover. ISBN 0-671-47066-3, \$10.95.

THE SOFTWARE WRITER'S MARKETPLACE, Dennis Joyce and John Earl Pickering. Philadelphia, PA: Running Press Book Publishers, 1984; 160 pages, 17 by 25.3 cm, softcover, ISBN 0-89471-262-4, \$9.95.

PROGRAMMING IN BASIC FOR THE IBM PERSONAL COMPUTER, David L. Heiserman. Englewood Cliffs, NJ: Prentice-Hall, 1984; 352 pages, 15.5 by 23.5 cm, hardcover, ISBN 0-13-729450-6, \$24.95.

SOLVING MARKETING PROBLEMS WITH VISICALC, Cochrane Chase, Kenneth L. Barasch, Raymond J. Wolf, David O. Olson, and William Conner. Radnor, PA: Chilton Book Co., 1984; 300 pages, 18.5 by 22.8 cm, softcover, ISBN 0-8019-7423-2, \$14.95.

A PROLOG DATABASE SYSTEM, Deyi Li. New York: John Wiley & Sons, 1984; 224 pages, 15.5 by 23.5 cm, hardcover, ISBN 0-471-90429-5, \$44.95.

THE 3-D ANIMATED APPLE, Phil Cohen. Englewood Cliffs, NJ: Prentice-Hall, 1983; 208 pages, 15.3 by 23 cm, softcover, ISBN 0-13-920224-2, \$18.95.

THE READER'S GUIDE TO MICRO-COMPUTER BOOKS, 2nd ed., Michael Nicita and Ronald Petrusha. Brooklyn, NY: Golden-Lee, 1984; 474 pages, 21 by 27.5 cm, softcover, ISBN 0-912331-04-6, \$14.95.

T1 BASIC, Richard Haskell and Jeffrey Haskell. Englewood Cliffs, NJ: Prentice-Hall, 1984; 176 pages, 21.3 by 27.8 cm, softcover, ISBN 0-13-921107-1, \$14.95.

REAL WORLD UNIX, John D. Halamka. Berkeley, CA: Sybex, 1984; 240 pages, 17.5 by 22.5 cm, softcover, ISBN 0-89588-093-8, \$16.95.

TOP-DOWN ASSEMBLY LANGUAGE PROGRAMMING FOR YOUR VIC-20 AND COMMODORE 64, Ken Skier. New York: McGraw-Hill, 1984; 416 pages, 18.5 by 23.3 cm, softcover, ISBN 0-07-057864-8, \$16.95.

THE ROBOT REVOLUTION, Tom Logsdon. New York: Simon & Schuster, 1984; 208 pages, 13.3 by 21.3 cm, softcover, ISBN 0-671-46705-0, \$9.95.

TURBODOS MADE EASY, Steven Marks. New York: ProComp Systems, 1984; 214 pages, 15.3 by 22.8 cm, softcover, ISBN 001-618-312-0, \$24.95.

THE SCIENCE OF MUSICAL SOUND, John R. Pierce. New York: Scientific American, 1983; 256 pages, 22.3 by 24.3 cm, hardcover, ISBN 0-7167-1508-2, \$25.26.

UNDERSTANDING ADA, Ken Shumate. New York: Harper & Row, 1984; 400 pages, 18.5 by 23.5 cm, softcover, ISBN 0-06-046133-0, \$18.95.

7TH INTERNATIONAL CONFERENCE ON AUTOMATED DEDUCTION, R. E. Shostak, ed. Lecture Notes in Computer Science #170. New York: Springer-Verlag, 1984; 518 pages, 15.5 by 23.3 cm, softcover, ISBN 0-387-96022-8, \$22.50.

UNDERSTANDING APL, Susan M. Bryson. Sherman Oaks, CA: Alfred Publishing Co., 1982; 48 pages, 10.8 by 27.8 cm, softcover, ISBN 0-88284-200-X, \$2.95.

THE SIMON & SCHUSTER GUIDE TO THE TRS-80 MODEL 100, Danny Goodman. New York: Simon & Schuster, 1984; 222 pages, 14 by 21.3 cm, softcover, ISBN 0-671-49254-3, \$9.95.

UNDERSTANDING ARTIFICIAL INTELLIGENCE, Paul Y. Gloess. Sherman Oaks, CA: Alfred Publishing Co., 1981; 48 pages, 10.8 by 27.8 cm, softcover, ISBN 0-88284-150-5, \$2.95.

SIMPLE COMPUTING, Chauncey Ching. Honolulu, HI: Total Concepts, 1984; 108 pages, 15.3 by

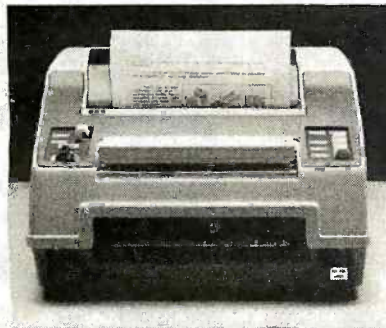
UNDERSTANDING C, Bruce H.

(continued)



# THE AT&T INTERNATIONAL BUSINESS NETWORK: IT COSTS LESS TO SEND YOUR FACTS BY FAX.

SAN FRANCISCO



TOKYO

An exact copy of the original.  
That's fax. And fax is the  
only system that can transmit  
blueprints, legal documents, and

signed contracts almost any-  
where in the world.

This unique ability makes fax  
one of the most exciting electron-  
ic mail technologies available today.

All you need is a telephone  
and a facsimile machine.

And in as little as 25 seconds,  
an exact duplicate arrives at its  
destination.

With fax, faster is cheaper.

And different machines have  
different capabilities, different  
speeds.

With the AT&T Network, you  
can transmit *up to* 400 words on  
a 1-minute call.

Most telex machines transmit  
at a standard 66 words per minute.

Any fax machine can match  
that rate. And most beat it easily.

In fact, you can save as much  
as \$8.00 per page with AT&T's  
lowest rates compared  
with sending the same  
page via telex. With  
some fax machines, you

don't even have to be there.

They can be programmed  
to transmit during Discount and  
Economy periods. Telex has no  
daily reduced rate periods.

Since fax is a copy of the  
original, you don't need a typist.  
No special operators.

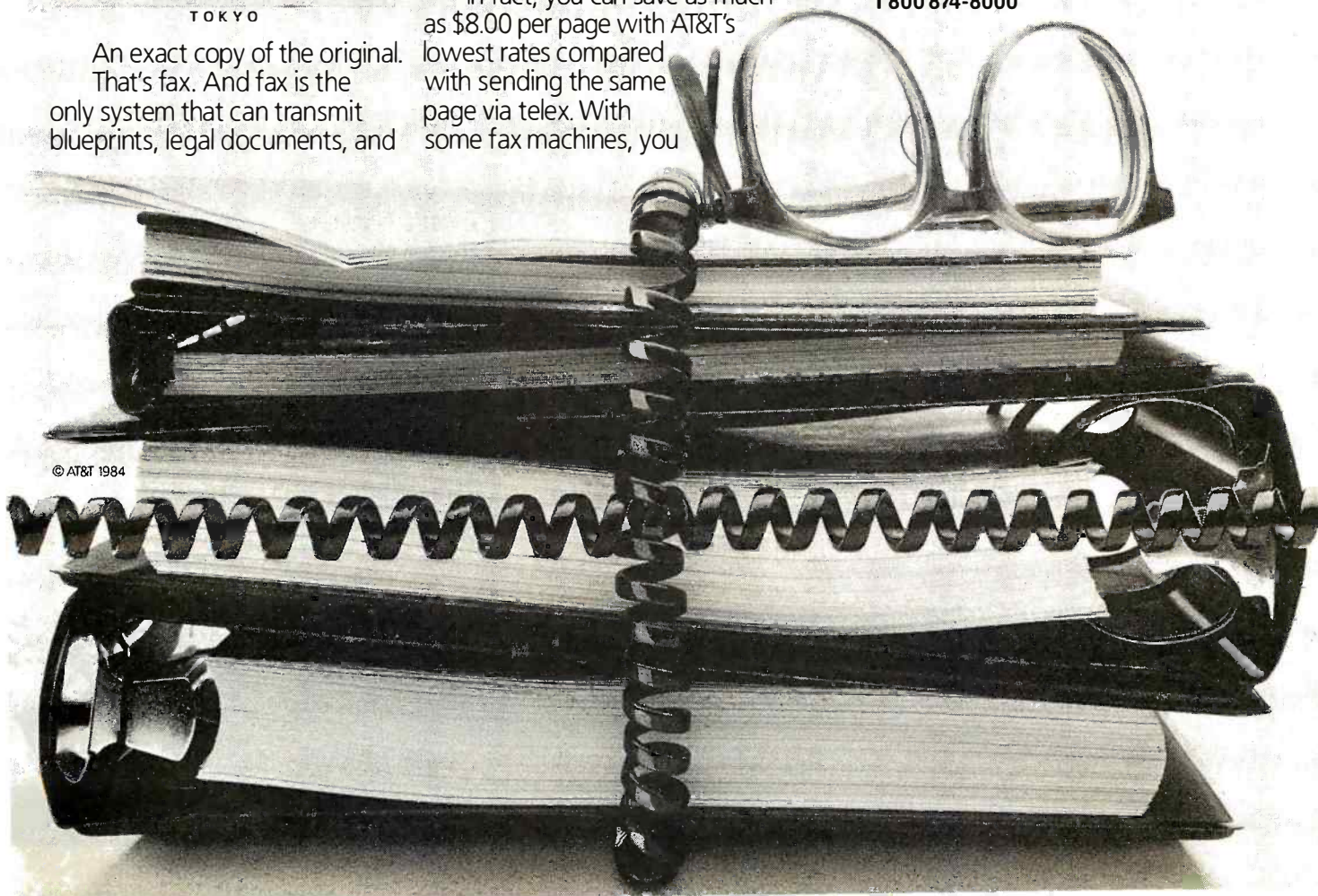
And since there's no retyping,  
no redoing of any kind, fax is free  
of transcription errors.

So if your international  
customer or business associate  
needs a document, a blue-  
print, or a signed contract in a  
hurry, you can fax it on the spot.

Transmitting facts with fax.

Another cost-effective service  
for your business from the AT&T  
International Business Network.  
International service to and from continental U.S.  
FOR A FREE BROCHURE, CALL TOLL FREE:

**1 800 874-8000**



# Call Oryx and order by phone ...without a single hang-up!

## IBM/PC SOFTWARE

**Alpha Software**  
Data Base Mgr II ..... \$179

**Arrays, Inc.**  
Home Acct. + ..... \$ 95  
Home Acct. w/  
Tax Advntg..... \$139

**Central Point**  
Copy II PC..... \$34

**CompuView**  
Vedit ..... \$130  
Vedit + ..... 179  
VPrint ..... 65

**Connecticut Software**  
Printer Boss  
w/ Letter Boss..... \$ 79  
Above w/ Side Kick... 119

**Digital Research**..... Call

**Dow Jones**  
Market Analyzer..... \$229  
Market Manager..... 189  
Spreadsheet Link..... 179

**Ecosoft, Inc.**  
Microstat..... \$259

**Enertronics**  
Energraphics..... \$259  
w/ Plotter Option..... 299

**Fastware Thor** (the  
thought organizer)... \$245

**Financier, Inc.**  
Financier II ..... \$119

**Fox & Geller**  
Grafox ..... \$189  
RGraph (for  
R-base 4000)..... \$175

**FYI**  
Superfile ..... \$149  
FYI 3000..... 287  
Sort Facility ..... 99

**Graphic/Mosaic  
Software**  
Superchartman  
Combo II & IV..... \$350

**Harvard Software**  
Project Manager..... \$249

**Hayes**  
Please..... Call

**Lifetree**  
Volkswriter Deluxe..... \$179

**Living Videotext**  
Think Tank (256K)..... \$139

**MDBS**  
Knowledge Man ..... \$299

**Menlo Corp.**  
In Search (Scan thou-  
sands of documents  
in seconds!) ..... \$299

**Micropro**  
Wordstar ProPak  
(WS, CS, MM, SI)..... \$299  
Wordstar ..... 199  
Professional  
Options Pak ..... \$129  
ProPak Plus (WS,  
CS, MM, SI, TM) ..... \$399  
TeleMerge ..... 109

**Microrim**  
R-base 4000 ..... \$279  
R-base Clout ..... 129  
R-Writer ..... 119  
Prog Interface ..... 259

**Microsoft**  
Project 1.01 ..... \$199  
C Comp ..... 309  
Basic Comp ..... 249  
Word 1.15 ..... 229  
MuMath/MuSimp ..... 199  
(All Microsoft products  
provided in MS DOS.)

**Morgan Computing**  
Prof Basic ..... \$299  
Trace 86 ..... 99

**Multimate** ..... Call

**Northwest Analytical**  
Statpak ..... \$365

**Peter Norton Computing**  
The Norton Utilities ... \$ 55

**Peachtree**  
PeachText 5000 ..... \$249  
Series 8 Account-  
ing Modules ..... \$389

**Samma Corp.**  
Samma Word + ..... \$229  
Samma Word II ..... 369  
Samma Word III ..... 439  
(Word processing pro-  
grammed uniquely for IBM.)

**Satellite Software**  
Word Perfect w/ Sp... \$255

**Software Publishing**  
PFS: File, Graph  
Write..... ea \$ 89  
PFS: Plan..... 99  
PFS: Access (MS DOS) 79  
PFS: Proof (MS DOS). 75

**Sorcim**  
Supercalc III..... \$249

**Star Software Systems**  
Acct'g Partner ..... \$229  
Acct'g Partner II..... 659

**Supersoft**  
C Compiler - 8086 .... \$350

**Wang Software**  
Grammatik ..... \$ 60  
Proofreader ..... 42

**Wamer Software**  
Desk Organizer..... \$219  
...and many more!

## APPLE SOFTWARE

**Apple Alpha Software**  
Apple-IBM  
Connection ..... \$169  
Typefaces ..... 69

**Arrays, Inc.**  
Home Acct. .... \$ 59  
FCM ..... 79

**Ashton-Tate**..... Call

**BPI** ..... Call

**Broderbund**  
Bank Street Writer ... \$ 45  
Bank Street Speller ... 49  
Others ..... Call

**Cdex**  
All Trng Prog's..... ea \$ 49

**Central Point**  
Copy II + ..... \$ 34

**Digital Research** ..... Call

**Dow Jones**  
Market Analyzer..... \$229  
Market Manager..... 189  
Spreadsheet Link..... 179

**Eduware** ..... Call

**Living Videotext**  
Think Tank ..... \$ 99

**Micropro**  
Pro Pak (WS,  
SS, MM, SI) ..... \$349

**Microsoft** ..... Call

**Peachtree**  
Back to Basics ..... \$149  
PeachPak  
Series 40 or 80..... \$239

**Penguin Software** ... Call

**Sierra**  
Frogger ..... \$ 25

**Software Publishing**  
PFS: File, Graph,  
Report..... ea \$ 79

**Spinnaker** ..... Call

**Xerox Education**  
Sticky Bear Series.. ea \$ 35

## CP/M SOFTWARE

All prices below are for  
8" standard.

**ATI**  
All Trng Prog's..... ea \$ 49

**CompuView**  
V-Edit 8080 ..... \$130  
V-Edit CP/M 86 ..... 130

**Digital Research**  
Pascal MT+ w/ SPP ... \$389  
DR Assembler & Tools 149  
CP/M 2.2 ..... 125  
C Basic ..... 115  
PL/I-80 ..... 375  
Personal Basic ..... 120  
CP/M Gold Card ..... Call

Access or  
Display Mgr..... \$299  
C Lang/compiler..... 260

All 8" - 86 Version  
of Above ..... Call

**Infocom**  
Deadline ..... \$ 49  
Starcross ..... 39  
Suspended ..... 39  
Zork, I, II, III ..... ea 39

**Micro Pro**  
WordStar ..... \$250  
InfoStar ..... 265

Pro-Pak (WS,  
MM, SI, SS)..... \$359

All Others ..... Call

**Microsoft** ..... Call

**Microstuf**  
Crosstalk ..... \$109

## dBASE II CORNER

**Anderson-Bell**  
Abstot ..... \$289

**Ashton-Tate**  
dBase II ..... Call  
dBase III ..... Call  
Framework ..... Call  
Friday ..... Call

**Fox & Geller**  
dGraph ..... \$169  
Quick Code..... 169  
dUtil ..... 58

**Human Soft**  
DBPlus ..... \$ 90

**Sensible Designs**  
dProgrammer ..... \$199

**Northwest Analytical**  
Statpak ..... \$365

**Oasis**  
Word Plus ..... \$120  
Punctuation & Style... 99

**Supersoft**  
Disk Doctor ..... \$ 74  
Scratchpad Plus ..... 129

## MACINTOSH CORNER SOFTWARE

**ATI**  
MacCoach ..... \$ 60

**Dow Jones**  
Straighttalk ..... 59

**Human Edge**  
Sales Edge ..... \$195  
Mgmt Edge ..... 195

**Intermatrix**  
MacPhane..... \$159

**Living Videotext**  
Think Tank..... \$119

**Main St. Software**  
Main St. Filer ..... \$225

**Microsoft**  
MacBasic V 1.01 .... \$ 99  
MacChart ..... 85  
MacWord ..... 159  
MacFile ..... 159

**Monogram**  
Dollars & Sense..... \$139

**Software Publishing**  
PFS: File, Report. ea \$ 99

**T/Maker**  
Click Art..... \$ 39

**Telos**  
File Vision..... \$139

**Games**  
Hayden, Infocom  
Penguin, Mirage  
Concepts, Sierra,  
and more..... Call

## HARDWARE

**Davong**  
Disk Drives..... Call

**Kensington Microware**  
Swivel ..... \$ 29  
Surge Suppressor.... 45  
Modem ..... \$399

**Memorex**  
3 1/2" Diskettes..... \$ 49

**Tecmar**  
Disk Drives..... Call

## APPLE/ FRANKLIN BOARDS

**ALS**  
CP/M Card ..... \$269  
Smartem II ..... 119  
Z-Engine ..... 139

**CCS 7711**  
Asynch Serial ..... \$ 99

**East Side**  
Wild Card II ..... \$ 99

**Microsoft**  
16K Ramcard ..... \$ 69  
Softcard ..... 249  
Softcard + ..... 449  
Prem Softcard (IIE) ..... 335

**Microtek**  
Printer I/F ..... \$ 75  
Dumping-16K ..... 169  
Dumping-GX ..... 89

**Mountain**  
A-D/D-A ..... Call  
Music System ..... \$349

**Orange Micro**  
Grappier+ w/ buffer. \$175

**Prometheus**  
Versacard ..... \$159

**Video-7, Inc.**  
V-Color RGB cards.... Call

**Videx**  
Videoterm VT-602 ..... \$249  
Ultraterm ..... 249

## IBM/PC BOARDS

**AST Research**  
Six Pak + 64K  
(exp 384K, S/P, Clk) .. \$279

MegaPlus 64K, (Cl/Cal,  
S Port, 512K cap  
w/ Megapak) ..... \$279

Extra ports available  
for Megapack and  
I/O Plus II (Game,  
P or S) ..... \$ 40

Megapak 256K up-  
grade for Megapack. Call  
I/O Plus II Cl/Cal  
and S Port ..... \$139

**Maynard Electronics**  
Floppy Drive Cntrlr. .... \$139  
w/ Par Port ..... 169  
w/ Ser Port ..... 179  
Sandstar ..... Call

**Orange Micro**  
Mr. Chips ..... Call

**Orchid Technology**  
the "Orchid Blossom"  
(To 384K, Clk w/ alarm,  
S&P ports, ram disk,  
disk caching, upgrade-  
able to PCNet) ..... Call

**Quadram**  
Quadboard 64K, (exp  
384K, Clk/Cal, S&P  
Ports, Software) ..... \$269

Microfazer Stack Printer  
-P/P BK (exp 512K) .... \$139  
-S/P BK (exp 64K) ..... 149  
-S/S BK (exp 64K) ..... 149

Quadlink 64K Memory  
(allows Apple SW to  
run on IBM/PC) ..... \$469  
Other Products ..... Call

**Tecmar Products** ..... Call

**Xedex/Microlog**  
Baby Blue ..... \$325  
Baby Blue II ..... 525

## DISPLAY CARDS

**Amdk**  
MAI Card ..... \$399

**Fredericks/Plan-  
tronics** Colorplus... Call

**Hercules**  
Graphics Board ..... \$349

**MA Systems**  
PC Peacock  
Color Board ..... \$249

**Paradise**  
Display Card  
(clr/monochrome). \$379  
Modular/Display.... 359

**Quadram**  
Quadcolor I ..... \$199  
Quadcolor II ..... 389

**Tecmar**  
Graphic Master ..... \$479

## DISK DRIVES

**CDC 1800** ..... \$209  
**Corona** ..... Call

**Corvus Hd** ..... Call

**Datamac**  
Truster 10H (for  
Macintosh, Ile, PC) ... Call

**Davong Hd** ..... Call

**I-Omega**  
Bernoulli Box 20MB  
(removable) ..... Call

**Maynard HD** ..... Call

## Mountain, Inc.

FileSafe Combo  
Disk/Tape Pack for  
the IBM PC or XT

Model 01-4000-04:  
35MB HD w/27MB  
tape backup

Model 01-4000-06:  
35MB HD w/60MB  
tape backup.

For more info ..... Call

**Tall Grass**

For Wisconsin customers Call

**Tandon TM-100-2** ..... \$199

## PRINTERS

**C. Itoh Electronics, Inc.**

Prowriter  
B510 AP (Par) ..... \$349  
B510 PC-II (Ser)  
(w/ 3K Buffer) ..... \$499

1515P ..... 599

Starwriter  
F10-40P (40cps) ..... \$999  
A10-20S (20cps) ..... 529

**Diablo**  
630 ECS ..... Call

**Juki Industries**  
6100 ..... \$449

**NEC** ..... Call

**Okidata 82-93** ..... Call

**Printek, Inc.**  
920 S/P ..... \$2050

**Star Micronics** ..... Call

**Teletex T1014** ..... \$399

**Transtar**  
T-130 P&S ..... \$659  
T-315 P - Dot Matrix.. 489  
T-120 P&S ..... 475

...and much more.

## MONITORS

**Amdk**  
300A Amber ..... \$149  
310A ..... 199  
300 Clr ..... 299  
500 Clr RGB ..... 449  
600 Clr HR ..... 549  
700 Clr Ultra HR ..... 629  
710 Clr Non Glare .... 649

**NEC**  
JB1201-12" Green ..... \$169  
JB1260-12" Green .... 119  
JC1216 RGB ..... 429

**Panasonic**  
CT160 10" comp ..... Call

**PGS**  
HX12 RGB Clr ..... \$489  
MAX 12 ..... 189  
SR12 (690x480 Res) ... 639  
Doubler Card ..... 175

**Quadram**  
Quadchrome ..... \$489

**Sanyo**  
8112 12" HR Green .... \$195

**Taxan**  
440 ..... \$679

**USI 1200A**  
12" HR Am ..... \$139

**Zenith**  
135 (RGB or comp) .... \$499  
136 ..... 669

## DISKETTES

**3M 5" DS, DD Box** ... \$ 35

**CDC** ..... \$ 32

**Maxell 5" DS,**  
DD MD2 Box ..... \$ 32

**Verbatim**  
5" DS, DD, Box ..... \$ 32

**Ultra Magnetics 5"**  
DS, DD, (box/10) ..... \$ 32

(3 Boxes Diskettes Min.)

## PLOTTERS

**Enter**  
P100 Sweet P ..... \$545  
Sweet P Six Shooter... Call

**Houston Instruments** Call

**Panasonic**  
VP6801P Plotter ..... \$1375

## MODEMS

**Hayes**  
Smartmodem 300 ..... \$195  
Smartmodem 1200 .... 489  
Smartmodem 1200B... 399

**Prometheus**  
Promodem ..... \$399

**Quadram**  
Quadmodem ..... \$529

**US Robotics**  
Auto-Dial 300/1200 ... \$459  
S-100 Modem ..... 349  
Password ..... 525

**Zoom Telephonics**  
Networker w/o SW ... \$109

## MISC.

**Alpha-Delta "MACC"**  
Surge Protector ..... \$ 69

**Computer Accessories**  
Power Director ..... Call

**Electronic  
Protection Devices**  
Lemon / EC I ..... \$ 45  
Lime / EC II ..... 65  
Orange / EC III ..... 105

**Hauptage**  
B7 Chip ..... \$159  
Other Products ..... Call

**Keytronic**  
Keyboard 5150 ..... \$169  
WP KB5151 ..... 175  
WP KB5151 Dvorak ... 175

**Street Electronics** ..... Call

**TG** ..... Call

**Versa Computing**  
VersaWriter ..... \$239

A variety of complete  
PC compatible systems  
are available at Oryx.  
For assistance in  
determining your needs  
use our technical line.\*  
We will be happy to  
provide full support.

## POLICY:

- ▶ Wisconsin residents add 5% for sales tax.
- ▶ Minimum \$4.00 for shipping, handling and insurance for orders to \$200.
- ▶ For orders over \$200, add 2½% for shipping, handling and insurance.
- ▶ For cash prepayment of orders \$200 or more, add ONLY 2% for shipping, handling and insurance.
- ▶ Foreign — either add 15% handling & shipping (Int'l money order) or inquire.
- ▶ Prices are subject to change without notice.
- ▶ All items subject to availability.

## WE WELCOME:

- ▶ Visa, MasterCharge and American Express. (No charge for credit cards.)
- ▶ Corporate, government or educational volume purchases, please ask for special accounts desk for additional discount. (1-715-848-1374)
- ▶ COD (Add \$2.00 per box/parcel. Cash or certified check required.)
- ▶ Checks. (Allow 1-2 weeks for clearing.)

## WORKING HOURS:

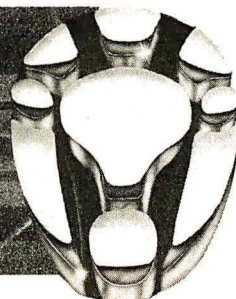
Monday-Friday 8:30-6:00 • Saturday 10:00-2:00 • Central Time  
For technical support, order status and customer service, call (715) 848-1374  
Circle 396 for Hardware inquiries. Circle 397 for Software inquiries.  
Circle 398 for December Specials.

**ORYX SYSTEMS, INC.**  
CRAFTSMEN OF THE NEW TECHNOLOGY

**1 800 826-1589**

WITHIN WISCONSIN **1 800 472-3535**

425 First Street • P.O. Box 1961  
Wausau, Wisconsin 54401  
INT'L TELEX: 260181 ORYX SYS WAU



## BOOKS RECEIVED

Hunter. Berkeley, CA: Sybex, 1984; 350 pages, 17.8 by 22.8 cm, softcover, ISBN 0-89588-123-3, \$17.95.

UNDERSTANDING CP/M. Joseph Reymann. Sherman Oaks, CA: Alfred Publishing Co., 1984; 64 pages, 10.8 by 27.8 cm, softcover, ISBN 0-88284-269-2, \$2.95.

UNDERSTANDING DATABASE MANAGEMENT. Michael J. Freiling. Sherman Oaks, CA: Alfred Publishing Co., 1984; 64 pages, 10.8 by 27.8 cm, softcover, ISBN 0-88284-221-8, \$2.95.

UNDERSTANDING DATA COMMUNICATIONS. Suri Harish. Sherman Oaks, CA: Alfred Publishing Co., 1983; 48 pages, 10.8 by 27.8 cm, softcover, ISBN 0-88284-236-6, \$2.95.

UNDERSTANDING FORTH. Joseph Reymann. Sherman Oaks, CA: Alfred Publishing Co., 1983; 48 pages, 10.8 by 27.8 cm,

softcover, ISBN 0-88284-237-4, \$2.95.

UNDERSTANDING FORTRAN. Herbert R. Ludwig. Sherman Oaks, CA: Alfred Publishing Co., 1981; 64 pages, 10.8 by 27.8 cm, softcover, ISBN 0-88284-148-3, \$2.95.

UNDERSTANDING LISP. Paul Y. Gloess. Sherman Oaks, CA: Alfred Publishing Co., 1982; 64 pages, 10.8 by 27.8 cm, softcover, ISBN 0-88284-219-6, \$2.95.

UNDERSTANDING PASCAL. George Ledin Jr. Sherman Oaks, CA: Alfred Publishing Co., 1981; 64 pages, 10.8 by 27.8 cm, softcover, ISBN 0-88284-149-1, \$2.95.

USING THE EAGLE PC AND 1600 SERIES. Kenniston W. Lord Jr. New York: Van Nostrand Reinhold, 1984; 352 pages, 15 by 22.5 cm, softcover, ISBN 0-442-26035-0, \$16.95.

VAX FORTRAN. Charlotte Middlebrooks. Reston, VA: Reston Publishing, 1984; 528 pages, 17.8 by 23.3 cm, softcover, ISBN 0-8359-8243-2, \$19.95.

VISICALC FOR MARKETING AND SALES. Michael V. Laric and Ronald Stiff. Englewood Cliffs, NJ: Prentice-Hall, 1984; 240 pages, 17.8 by 23.3 cm, softcover, ISBN 0-13-942418-0, \$12.95.

VU-CALC AND VU-FILE (THE ORGANIZER): GETTING SERIOUS WITH YOUR TIMEX/SINCLAIR. Robert B. V. Masters. Bowie, MD: Robert J. Brady Co., 1984; 176 pages, 17.8 by 23.5 cm, softcover, ISBN 0-89303-941-1, \$17.95.

THE WELL-TRAINED COMPUTER. Mynga K. Futrell and Paul Geisert. Englewood Cliffs, NJ: Educational Technology Publications, 1984; 288 pages, 15.8 by 24.3 cm, hardcover, ISBN 0-


87778-190-7, \$23.95.

WHAT IF? A USER'S GUIDE TO SPREADSHEETS ON THE IBM PC. Andrew T. Williams. New York: John Wiley & Sons, 1984; 296 pages, 17 by 25.3 cm, softcover, ISBN 0-471-89218-1, \$16.95.

WHO OWNS THE RAINBOW? CONSERVING THE RADIO SPECTRUM. Hal Glatzer. Indianapolis, IN: Howard W. Sams & Co., 1984; 304 pages, 20 by 23.3 cm, softcover, ISBN 0-672-22034-2, \$15.95.

WORDSTAR SIMPLIFIED FOR THE IBM PERSONAL COMPUTER. Don Cassel. Englewood Cliffs, NJ: Prentice-Hall, 1984; 208 pages, 18.3 by 24 cm, hardcover, ISBN 0-13-963620-X, \$22.95.

WOZ: THE PRODIGAL SON OF SILICON VALLEY. Doug Garr. New York: Avon Books, 1984; 160 pages, 10.5 by 17.5 cm, softcover, ISBN 0-380-88484-4, \$2.75. ■



**AMERICA WORKS BEST**

Teamwork is making a comeback in America. Cooperation on the production line helped America win World War II. We're in another kind of battle today—a fight for economic survival in an increasingly competitive world market. Cooperation in the workplace is helping us meet this challenge too. In plants and offices throughout the country, management is asking employees for their ideas on how to increase productivity and improve the

**WHEN AMERICANS WORK TOGETHER**

work environment. And workers and their unions are responding with a wealth of practical suggestions and a renewed spirit of cooperation. For information about how others are working better by working together, contact:

Cooperative Labor-Management Programs  
U.S. Department of Labor  
Washington, D.C. 20216  
202—523-6098

U.S. Department of Labor

SPECIAL ADVERTISING SECTION OF ENGINEERING PRODUCTS AND SERVICES 9 3/4"

90°

National Edition 1984-1985

**PROFESSIONAL ENGINEERING** DIRECTORY

The national buying guide of engineering products and services

MEMBERSHIP DIRECTORY OF THE NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

ALL NSPE MEMBERS LISTED INDIVIDUALLY

GUIDE TO FIRMS IN PRIVATE PRACTICE AND CONSTRUCTION

INTERNATIONAL SECTION OF PRIVATE PRACTICE AND CONSTRUCTION FIRMS WORLDWIDE

THE OFFICIAL DIRECTORY OF THE NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

BELLSOUTH NATIONAL PUBLISHING

2"

1 1/2"

# Now! Reach 120,000 Specifiers Of Engineering Products And Services With The Most Comprehensive Directory Ever To Come Off The Drawing Board.

**You simply can't afford to miss this opportunity.**

Now, for the first time, your advertising message can reach all 80,000 members of the NSPE in a single publication—the unique, new "Professional Engineering Directory." Every member of NSPE—a group identified by a Gallup poll as a leading force in the profession—will be listed and have a copy for ready reference.

**There's never been a directory like it.**

To provide optimum convenience and usefulness to engineers, the "Professional Engineering Directory" has the unique distinction of being planned and developed by a panel of NSPE engineers in cooperation with BellSouth National Publishing, one of the country's most experienced directory publishers with offices in Atlanta, Chicago, Dallas, Los Angeles, Miami and New York. BellSouth National Publishing is developing a network of marketing information tools, including the Regional Industrial Pages (currently in Florida, Georgia, Alabama, Tennessee and the Carolinas) and an Import/Export Directory for Latin America.

**This could be your last chance to sell the cream of the engineering crop.**

Think for a moment what you will miss if you fail to advertise in this directory—80,000 members of the NSPE in all five categories of practice: private, industry, government, construction and education. What's more, copies of this directory will also be sent to 40,000 specifiers of engineering products and services in such fields as architecture, construction, transportation, communications,

government and others.

Altogether, circulation will total 120,000. And you can reach them all in this one, single directory. In fact, if you sell more than one product or service, you'll want to consider ads under more than one category heading. This new, comprehensive directory will offer up to 6,000 different headings.

So don't wait! November 16 is the closing date for this significant, new advertising medium. For complete details, write or call today.

**BELLSOUTH NATIONAL PUBLISHING**  
P.O. Box 19739, Atlanta, Georgia 30325

Please send me complete details on your new *Professional Engineering Directory*.

I would like to join NSPE.  I would like to obtain a copy.  I am interested in advertising.

NAME \_\_\_\_\_ TITLE \_\_\_\_\_  
FIRM \_\_\_\_\_ (PHONE) \_\_\_\_\_  
PRODUCT OR SPECIALTY \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_ 4C

**TOLL FREE: 1-800-222-1207**  
Inside Georgia, call  
**1-800-554-1169.**

**BELLSOUTH**  
**NATIONAL PUBLISHING**  
A Division of BellSouth Advertising & Publishing Corporation

**"Hello, I'm from Thoughtware.  
I'm an ingenious expert business  
consultant.  
Together we'll Trigger actions to run  
your business better  
than it's ever been run before!"**



# The Age Of Trigger™ Has Begun.

*Trigger Is A New Generation  
Of Personal Computer Software  
From Thoughtware.*

*It Makes You Run Your Business  
With Greater Insight, Power And  
Control Than Ever Before.*

*It Triggers Actions To Make  
Smarter And More Profitable  
Business Decisions.*

A manager has three overwhelming problems. A lack of time. An information overload. A difficulty in remaining focused on key business objectives and controlling them. Trigger solves these problems in a brilliant and innovative way.

It will transform the way you run your business. Trigger monitors key performance areas. And performance can be measured in volume, dollars, behavior; whatever criteria are important to your business.

And whenever an element being monitored falls outside of its acceptable performance range, Trigger issues action memos, with probable causes and actions to be taken, requiring the individuals responsible to respond. And it makes sure those actions are taken.

*The More You Use It, The Smarter You Get.*

Trigger becomes an expert system, learning from experience and helping you learn as well. The more you use it the smarter you both get. The more you use it, the more easily and efficiently you can analyze problems, make decisions and create solutions.

It works with your people, monitoring and analyzing their actions, day to day, week to week, month to month. In your absence, Trigger is still present, acting as your surrogate, making sure what needs to be done, gets done.

The more you use it, the more smoothly and beautifully your business will run.

*Why It's Easy To Consult With Trigger.*

Getting to know Trigger is exciting. Everything is provided to quickly and easily integrate Trigger into your regular business operations. The computer, itself, assists you in every phase of using the program. It explains the business approach on which it is based, and provides all the consultative help that you will need to set up Trigger, and involve and motivate your people.

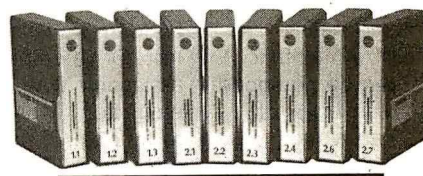
*The Thoughtware Behind Trigger.*

Thoughtware pioneered personal computer-based management training. As a member of the Alexander Proudfoot worldwide family of companies, Thoughtware drew on Proudfoot's nearly forty years of management consulting experience in thousands of companies, to develop Trigger.

To meet Trigger, your astounding new Expert Business Consultant, or Thoughtware's other Expert Consultants listed below, visit your local software or computer store, or call toll-free 1-800-556-2283 for the dealer nearest you. For further information about Trigger or Thoughtware call 1-800-THT-WARE.

*Assessing Personal Management Skills—Evaluating  
Organizational Effectiveness—Understanding Personal  
Interaction Styles—Leading Effectively—Motivating To  
Achieve Results—Defining Goals and Objectives—  
Improving Employee Performance—Performance  
Appraisal—Managing Time Effectively—Conducting  
Successful Meetings—Managing By Exception.*

Trigger runs on: IBM® PC, XT, AT and operationally compatible PC's.  
Trigger is a Trademark of The Alexander Proudfoot Company.  
Thoughtware is a Registered Trademark of Thoughtware, Inc.



**Thoughtware®**

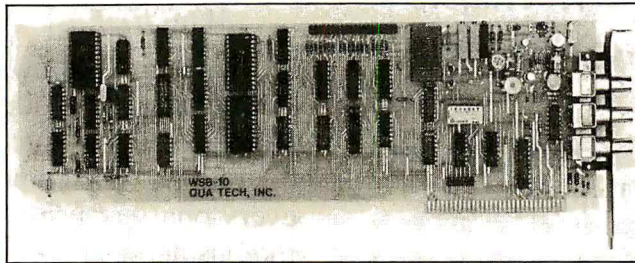
*Expert Consultants In Your Computer.™*

## A D D - I N S

**Arbitrary Waveform Generator for PC**

Qua Tech's WSB-10 is an arbitrary waveform generator for the IBM Personal Computer. Application software with BASIC-callable drivers is supplied with this system.

WSB-10 lets you define up to 2048 data points. The data points can be output as periodic, single-cycle, or burst waveforms in single-cycle or continuous modes. A 16-bit software-programmable timer is used to set the output rate from 2.4 millihertz to 5 MHz. Output



resolution is 12 bits, with a range of  $-5$  to  $+5$  volts. The WSB-10 operates as a stand-alone unit after it has been initialized.

With software, the WSB-10

is \$595. For more information, contact Qua Tech Inc., 478 East Exchange St., Akron, OH 44304, (216) 434-3154.

Circle 563 on inquiry card.

**Graphics, Text Merged, Output on Daisy-Wheel**

IBM PC, PC XT, and PC AT users can merge text and graphics and print the results on a letter-quality printer with ConvertaBuffer II and GT Merge software from von Leivendyke Enterprises.

ConvertaBuffer II, a plug-in card, lets you print presentation graphics on your daisy-wheel or thimble printer using its period character. It does this by translating the Epson graphics output from such programs as Lotus

1-2-3 into the necessary format for graphics printing on most letter-quality printers. ConvertaBuffer comes with a parallel printer adapter and 32K bytes of print buffering, expandable to 64K bytes.

GT Merge is a menu-driven program for intermingling graphics and text. It lets you position graphics anywhere on a page, as well as crop and rotate your image. Positive- or negative-image printing can be obtained, and full disk saves

are supported. Additionally, GT Merge has a mail-merge facility that's compatible with dBASE and other database-management software. It's also compatible with a variety of word processors, graphics programs, and text editors.

ConvertaBuffer II with the GT Merge software is \$249. Contact von Leivendyke Enterprises, Silvermine Ave., Norwalk, CT 06850, (203) 846-4973.

Circle 564 on inquiry card.

**Expansion Boards Extend PC Memory**

The Persyst PC/Memory Plus Clock and the PC/Short Memory expansion boards from Emulex Corporation are tailored for the IBM PC, PC XT, PC AT, and the Portable PC.

The PC/Memory Plus Clock, a full-size multifunction board, can be equipped with up to 576K bytes of memory. It features a clock/calendar for automatic time/date stamping of your files and a program-security facility. It has split-memory addressing, which lets you use application programs

that require more than 640K bytes of RAM by providing access to an additional 128K bytes of memory.

Two software programs, Insta-Drive and Wait-Less Printing, come with PC/Memory Plus Clock. Insta-Drive employs user-assignable RAM for disk emulation that's equivalent to four single-sided floppy-disk drives. Wait-Less Printing buffers up to 30 pages of data or text. Buffering is user-defined through automatic spooling for serial or parallel printers.

The PC/Short Memory board for the half-size PC XT or Portable PC expansion slot is designed to provide up to 384K bytes of memory. It's available in five configurations: 64K, 128K, 192K, 256K, and 384K bytes. Byte parity is provided, and switch-selectable starting addresses, ranging from 128K to 512K bytes, allow it to operate with a variety of motherboard RAM capacities.

The PC/Short Memory board can also plug into a full-size PC AT slot, enabling

**Low-Cost Light-Pen System**

Tech-Sketch is a color-graphics, light-pen system for the Apple II, II+, and IIe, complete with interface card and software.

At the heart of Tech-Sketch is a program called Micro Illustrator. This program lets you store up to 48 pictures on disk, erase mistakes, and magnify images on a pixel-by-pixel basis. It provides 10 different brush strokes and such drawing modes as lines, rays, boxes, circles, color fill, and freehand drawing. Picture data can be stored in binary format for transmission or hard-copy output. Color shading is also offered.

The light pen features fingertip control and a coil-free cord. The interface card plugs into Apple slot 7 (slot 5 is also acceptable) and is cable-connected to a joystick port outside the computer. The light pen is hooked into the joystick port.

The complete Tech-Sketch package is \$149.95. For further details, contact Tech-Sketch Inc., 26 Just Rd., Fairfield, NJ 07006.

Circle 565 on inquiry card.

you to realize that computer's full 640K-byte memory capacity.

The price for the basic 64K-byte PC/Memory Plus Clock is \$345. The top-of-the-line 576K-byte version costs \$1145. With 64K bytes of memory, the PC/Short board is \$259. The 384K-byte model sells for \$759.

For complete specifications, contact Emulex Corp., 3545 Harbor Blvd., POB 6725, Costa Mesa, CA 92626, (800) 854-7112; in California, (714) 662-5600. Circle 566 on inquiry card.



MASS STORAGE

**Winchester Has 256K-Byte RAM Cache**

The DisCache Winchester-disk subsystem for the IBM Personal Computer has an internal, micro-computer-controlled RAM cache area. The cache, which can be used for programs or data, has an access time of 100 microseconds (maximum). The average disk-access time is 8 milliseconds.

Available with 10, 20, or 40 megabytes of formatted storage and with a 256K-byte cache, the DisCache

has an independent micro-processor that monitors and files frequently requested sectors in the RAM cache. Part of the cache is reserved for a so-called anticipatory buffer, which consists of 31 sectors related to the requested one.

When writing a sector to disk, the DisCache processor immediately stores the sector into RAM, which frees your program for further processing without a disk-access delay. The processor

transfers each new sector to disk.

The processor constantly keeps track of the sectors being updated, and at the end of the day, it gives you the option of writing just those sectors to the computer's floppy disk.

Other features include shared access of 0.5 megabyte for up to 21 computers, support of multiple operating systems that can be selected from a front-panel display, a 1-megabyte print

spooler, and a choice of ports: Centronics parallel or RS-232C serial.

DisCache will also work with NEC and Apple computers. A 10-megabyte DisCache lists for \$3350. The 40-megabyte DisCache will list for \$5650 when shipments begin in January. For more information, contact Eicon Research Inc., Penthouse Suite, 520 Fifth Ave., New York, NY 10036, (212) 719-5353.

Circle 567 on inquiry card.

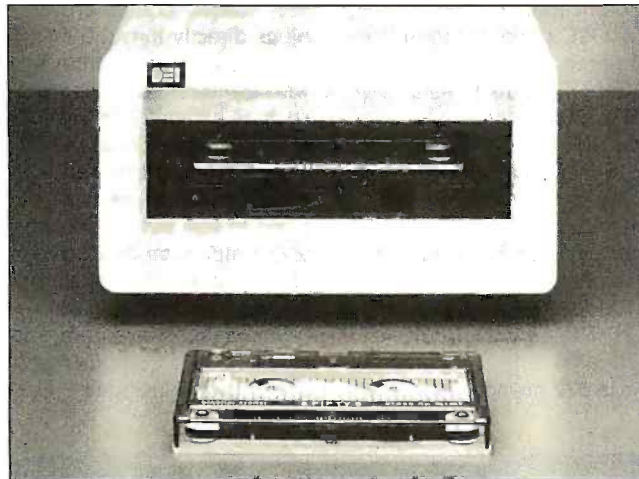
**NCR Hard Disks Are IBM-Compatible**

NCR's 6097 series of IBM PC-compatible hard-disk drives are available with storage capacities ranging from 10 to 60 megabytes. The series is divided into basic single- or dual-drive 10- and 30-megabyte units, all of which fit into the same enclosure. One full IBM expansion slot is required, and the series is compatible with the IBM hard-disk operating system, which lets you boot directly from the drive.

The 10- and dual 10-megabyte drives feature a recording density of 9075 bits per inch and an average disk-access time of 93 milliseconds. The 30- and dual 30-megabyte drives have 9550-bit-per-inch recording densities and a 53-millisecond average access time.

The 10-megabyte 6097 fixed-disk drive is \$2750. Its double-drive complement is priced at \$3750. The basic 30-megabyte unit sells for \$4250. With twice the storage, it's \$6750. For further details, contact NCR Corp., 3718 North Rock Rd., Wichita, KS 67226. Circle 568 on inquiry card.

**Tape Subsystem Works Like Floppy**



Data Electronics has entered the end-user market with a tape-cartridge subsystem that serves both

as a streaming-tape backup and as a large-capacity disk drive. The SL-6 subsystem, which is designed for the

IBM PC XT, handles 17 megabytes of formatted data or 21.3 megabytes of unformatted information. It uses a high-density ¼-inch tape cartridge that meets all ANSI X3.55-1977 standards.

The SL-6 features file-selectable and intelligent streamer modes. The file-selectable mode lets you retrieve and work with files just as if you were using a floppy disk. In its intelligent streamer mode, the SL-6 bypasses unused space and bad sectors, which are normally copied by streaming-tape backups, and stores only your data files.

The SL-6 reads data at 30 ips and searches at 90 ips. At 30 ips, the transfer rate is 24K bytes per second. The head type is dual gap read/write, with a four-track serpentine with separate erase. To support the strain inherent in the file-select feature, the SL-6 is said to incorporate a special-purpose start/stop motor.

The SL-6 is \$2195. The media are \$46. Contact Data Electronics Inc., 10150 Sorrento Valley Rd., San Diego, CA 92121-1699, (619) 452-7840. Circle 570 on inquiry card.

(continued)

**Disk Subsystem Stores 20 Megabytes**

Plato, a 20-megabyte Winchester hard-disk subsystem for the Apple II, comes with a controller and a host adapter with software enhancements in ROM.

This subsystem supports and runs four operating systems: AppleDOS, ProDOS, Pascal, and CP/M. DOSes can be switched with a simple command, and all

are auto-bootable. Utility software on the host adapter includes file, volume, or disk copy. Individual files and volumes can be password-protected.

Single-unit pricing for Plato is \$1500. Contact Disc Tech One Inc., 849 Ward Dr., Santa Barbara, CA 93111, (805) 964-3535.

Circle 569 on inquiry card.

## PERIPHERALS

**IBM Unveils Printers**

IBM's Quietwriter and Wheelprinter printers are compatible with the full PC product line, including the PCjr and the Portable PC.

The Quietwriter operates at 40 cps in 10 pitch, 48 cps in 12 pitch, 60 cps in 15 pitch, and 40 to 60 cps in proportional spacing. Double-width printing is available with all pitches. It uses electronic type-font car-

tridges, two of which are on line simultaneously, and supports graphics output.

Automatic cut-sheet and continuous-forms feed paper-handling capabilities are optional features; semi-automatic cut-sheet feed is standard. Supplied diagnostics are power-on test and operator-initiated ripple and wrap.

Quietwriter comes with

four 252-character electronic fonts, print ribbon, print head, cleaning cartridge, and a Centronics-type parallel interface. It lists for \$1395.

The bidirectional Wheelwriter uses a 96-character cartridge print wheel. Print pitches are 10, 12, and 15, plus proportional spacing. It offers 25-cps burst printing at 12 pitch. Integrated continuous-forms and

automatic sheet feed capabilities are standard.

It comes with nine ASCII print wheels and single- and multistrike ribbons. Either Centronics parallel or RS-232C serial interfaces are available. The list price is \$1795. For more information, contact IBM Corp., POB 1328, Boca Raton, FL 33432, (800) 447-4700.

Circle 571 on inquiry card.

**Optical-Link RS-232C Modem Set**

The FI-DP232 from Foundation Instruments is a fiber-optic RS-232C modem set offering fully passive operation and full RS-232C functionality. The link is made up of twin modems, mounted at both ends of a length of cable. The modems plug into a standard 25-pin RS-232C source, such as a printer or computer, in a matter of seconds.

The FI-DP232 derives its operating power from the transmit data. It supports full-duplex asynchronous

operation from 75 to 20,000 bps. DTC or DCE operation is switch-selectable. Modifications to the RS-232C pin-outs are not required.

Cable lengths ranging from 10 to 2000 meters are available. The FI-DP232 with a 10-meter cable costs \$495. Extra cabling is \$2.98 per meter. For further details, contact Foundation Instruments Inc., 24 Colonnade Rd., Nepean, Ontario K2E 7J6, Canada, (613) 226-4000.

Circle 572 on inquiry card.

**Capture Images for Commodore**

Computereyes is a video-acquisition system for the Commodore 64. A slow-scan device, Computereyes plugs directly into the 64's user I/O port and connects with standard video sources, such as a camera or videodisc unit. Through software control, a black-and-white image can be captured in less than 6 seconds, and a multiscan mode provides you with gray-scale images.

Comprehensive software is supplied with Computereyes. The software includes

machine-language image-capture routines, a menu-driven executive, and image compression/decompression routines to maximize disk space.

A Commodore 1541 or compatible disk drive is required. With interface module, software, and manual, Computereyes is \$129.95. A complete system with a camera can be purchased for \$349.95. Contact Digital Vision Inc., Suite 2, 14 Oak St., Needham, MA 02192, (617) 444-9040. Circle 573 on inquiry card.

## NEW SYSTEMS

**MicroMix Expands DP Operations**

The MicroMix 16 from Trios Micro Systems is a 16-bit computer said to be completely compatible with IBM PC and PC XT hardware, peripherals, and software. It is designed to use the IBM's keyboard and display screen for PC and host operations. The MicroMix 16 plugs directly into the IBM computer or into an asynchronous terminal, permitting full use of a data-processing department's base of installed terminals. It can connect with IBM 3270-type computers,

ASCII terminals with RS-232C ports, electronic typewriters, stand-alone word processors, and other personal computers.

The basic system comprises a 16-bit Intel 8088 processor, 128K bytes of RAM, a 320K-byte double-density drive, and a universal terminal controller (UTC), which is a high-speed interpreter and communications controller between the MicroMix 16's central processor and the attached computer.

MicroMix 16 accepts

accessory boards and peripherals built for the IBM PC and offers room for a second disk drive and a mathematics coprocessor. It has a single RS-232 serial port, four I/O expansion slots, and a Centronics-type parallel printer port. RAM is expandable to 256K or, with IBM PC memory expansion cards, to 640K bytes.

Optional equipment includes 64K-byte memory upgrades, a secure transfer program, a keyboard, and a carrying case.

A basic unit, with 256K

bytes of RAM, twin floppy-disk drives, serial and Centronics ports, and an asynchronous terminal controller, sells for \$2150. With one drive, a 10-megabyte Winchester hard disk, parallel and serial ports, and the UTC with IBM 3278 coax and RS-232C interface, the MicroMix 16 sells for \$3586. For further information, contact Trios Micro Systems Inc., 147 Beacon St., South San Francisco, CA 94080, (415) 583-7733.

Circle 574 on inquiry card.

## NEW SYSTEMS

**MS-DOS, Proprietary DOS, Multiusers**

The AM-680 Series ELS from Alpha Microsystems is a multiuser computer with two operating systems and a pair of microprocessors. Capable of supporting three users, ELS combines a 16-bit Intel 8088 running MS-DOS and the 16-/32-bit Motorola M68000 chip running AMOS, a proprietary multiuser operating system.

Standard equipment on the AM-680 includes a 10-megabyte hard-disk drive, a single 360K-byte floppy-disk drive, an M68000 coprocessor board, a monitor with controller, a keyboard, and a battery-backed clock/calendar for AMOS. It has 128K bytes of RAM, expandable to 256K, dedicated to AMOS and 256K bytes of memory for MS-DOS, which can be ex-

panded to 640K bytes. Single serial and parallel interface ports are supplied.

The AM-680 has been designed with a number of performance features that facilitate the integration of both DOSes. For example, the 10-megabyte hard disk can be partitioned between the operating systems, which maximizes disk space. Another feature lets you transfer text files between the operating systems.

Options include a color monitor, an IBM serial interface, and 128K-byte expansion boards. With a monochrome monitor, the AM-680 Series ELS is \$6870. With a color monitor, it's \$470 more. Contact Alpha Microsystems, 17332 Von Karman Ave., Irvine, CA 92714, (714) 957-8500. Circle 575 on inquiry card.

**Sinclair Adds Full-Travel Keyboard to Spectrum**

Sinclair Research has announced that the ZX Spectrum's original "chiclet" style keyboard has been abandoned in favor of the full-travel keyboard used on the company's QL computer.

The ZX Spectrum+ is a Z80A-based microcomputer with 48K bytes of RAM and

256- by 176-pixel graphics in eight colors. In England, it costs £179.95 (approximately \$213). It is not available in the U.S.

Contact Sinclair Research Ltd., 6 Kings Parade, Cambridge CB2 1SN, England; tel: 011 (44) 233-353-204. Circle 576 on inquiry card.

## SOFTWARE • APPLE

**Program Computes Deviation, Draws Graphs**

Analytics software package for scientists and engineers, Analytical Graphics runs on the Apple II+ and IIe. It accepts data from the keyboard or DIF files, computes the standard deviation or standard error of the mean, and displays the data and error bars in a variety of graphic formats.

With Analytical Graphics, you can produce point and line graphs and solid, line, split, or merged bar charts. Linear, semilog, and log/log axes can be used with automatic or manual scaling.

Multiple line or bar overlays and linear regression analyses are supported. Labels and headings are user-controlled. Hard copy can be obtained through screen dumps.

Analytical Graphics requires 64K bytes of RAM and a disk drive. It's priced at \$90, which includes two copies of the program, a tutorial disk, and a manual. Contact Scientific Software Products, 5726 Professional Circle, Indianapolis, IN 46241, (317) 244-6163. Circle 577 on inquiry card.

**Turn Mac into an Information Center**

MacLink converts the Macintosh into an information utility system that can serve as a private electronic-mail system, a public news system, a file-distribution system, or all three. It uses a simple user interface and supports remote access from Macintosh computers, personal computers, and ASCII terminals.

MacLink handles 7 or 8 data bits with even, odd, or no parity and a single stop bit. Automatic data-rate select is provided, with rates of either 300 or 1200 bps.

The electronic-mail capability has such features as address validation, reply generation, and mail-receipt verification. Its editor is said to be easy to use, and MacLink imposes no limit on message size.

The BBS aspect of MacLink permits a virtually unlimited number of categories to be read or posted. Features such as headline scanning, automatic reply generation while reading, and reading specified articles without

pause are standard. Users can specify the range of articles to be read, or MacLink can automatically give them a list of newly posted items.

Data files can be uploaded and downloaded with the file system. With MacLink, you can create any number of directories for categorizing files. A summary list is available, and a file list showing names, sizes, date and time of upload, and a description of a file's contents is provided.

Sysops access MacLink from the Macintosh or from a remote site. They wield commands that let them enter the message of the day, change a user's access privileges, delete users and items, add and change categories or file system directories, and shut down the system.

MacLink's suggested price is \$50. For more information, contact Connick and Associates Inc., 2329 Old Trail Rd., Reston, VA 22091. For an on-line demonstration, call (703) 476-9459. Circle 578 on inquiry card.

(continued)

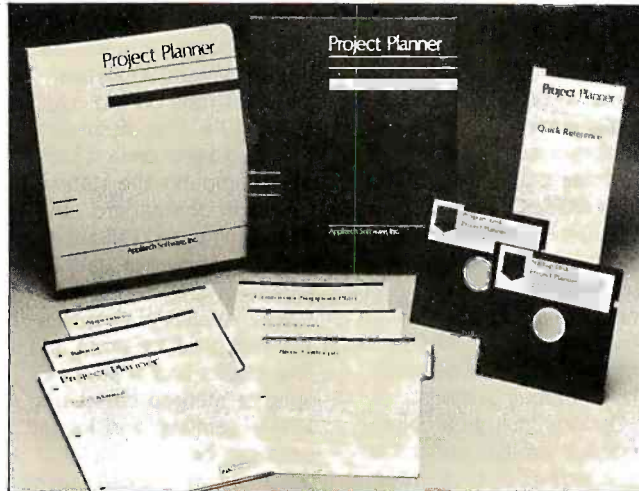
## SOFTWARE • APPLE

**Idea Processor/Project Manager Lets You Visualize Plans**

Applitech Software's Project Planner is an idea-processor/project-management tool for the Apple II family that lets you analyze the planning and scheduling of a project still in its formative stages.

The key to this system, according to the manufacturer, is its automatic project graph-filtering and generation capability. This feature lets you enter activities and a minimal amount of information into Project Planner, which then automatically generates a project flowchart and schedule and filters out inconsistent information. Once the flowchart is prepared, you can use the supplied critical-path method (CPM) feature to fine-tune your project.

Project Planner has traditional CPM capabilities. It lets you plan, organize, schedule, and monitor a



project, focus on its critical activities, and see and analyze the results of alternative strategies.

Currently available for dual-drive, 64K-byte Apple II+, IIe, and IIc computers, Project Planner has a suggested retail price of \$150. An enhanced, 128K-byte ver-

sion for the Apple IIc and IIe with 80-column card will be available soon. An IBM PC version with a user interface similar to the Macintosh is in the works. Contact Applitech Software Inc., 381 Harvard St., Cambridge, MA 02138, (617) 497-8268. Circle 579 on inquiry card.

**Site Network on Apple**

Nocterminal is a telecommunications program that lets you use an Apple IIc, IIe, or III as the intelligence behind a network.

It's a simple system designed for showing, selling, or receiving orders. Attendants are not required, and Nocterminal uses standard communications protocols. Presently, it operates at full-duplex with 7 bits and space parity.

Nocterminal lets you enter data, customize files, impose time limits, and test presentations before they go on line. The entire system can be password-protected. As operator, you can access selected password-protected files and allow callers to attach comments to files.

Nocterminal comes with a text editor, a filing utility, and operator and caller assistance. Both help systems contain text files that can be edited by the system operator. An on-line mode lets you display information to callers automatically.

The Apple III version of Nocterminal, \$200, requires 256K bytes of RAM. It runs in native mode. The IIc/IIe versions, \$175, need half as much RAM. Additional hardware requirements are an auto-answer modem that supports the Hayes Smartmodem command set and two disk drives. If you wish to use Nocterminal's connect-log, time-out, and time-stamp file features, a system clock is needed.

Contact Nocturnal Software, POB 794, Soquel, CA 95073, (408) 462-3912. For an on-line demonstration, call (800) 237-0601; in California, (800) 523-7917. Circle 582 on inquiry card.

**Search, Edit Mac's Memory**

Mac Zap, a Macintosh disk and memory utility program, lets you search, edit, and modify a disk or memory. It supports a full-screen editor using the Mac's mouse and hexadecimal and ASCII formats. If you have two disk drives, you can compare and copy disks.

Mac Zap provides disk information regarding block allocation maps and volume information (edit). File information provided includes a file allocation map for resource and data forks and edit file information.

After you create, say, a block allocation map, you can use the Mac Zap utilities to apply patches or recover files. Mac Zap is suitable for repairing damaged disks and customizing menus. It has a routine that

lets you search a disk for damaged areas or the Mac's memory.

The suggested list price is

**New Apple DOS**

DOS 4.0 from Rune Enterprises is said to provide up to 35 percent more disk-storage space than prior Apple disk operating systems. DOS 4.0, which comprises a CMOS 6502 microprocessor, software, and supporting manuals, has a suggested retail price of \$95.

DOS 4.0 increases the available RAM for language-card users by 10K bytes and can expand the formatted disk-storage capacity to approximately 190K bytes. It reportedly has faster reading

\$60. Contact Micro Analyst Inc., POB 15003, Austin, TX 78761, (512) 926-4527.

Circle 580 on inquiry card.

and updating of files, automatic compression of Apple-soft programs, and improved file-handling capabilities.

The CMOS 6502 allows absolute indexed indirect addressing and absolute indirect addressing. Branch always and store zero in memory are two of its eight new instructions.

DOS 4.0 works with the Apple II, II+, and IIe. Contact Rune Enterprises, Sales Department, Suite 214, 80 Eureka Square, Pacifica, CA 94044, (415) 355-4851. Circle 581 on inquiry card.

## SOFTWARE • APPLE

**Run DOS 3.3 Programs on Profile**

**P**rofix lets you run your DOS 3.3-specific software on the Apple ProFile hard disk without converting to ProDOS. You can map portions of the ProFile with DOS 3.3 format and reserve other areas for ProDOS and Pascal.

The Profix utilities disk comes with file-transfer pro-

grams, a configuration program, and routines for initialization, disk copying, and disk backup. It runs on the 64K-byte Apple II+ and 64K- or 128K-byte Apple IIe systems. It costs \$59.95. Contact Nordic Software Inc., 4910 Dudley St., Lincoln, NE 68504, (402) 466-6502. Circle **583** on inquiry card.

**Easy to Design Graphs**

**G**emini Video says that its Environmental Graphics software is tailored for people who want easily designed graphs. It includes contour maps, scatter diagrams, linear and logarithmic axes, bar and pie charts, and mathematical equations. Graph and text editing is provided, and

data is entered in a style that's similar to a spreadsheet.

Environmental Graphics runs under DOS 3.3 on the Apple II. This program sells for \$69.95. For more information, contact Gemini Video, POB 2018, Vernon, CT 06066, (203) 875-0052. Circle **584** on inquiry card.

## SOFTWARE • CP/M / MS-DOS

**68000 Assembly Development Package Works with CP/M**

**X**MAC68K is an assembly-language development package for computers based on the Motorola 68000 microprocessor and running under CP/M, CP/M-86, MS-DOS, or PC-DOS.

Priced at \$595, XMAC68K will also be available for

several different implementations of UNIX.

The XMAC68K package is composed of assembler, macro preprocessor, linkage editor, librarian, and symbol report generator modules, augmented by utility programs. It uses standard 68000 assembly-language

code as input, and its various modules work in consort to produce hexadecimal object files in Intel, Mostek, and Motorola formats.

According to the manufacturer, key features include compatibility with Motorola assembly language, macro in-

structions and structured assembly statements, detailed cross-references, and English diagnostic messages.

For further details, contact Avocet Systems Inc., 10 Summer St., Rockport, ME 04856, (207) 236-8227. Circle **585** on inquiry card.

**BASIC Compiler Has Multitasking Abilities**

**A** process-control BASIC compiler featuring high-speed executions and real-time, multitasking capabilities. CDI\*BASIC is designed for computer-control projects for any CP/M-based system. In addition to most standard BASIC commands, this compiler has a number of commands that facilitate interfacing with the Z80 interrupt structure.

Because only one task can be in control of the processor at any given time, CDI\*BASIC cannot be considered a true multitasking system. However, the software within it automatically switches processor time between each task, which, in turn, results in the appearance that multiple tasks are running concurrently.

Source code is compiled at a rate of more than 100 BASIC lines per second and then executed. Compiled Z80

code can be stored to run at a later time without a run-time license agreement.

CDI\*BASIC can provide machine-language programmers with a list of jump vectors of all designated logical

I/O devices, which can be helpful when writing high-speed, custom I/O drivers.

With a manual, this package has a suggested list price of \$485. Most CP/M formats are available. A

demonstration disk with the manual can be obtained for \$30. Contact Computer Dynamics, 105 South Main St., Greer, SC 29651, (803) 877-7471.

Circle **586** on inquiry card.

**CP/M Communications Utility**

**A** CP/M-based communications package, the Softcom-Telecommunications Utility can be used as an intelligent terminal program and as a CP/M-to-CP/M file-transfer tool. Softcom can be used to turn your computer into a terminal to host a timesharing system or for capturing data from a host. When communicating with another microcomputer running Softcom, you can exchange files with error detection and automatic retry.

In its intelligent terminal

mode, Softcom supports half-duplex and full-duplex transfer at rates of up to 9600 bits per second. Since it supports XON/XOFF protocols, Softcom can be used for sending large ASCII files to any host using those protocols. Unattended file transfers between CP/M systems and transfers through the CP/M console port are also supported.

Data can be prepared beforehand or at the terminal at the time of transfer. Received data can be stored

or printed.

The Softcom-Telecommunications Utility package requires 32K bytes of memory, the CP/M operating system, and a computer based on an 8080, 8085, or a Z80 microprocessor. Softcom is available in most 8- and 5¼-inch disk formats. The list price is \$150.

For more information, contact The Software Store, 706 Chippewa Square, Marquette, MI 49885, (906) 228-7622.

Circle **587** on inquiry card.

(continued)

## SOFTWARE • CP/M/MS-DOS

**Dynamic Debuggers**

**P**fix86 and Pfix86 Plus are advanced debugger utility programs for 8088/8086 microcomputers with MS-DOS.

Pfix86 is a dynamic debugger for use with assembly language or high-level programming languages. Its multiple-window display lets you simulta-

neously view program code and data, breakpoint settings, current machine register, and stack contents. An in-line assembler and such advanced breakpoint features as permanent and temporary settings are provided. Pfix86 supports single-keystroke tracing.

Pfix86 Plus is an enhanced

version of Pfix86 that offers symbolic and overlaid program debugging capabilities. The symbolic debugging tool eliminates hassling with linker memory maps because it accepts symbolic names whenever you would normally have to enter an address. Its in-line assembler permits temporary patches,

which prevents the need to recompile when program bugs are identified.

Pfix86 is priced at \$195, and Pfix86 Plus is \$395. Contact Phoenix Computer Products Corp., Suite 220, 1416 Providence Highway, Norwood, MA 02062, (617) 762-5030.

Circle **588** on inquiry card.

## SOFTWARE • IBM PC

**Word Processor for Scientists**

**T**he T<sup>3</sup> Scientific Word Processing System from Triad Computing provides for unlimited file size, 25 levels of superscripts and subscripts, chemical formulas, complex mathematical expressions, footnotes, headers, and footers. This is a menu-driven system that runs on the IBM PC, PC XT, PC AT, and many compatibles.

T<sup>3</sup> lets you define and mix eight fonts in a single document; each font contains 128 characters. It has standard word-processing functions, such as move, copy, and delete, as well as a font editor, and boldface, underline, and strike-out of any character. Various dot-matrix and laser printers, such as Epson and IBM, are supported; drivers are available for other printers.

Two double-sided, double-density disk drives, PC-DOS, 512K bytes of RAM, and a color-graphics adapter are required. It can run off a hard disk. T<sup>3</sup> is \$595. A UCSD Pascal version is \$495. For details, contact Triad Computing Inc., 1190-B Foster Rd., Las Cruces, NM 88001, (800) 874-2383; in New Mexico, (505) 522-4600.

Circle **589** on inquiry card.

**Compiler Enhances dBASE III Applications**

**C**lipper is a compiler for Ashton-Tate's dBASE III relational database system. The manufacturer, Nantucket Inc., says that compiled dBASE III applications should run from 2 to 20 times faster than interpretive versions. Clipper is also said to make more efficient use of disk-storage space by creating more compact application-code files than

interpreted versions of dBASE III.

This compiler generates relocatable, executable elements that cannot be backtracked to the source codes. Consequently, you are not forced to devise complex data-encryption schemes to guard your work. Clipper has a complete set of compiler-generated error messages

that assist in locating programming bugs.

Clipper is currently available for the IBM PC and true compatibles. Versions for major 8- and 16-bit computers will be announced soon. The suggested list price is \$695. Contact Nantucket Inc., 20456 Pacific Coast Highway, Malibu, CA 90265, (213) 456-7315.

Circle **590** on inquiry card.

**Four-In-One Color Graphics System**

**P**roDraw for 256K-byte IBM PCs combines a color paint system, database with an auto-cycle option, a NAPLPS non-SRM decoder, and a telecommunications emulator. It provides the means for creating and transmitting color graphics and text images for a variety of presentations.

The drawing module uses pop-up menus and gives you rubber-banding and graphics- and text-editing abilities. Also featured are scrolling within windows and an on-line manual.

The database allows for an unlimited number of pages to be linked into a presentation. Each page can branch into 10 different pages. As many as 200 ProDraw images can be stored in a

single 360K-byte floppy disk.

ProDraw's decoder module produces displays with a 320- by 200-pixel resolution in 10 or 16 colors, dependent upon your color board. It has eight fill textures and user-definable brush and text sizes.

The terminal emulator has ASCII and NAPLPS modes, auto-dial and log-on, file-save capabilities, and 300- to 9600-bps data rates. Five different color boards are supported.

ProDraw works with more than 20 IBM PC-compatibles, DOS 2.0 is required. The price is \$350. Contact Limicon Inc., 144 Hampton Ave., Toronto, Ontario M4K 2Z1, Canada, (416) 481-7859.

Circle **591** on inquiry card.

**Multitasking for IBM**

**M**ulti-Job lets you run up to nine IBM PC-DOS programs simultaneously. The keyboard and screen can be assigned to any job with a simple keystroke, while the remaining jobs execute unattended.

Multi-Job divides computing time and memory among tasks. It lets you assign job priorities, and any task can be displayed.

Additional hardware is not required; however, extra system memory may be required by your programs. It supports DOS 2.0, 2.1, and 3.0 running on the IBM PC, PC XT, and PC AT. It costs \$159. Contact B&L Computer Consultants, Suite B, 7337 Northview, Boise, ID 83704, (208) 377-8088.

Circle **592** on inquiry card.

## SOFTWARE • IBM PC

**Indexing Tool for Word Processors**

**T**exin is a general text-indexing tool that creates an index for standard text files. Phrases, sentences, or paragraphs also can be extracted and saved for later reference, and indexes can be printed in a standard format or with page and line numbers.

Texin lets you devise keyword files from the original text or from your own list. Both keyword and index files can be updated or modified at any time, and when you add or delete pages from your manuscript, Texin lets you update the index file without creating a new one.

The original text is not corrupted when you use Texin. In addition, keyword extraction and index creation do not demand that you

manually scan the text to identify keywords.

A conversion module lets you alter WordStar files for direct processing. This feature can be used to create a standard ASCII file for transmission or printing outside of WordStar. Miscellaneous features include menu-driven operation, extensive help, error messages, on-line explanations, and word tallies by keywords, references, or total manuscript word count.

An IBM PC or PC-compatible with 128K bytes of RAM, PC-DOS or MS-DOS, and one disk drive is required. It sells for \$80. Contact Mariach Ltd., POB 1324, Station B, Ottawa, Ontario K1P 5A0 Canada, (613) 237-3189.

Circle 593 on inquiry card.

**Solve Equations**

**O**ptisolve is a mathematical problem-solving program for the IBM PC and selected MS-DOS microcomputers. It can handle such problems as least-squares fitting, single equation with one unknown, a system of simultaneous equations in several variables, and maximization or minimization of a function with constraints. Transcendental functions include exponentials, logarithms, and trigonometric functions. Solution accuracy is seven digits.

Optisolve lets you enter problems in symbolic form, without requiring the use of a programming language. You can also enter problems from a file.

This program accepts linear or nonlinear constraints in the form of equa-

tions or inequalities. You can modify variables interactively, and variables can be real or complex. Variable names can have an arbitrary length. Optisolve can give you global solutions or local solutions that are near to the input starting values.

If you have Lattice C or Microsoft's C Compiler, you can link Optisolve with C language functions. Minimum hardware requirements are 128K bytes of RAM and a disk drive. DOS 1.0 or higher is necessary. An 8087 coprocessor is recommended. A Macintosh version will be available soon. The list price is \$195. For more information, contact Optisoft, 1445 Crone Ave., Anaheim, CA 92802.

Circle 594 on inquiry card.

## SOFTWARE • OTHER COMPUTERS

**PDP/11 Compatibility for Pro 350**

**S**&H Computer Systems' Pro/TSX-Plus operating system transforms the DEC Professional 350 into a multiuser, PDP/11-compatible computer.

Pro/TSX-Plus gives the Pro 350 three-user capability, multitasking operation, and access to the entire range of applications and utilities under DEC's RT-11 operating system.

At the heart of Pro/TSX-Plus is an adaptive scheduling algorithm that enhances resource management for rapid system response. It lets you set your job priorities, and it then adjusts those priorities for the best response during the program execution. Other enhancements to increase system response include data and directory caching for improved file I/O speed.

Pro/TSX-Plus gives you 64K bytes of virtual address space for each task, which lets you run the full complement of RT-11 applications. Unreserved physical memory can be used by programs that employ either virtual

overlays or arrays.

Miscellaneous features are spooled printing, record locking, communications with dial-in support, concurrent program control, log-on security, interprogram messages, and a virtual

debugger.

Pro/TSX-Plus is \$900. Quantity discounts are offered. Contact S&H Computer Systems Inc., 1027 17th Ave. S, Nashville, TN 37212, (615) 327-3670. Circle 595 on inquiry card.

**Low-Cost Communications for TRS**

**L**azyComm is a \$34.95 communications program for the Radio Shack TRS-80 Models I, III, and 4. It can be configured for any host system, and LazyComm automatically logs on and dials using a smart modem. It also tracks your time on line.

Many LazyComm parameters, such as the codes for XON and XOFF, are user-definable. All framing, parity, and overrun

errors are reported by means of graphic shapes on screen.

You can send received data to a printer for continuous output or store it to disk. Print screens are supported. When you're uploading data, LazyComm gives you the option of sending blocks or single lines of text. Information can be sent or received at rates of up to 9600 bps. Also featured are ASCII and

binary file transfers and a capture buffer with room for approximately 30K bytes of data.

LazyComm works with any Model I or III DOS. It can be integrated with the Lazy Writer word processor in the Model I, III, or 4 versions. Contact AlphaBit Communications Inc., 13349 Michigan Ave., Dearborn, MI 48126, (313) 581-2896. Circle 596 on inquiry card.

(continued)

**Open Access for DG/One**

**O**pen Access, an integrated software package, is available for the Data General/One portable computer.

Open Access is made up of six modules: relational database, spreadsheet, word processing, appointment calendar, communications, and graphics. It comes on five 3½-inch floppy disks, which include a pair of tutorials.

The database can process five files simultaneously. The spreadsheet is not limited to RAM space, and the word processor can link files together and incorporate

data and graphics from other modules.

The graphics module, which has three-dimensional capabilities, can be used for creating slide shows. The communications module can be set to operate in either slave or unattended modes.

Open Access is \$695. It's also available for the Compaq, Columbia, IBM PC, Sperry, Tandy 2000, TI Professional, and IBM PC-compatibles. Contact Software Products International, 10240 Sorrento Valley Rd., San Diego, CA 92121, (619) 450-1526.

Circle 597 on inquiry card.

**Software Streamlines Office**

**T**he Administrator is an office-automation software system for the DEC Rainbow. An integrated package, the Administrator can operate alone or as part of a linked network. It's designed to streamline such office tasks as scheduling meetings, tracking memos, and outlining personal expenses. When used in a network, the Administrator automatically checks for conflicts in the schedules of all individuals on the system.

The Administrator provides a clock/scheduler system, a personal to-do list, an index

file, a calculator, an expense tracker, electronic mail and filing, and a telephone message file.

A Rainbow with 256K bytes of memory, a disk drive, and a 5-megabyte hard disk is required. The Administrator will also work with the DEC Pro 350 series and the IBM PC XT and PC AT. The suggested retail price is \$795. A license for the multiuser DEC Pro 350 is \$1795. For more information, contact Inteck Inc., Suite 20, 695 South Colorado Blvd., Denver, CO 80222, (303) 733-5900. Circle 598 on inquiry card.

**ALLWRITE!**

**A**LLWRITE! from Prosoft is an advanced word processor for the Radio Shack TRS-80 Models I, III, 4, and 4P. It's suitable for writing simple letters, devising customized form letters, constructing legal documents, and authoring books.

ALLWRITE! comes with controls for a variety of printers, and right-justified, proportional spacing is standard.

Two-key English-language-based commands simplify usage. Predefined soft keys for such functions as paragraph indents and centering text are also provided. ALLWRITE! can develop tables of contents, indexes, and footnotes. It can process several floppy disks as a single document.

An on-line help library explains more than 50 subjects and is accessed with a single keystroke. A quick-reference card fits on the keyboard, and a 350-page manual offers examples and a tutorial.

ALLWRITE! will work with the Electric Webster 1.7

spelling checker and the DotWriter 4.0 graphics text formatter. It will not work with CP/M.

ALLWRITE! file structures are upward-compatible with NEWSCRIPT's file structure.

The Model 4 version supports an 80-column by 24-line screen and lets you edit three files simultaneously on a 128K-byte machine.

System requirements are 48K bytes of memory, two

disk drives, and a TRSDOS-style operating system.

ALLWRITE! is available for \$249.95 from Prosoft, POB 560, North Hollywood, CA 91603, (818) 764-3131. Circle 599 on inquiry card.

**Music for the Commodore**

**M**acmusic is a musical composition program for the Commodore 64 that has a user interface styled after the Apple Macintosh's, replete with pull-down menus and icons.

Melodies are drawn in color on screen using a joystick or a KoalaPad. They can be edited with such commands as select, invert, transpose, zoom, and cut/paste/copy. All editing

functions have a direct correspondence with what's seen on screen and what's played back.

An arrange menu shows you how to change the order of a melody, which can then be saved to disk. An instruments menu lets you alter preset instruments during a preprogrammed tune, of which 10 accompany Macmusic, or while you are drawing a melody on screen.

Macmusic is a stand-alone package, although it will work with the Music 64 Keyboard. It's \$49.95. Contact Passport Musicsoftware, Suite 103, 625 Miramontes St., Half Moon Bay, CA 94019, (415) 726-0280. Circle 600 on inquiry card.

.....  
 : WHERE DO NEW PRODUCT ITEMS COME FROM?  
 : The new products listed in this section of BYTE are culled  
 : from the thousands of press releases, letters, and telephone  
 : calls we receive each month from manufacturers, distributors,  
 : designers, and readers. The basic criteria for selection for  
 : publication are: (a) does a product match our readers' in-  
 : terests? and (b) is it new or is it simply a reintroduction of  
 : an old item? Because of the volume of submissions we must  
 : sort through every month, the items we publish are based  
 : on vendors' statements and are not individually verified. If  
 : you want your product to be considered for publication (at  
 : no charge), send full information about it, including its price  
 : and an address and telephone number where a reader can  
 : get further information, to New Products Editor, BYTE, POB  
 : 372, Hancock, NH 03449.  
 : .....



We don't have to  
**YELL**



When you have what we have, you can leave the noisy advertising to hucksters, shlocksters, and amateurs. Look closely. We seldom "SCALL," we never "beat any price," we don't even try to lure you into buying a second-rate product just because we got a good deal. And while THEY were trying to match our clearly published prices, we were

- doing more compatibility testing that any other advertiser in Byte
- training the most knowledgeable sales personnel
- offering the most flexibility in configuring systems to your specification
- making a profit.

We best be careful, lest our priorities get jaded.

This is the system IBM forgot to offer!

We call it

**THE XT-AT**

- IBM PC with 256K RAM
- one 10MByte Internal half-height hard disk
- one 360K half-height Teac floppy disk
- one 1.2MByte half-height Teac floppy disk (media compatible with IBM AT)
- J-Format and other utilities to pull the system together.

Add any one of numerous video cards, monitors, or multifunction cards. Its more compatible than an AT, more useable than an XT, and cheaper than both.

**\$2595**

The XT-AT with Monochrome-Graphics video interface, printer port, and 400 line Green CRT:

**\$2995**

If you need speed, remember you can still add an Orchid Turbo-186 (and retain compatibility) for

**\$995**

Naturally, we also sell standard PCs, XT's, and AT's.

**IBM**

|                                      |        |
|--------------------------------------|--------|
| PC: 256K, 2 std drives               | \$1795 |
| PC: 256K, 2 half-height TEAC drives  | \$1655 |
| PORTABLE: 256K, 2 drives             | \$2345 |
| XT: 256K, 10MB                       | \$3335 |
| AT: BASE CONFIGURATION (list \$3995) | \$3385 |
| AT: w/20MB (list \$5795)             | \$4985 |
| AT: w/40MB                           | \$6150 |

**LEADING EDGE PC AND FXD**

Built by MITSUBISHI

**Compatibility Service Policy**

If you buy a LE computer from Expert and you find any software or hardware that doesn't operate the same as it would on an IBM PC or XT, Expert will serve as a go-between to get the software or hardware modified to operate as advertised.

The exception is software distributed by IBM.

- Dual speed CPU - Parallel, serial, clock - 7 wide slots - MS-DOS 2.11, GW-Basic
- One year warranty, nationwide service.

|                                                      |        |
|------------------------------------------------------|--------|
| MONO PC-256: 2 Drives, 256K RAM, Mono w/Green        | \$1550 |
| AMBER: Swap amber CRT for Green                      | \$ 10  |
| COLOR PC-256: 2 Drives, 256K RAM, Color with 13" RGB | \$1895 |

FXD models include a 10MByte fixed disk, and one 360K floppy drive. The savings is easily more than a \$1000 vs. IBM XT with similar features.

|                                    |        |
|------------------------------------|--------|
| MONO FXD-256: 256K RAM, Mono/Green | \$2225 |
| AMBER: Swap amber CRT for Green    | \$ 10  |
| COLOR FXD-256: 256K RAM, Color/RGB | \$2570 |

**Recommended Options:**

|                                                             |       |
|-------------------------------------------------------------|-------|
| LE Word Processing Software                                 | \$ 75 |
| RAM Sets [384K installed]                                   | \$215 |
| RAM-Disk and Print Spooler software                         | \$ 55 |
| Mono-Graphics Video: Like Hercules, includes 132x44... swap | \$290 |

**COMPAQ**

|                                              |        |
|----------------------------------------------|--------|
| PORTABLE: 256K, 2 drives                     | \$2245 |
| PORTABLE "PLUS": 256K, 10MB                  | \$3550 |
| DESKPRO: #2 - \$2335 #3 - \$3895 #4 - \$5575 |        |

Compaq prices include green CRT.

**TECH/ADVICE (818) 344-6063**  
**SALES (800) 528-9537**

**GENERAL PERIPHERALS**

|                                                     |         |
|-----------------------------------------------------|---------|
| Anchor Automation Mark XII modem                    | \$ 245  |
| Backup Power 200W PFI 300W                          | \$ 275  |
| CA #P2 6-Plug Monitor Base                          | \$ 99   |
| C Itoh F-10-40 daisywheel                           | \$ 945  |
| F-10-55 55cps daisy                                 | \$1245  |
| Corona Laser Printer (8 sheets/min)                 | \$3250  |
| Dataproducts Prism 132C (200cps, color, dual model) | \$1325  |
| *8070 (400cps, tri-model)                           | \$1885  |
| Epson FX-80                                         | \$ 395  |
| FX-100 wide                                         | \$ 615  |
| LQ1500 w/int                                        | \$1275  |
| Hayes 1200 Smartmodem                               | \$ 485  |
| H-P Laserjet Printer                                | \$2895  |
| H-P Thinkjet Printer                                | \$ 445  |
| *Maxell 25 Disk Hamper w/key                        | \$ 19   |
| NEC PC8027 (PC8023 w/handle) printer                | \$ 365  |
| P2 Pinwriter w/int                                  | \$ 675  |
| P3 "w/int (wide)                                    | \$ 875  |
| Okidata 92P-1                                       | \$ 425  |
| 93P-1                                               | \$ 625  |
| Plotter/Digitizers Houston Instrument               | \$-1596 |
| Printonix P-300 w/Cen                               | \$1000  |
| P-600 w/Cen                                         | \$7100  |
| Prometheus Promodem 1200                            | \$ 355  |
| Options Processor                                   | \$ 75   |
| Q-4 "A-B" switch Serial                             | \$ 65   |
| "A-B" switch Parallel                               | \$ 85   |
| Star Micronics printers                             |         |
| Gemini 10-X matrix                                  | \$ 275  |
| Gemini 15-X wide                                    | \$ 385  |
| PowerType daisy, w/ ser and par                     | \$ 355  |
| Tractor                                             | \$ 55   |
| TAXAN #305 TV TUNER                                 | \$ 95   |

**PC PERIPHERALS**

|                                                  |        |
|--------------------------------------------------|--------|
| Amdek 310A amber CRT                             | \$ 169 |
| 710 RGB color                                    | \$ 565 |
| AST PC-Net II Starter Kit                        | \$ 795 |
| AST SixPAK + 64K                                 | \$ 265 |
| Co-Processor 8087 Std                            | \$ 165 |
| *DTC 5150BX hard disk controller                 | \$ 320 |
| Everex Graphics Edge                             | \$ 395 |
| 10MB Internal Hard Disk System                   | \$ 845 |
| FT 15 + 5 External                               | \$2750 |
| FT 33 + 5 External                               | \$3475 |
| SMB Cartridge                                    | \$ 95  |
| Genie 5 + 5                                      | \$2650 |
| *Genie 11 + 11                                   | \$3085 |
| 11MB Cartridge                                   | \$ 145 |
| Hayes 1200B w/Smartcom                           | \$ 435 |
| Hercules Graphics Card                           | \$ 335 |
| I-2 10MB tape                                    | \$ 835 |
| Tapes                                            | \$ 49  |
| IBM Keyboard                                     | \$ 95  |
| IOmega PC-20 dual removable                      | \$2875 |
| 10 MB cartridge                                  | \$ 68  |
| IRMA                                             | \$ 895 |
| Keytronic KB5151                                 | \$ 195 |
| Mouse w/Pop-up and Paint                         | \$ 145 |
| Orchid PC Turbo-186                              | \$ 995 |
| Blossom 64 w/PCNet                               | \$ 575 |
| Paradise Modular Graphics Bd                     | \$ 295 |
| "A" Module [P] [S] or [G]                        | \$ 90  |
| "B" Module [256K-64/C] [384K-64/C] or [Floppy/P] | \$ 235 |
| PC Replacement 100W Power                        | \$ 175 |
| PerSyst BoB w/Taxan #440                         | \$ 975 |
| PGS HX-12                                        | \$ 465 |
| SR-12 w/Scan Doubler                             | \$ 795 |
| MAX-12 amber                                     | \$ 180 |
| Phone Activated Power Module                     | \$ 175 |
| Prometheus Promodem 1200B w/soft                 | \$ 285 |
| RAM 64K (9 chips)                                | \$ 41  |
| RAM 256K (9 chips)                               | \$ 325 |
| *Sakata 13" RGB w/Optech Anti-Glare              | \$ 485 |
| Shipping Case                                    | \$ 350 |
| STB Graphix Plus II                              | \$ 355 |
| Tandon 100-2 dsdd                                | \$ 175 |
| TEAC 558 drive w/instructions                    | \$ 137 |
| Tecmar Graphics Master                           | \$ 475 |
| 5 MB Removable Disk                              | \$1475 |
| 3COM Etherlink                                   | \$ 595 |
| *Vertex Apple Turnover                           | \$ 265 |
| VoiceMail Dial/Log                               | \$ 465 |

**PC SOFTWARE**

|                                      |       |
|--------------------------------------|-------|
| Crosstalk XVI                        | \$135 |
| Remote                               | \$125 |
| *Transporter                         | \$195 |
| dBBase III                           | \$425 |
| dBBase II - III kit                  | \$145 |
| *DC-10: Flight Simulator PC or Sanyo | \$ 49 |
| Fancy Font                           | \$155 |
| *Fontrix                             | \$110 |
| Framework                            | \$425 |
| Framework Programmers' Reference     | \$ 23 |
| Harvard Project Manager              | \$285 |
| Kensington Remote Control            | \$155 |
| KnowledgeMan                         | \$355 |
| Lotus 1-2-3                          | \$310 |
| Lotus Symphony                       | \$455 |
| Lotus 1-2-3 to Symphony              | \$155 |
| Microsoft Fortran                    | \$245 |
| Microsoft Multiplan                  | \$145 |
| Microsoft WORD w/Mouse               | \$225 |
| *Morgan Trace-86                     | \$ 97 |
| Norton Utilities 2.01                | \$ 59 |
| Prokey 3.0                           | \$ 95 |
| Quaid Copy Write                     | \$ 50 |
| Quaid Disk Explorer                  | \$425 |
| *Quaid Zero Disk                     | \$ 75 |
| RBase 4000                           | \$295 |
| Clout                                | \$145 |
| TKI Solver                           | \$285 |
| Tutor Disk (DOS)                     | \$ 25 |
| Vertex XenoCopy Plus 2.0             | \$135 |
| XenoDisk                             | \$365 |
| *80Mate (Z-80 emulator)              | \$135 |
| Warner Desk Organizer                | \$195 |
| Wordstar Pro (newest)                | \$345 |
| *Zyindex 3td (1500 documents)        | \$125 |

**EPSON PX-8 GENEVA**

This is an extraordinary value in an 80-column "lap" computer. Includes Wordstar, spreadsheet, 8 line display, and cassette drive.

\$795

**64K RAM Sets**  
**\$37**

**Last Minute Software Selections**

|                                                                                                          |       |
|----------------------------------------------------------------------------------------------------------|-------|
| Borland Turbo Pascal - IBM                                                                               | \$45  |
| Borland Turbo Pascal - Sanyo 55X                                                                         | \$45  |
| Borland Turbo Toolbox - IBM                                                                              | \$45  |
| Borland Sidekick - IBM (no copy)                                                                         | \$45  |
| Borland Sidekick - IBM (copyable)                                                                        | \$75  |
| Unisource Venix-86 (tested compatible with Leading Edge computers, Orchid Turbo-186, and 3-COM networks) | \$785 |

**Star Micronics Powertype**

**20cps Daisywheel Printer**

This is easily a better buy than Brother, Dynax, Abati, Juki, and generally any other "under \$500" daisywheel.

- Parallel and Serial Interfaces
- Diablo ribbons and wheels
- Tractor is only \$59
- 13" Carriage
- 2 Software Modes, Gemini and Diablo
- 1 Year Warranty

**\$345**



**EXPERT COMPUTERS**

**TECH (818) 344-6063**  
**SALES (800) 528-9537**  
**EASYLINK 888647 IBM-USA**  
**17314 CRENSHAW BLVD.**  
**TORRANCE, CA 90504**

Circle 150 on inquiry card.

# CCT-4 SYSTEM SERIES

The latest CCT implementation of the new generation Intel 16-Bit Processor technology. This means extreme speed, unequalled power, and the ultimate in reliability, and of course, the innovators at CCT behind it.

This series in the CCT line exploits the speed and power of the Intel 80286 and Zilog Z-80H (8MHz), on the 286Z CPU board. This combination, along with CompuPro DMA controllers and I/O boards, yields a dramatic improvement in system throughput speeds, from basic CP/M operation, up to large powerful multi-user/multi-tasking machines. The CCT-4 represents the most advanced hardware presently available in a microcomputer to run the thousands of CP/M type software programs on the market, and with CONCURRENT DOS 8-16 and the CompuPro PC Graphics board (when available), all software written for the IBM PC machines. This series is for the serious business/scientific user.

**CCT-4A** State-of-the-art power in it's basic form. Consists of CCT-286Z CPU board, along with CompuPro: Enclosure 2 Desk (21 slot MF), Disk 1A, System Support 1, Interfacer 4, Ram 22 (256K), the CCT-2.4 floppy drive system, and CP/M 80 and CP/M 86 . . . . . **\$5,995.00**

**CCT-4B** Single-user/hard disk power. As the 4A, except priced without the CCT-2.4, to add in your choice of CCT hard/floppy combination drive subsystem, at the published pricing. . . . . **\$4,895.00**  
 (Example: CCT-4B Mainframe with CCT-10/1 = \$7,244.00) Plus cost of selected drive subsystem

**CCT-4C** Multi-user/hard disk power. As the 4B, with the CCT M512 (512K static RAM board) instead of RAM 22; Interfacer 3 instead of Interfacer 4; and the addition of the MP/M 8-16 operating system. (6 user system) . . . . . **\$6,695.00**  
 (Example: CCT-4C Mainframe with CCT-40/1 = \$10,044.00) Plus cost of selected drive subsystem

**NEW RAM BOARD!**

### CCT BONUS ON 4C: FREE CONCURRENT DOS UPDATE!

The above systems include all necessary cabling, assembly, testing, minimum 20 hour burn-in, and the CCT unconditional 12 month direct warranty.

**CCT-M512** CCT introduces it's 512K static RAM board. IEEE Standard 12MHz. 512K in one slot! **Introductory Price: \$2,249**

**CUSTOM COMPUTER TECHNOLOGY / BOX 4160 / SEDONA, ARIZONA 86340**

**TOLL FREE ORDERING: 800-222-8686 / For technical support / service: 602-282-6299**

## SUNNY LOW LOW COST POWER SUPPLIES (LINEAR & SWITCHING) FOR S-100, DISK DRIVES



### S-100 & DISK POWER SUPPLIES: OPEN FRAME, ASSY. & TESTED, 6 OUTPUTS, ADJU. & FUSES PROTECT.

| ITEM           | IDEAL FOR                                      | +5V OVP | -5 or -12V | +24 or +12V | +8V | +16V | SIZE W x D x H       | PRICE  |
|----------------|------------------------------------------------|---------|------------|-------------|-----|------|----------------------|--------|
| S <sub>3</sub> | 12 SLOT & 2 FLOPPY<br>(1 Floppy & 1 Hard Disk) | 5A      | 1A         | 5-7A PEAK   | 13A | 3A   | 10" x 6" x 5"        | 105.95 |
| S <sub>4</sub> | 6 SLOT & 2 FLOPPY                              | 4A      | 1A         | 4-5A PEAK   | 8A  | 3A   | 8 3/8" x 5" x 4 3/4" | 95.95  |

| ITEM           | IDEAL FOR                 | +5V OVP | -5 or -12V | +24 or +12V    | +8V Unreg. | +12V | SIZE W x D x H        | PRICE |
|----------------|---------------------------|---------|------------|----------------|------------|------|-----------------------|-------|
| R <sub>0</sub> | 2 x 8" SLIMLINE           | 2.5A    |            | 2.5A - 5A Peak |            |      | 5" x 4" x 4"          | 51.95 |
| R <sub>1</sub> | 2 x 8" or 2 x 5 1/4" DISK | 4A      | 1A         | 3A - 5A Peak   | 2A         |      | 8" x 4" x 3 3/4"      | 56.95 |
| R <sub>2</sub> | 3 x 8" (or 5 1/4") FLOPPY | 6A      | 1A         | 6A - 8A Peak   |            |      | 10" x 4 7/8" x 3 3/4" | 71.95 |
| R <sub>3</sub> | or 1x Floppy & 1x Hard    | 6A      | 1A         | 6A - 8A Peak   |            | 1A   | 9" x 6 1/4" x 4 3/8"  | 98.95 |

AC & DC POWER CABLES WITH CONNECTOR FOR 2 DRIVES 8.00

### S-100 POWER SUPPLY KITS (OPEN FRAME WITH BASE PLATE, 3 HRS. ASSY. TIME)

| ITEM  | (IDEAL FOR) | +8V | -8V | +16V | -16V | +28V | SIZE: WxDxH           | PRICE |
|-------|-------------|-----|-----|------|------|------|-----------------------|-------|
| KIT 1 | 15 CARDS    | 15A | --- | 2.5A | 2.5A | ---  | 12" x 5" x 4 7/8"     | 54.95 |
| KIT 2 | 20 CARDS    | 25A | --- | 3A   | 3A   | ---  | 12" x 5" x 4 7/8"     | 61.95 |
| KIT 3 | DISK SYSTEM | 15A | 1A  | 3A   | 3A   | 5A   | 13 1/2" x 5" x 4 7/8" | 69.95 |

### POWER TRANSFORMERS (WITH MOUNTING BRACKETS)

| ITEM           | PRIMARY | SECONDARY #1 | SECONDARY #2     | SECONDARY #3   | SIZE W x D x H           | PRICE |
|----------------|---------|--------------|------------------|----------------|--------------------------|-------|
| T <sub>1</sub> | 110/120 | 2x8 Vac, 15A | 28 Vac, CT, 2.5A |                | 3 3/4" x 3 3/8" x 3 1/8" | 22.95 |
| T <sub>2</sub> | 110/120 | 2x8 Vac, 25A | 28 Vac, CT, 3.5A |                | 3 3/4" x 4 3/8" x 3 1/8" | 28.95 |
| T <sub>3</sub> | 110/120 | 2x8 Vac, 15A | 28 Vac, CT, 2.5A | 48 Vac, CT, 2A | 3 3/4" x 4 3/8" x 3 1/8" | 30.95 |
| T <sub>4</sub> | 110/120 | 2x8 Vac, 6A  | 28 Vac, CT, 1.5A | 48 Vac, CT, 3A | 3 3/4" x 3 3/8" x 3 1/8" | 23.95 |
| T <sub>5</sub> | 110/120 | 2x8 Vac, 6A  | 28 Vac, CT, 2A   |                | 3" x 3" x 2 1/2"         | 15.95 |

SHIPPING FOR EA. PWR SUPPLY: \$5.50 IN CALIF.; \$8.00 IN OTHER STATES; \$18.00 IN CANADA. FOR EA. TRANSFORMER: \$5.00 IN ALL STATES; \$12.00 IN CANADA. CALIF. RESIDENTS ADD 6.5% SALES TAX.

**\* R<sub>1</sub> COULD BE FACTORY MODIFIED TO +5V 3A, +12V 2.5A and -12V 1A. PLEASE SPECIFY WHEN ORDERING.**

#### MAILING ADDRESS:

P.O. BOX 4296  
 TORRANCE, CA 90510  
 TELEX: 182558

#### SUNNY INTERNATIONAL

(TRANSFORMERS MANUFACTURER)  
 (213) 328-2425 MON-SAT 9-6

#### SHIPPING ADDRESS:

22129 1/2 S. VERMONT AVE  
 TORRANCE, CA 90502



**TOLL-FREE  
ORDERING:  
800-222-8686**

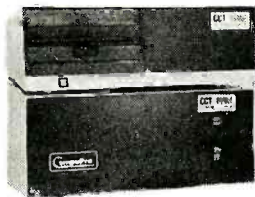
# CCT<sup>®</sup> CUSTOM COMPUTER TECHNOLOGY

**FOR TECHNICAL SUPPORT/  
SERVICE / IN ARIZONA:  
602-282-6299**

**1 CCT PLAZA — P.O. BOX 4160 — SEDONA, ARIZONA 86340**

Purchase your Hardware and Software directly from an OEM / Systems Integrator. Take advantage of our buying power! We stock a full line of Board Level Components, Software and Peripherals. Call for your needs. We'll give you the Lowest Prices, and the Technical Support and Know-How we are quickly becoming well-known for. Satisfied Customers Nationwide. The Nation's Custom Systems House for Business, Education and Science. Call for a system quote. CCT implements tomorrow's technology today!

**• FOREMOST QUALITY • ADVANCED SUPPORT • REASONABLE COST •**



## 80286 NOW!

- CCT-286Z is our modified version of the MI-286 dual processor board from Macrotech. It features a Z-80H and the Intel 80286, with socket for the 80287. Directly replaces 8085/88 under MP/M 8-16, at throughput increases of 3 to 5!
- Introductory price - \$1099.

**SEE THE NEW  
CCT-4 SYSTEM SERIES  
ON FACING PAGE**

## INDUSTRIAL GRADE SUPERIOR QUALITY CCT DISK DRIVE SYSTEMS ROLLS ROYCES OF THE INDUSTRY

### S-100 HARD DISK SUBSYSTEMS

Professionally engineered ST-506 type systems for the business market S-100 Computer user. Includes industry top quality drives, CompuPro Disk 3 DMA controller, all cabling, A&T, formatted, burned-in. Provisions for up to two hard disks in each system. We include operating system update. CP/M 80, CP/M 86, CP/M 8-16, MP/M 8-16, CP/M 68K. (1 Systems are CCT innovated hard/floppy combinations, with Mitsubishi DSDD 8" drive.) 12 month warranty.

|                                 |        |                 |        |
|---------------------------------|--------|-----------------|--------|
| CCT-10 (11 + MEG) .....         | \$1799 | CCT-10/1 .....  | \$2349 |
| CCT-20 (22 + MEG) .....         | \$2319 | CCT-20/1 .....  | \$2869 |
| CCT-40 (36 + MEG) .....         | \$2799 | CCT-40/1 .....  | \$3349 |
| CCT-60 (58 + MEG) (New) .....   | \$3999 | CCT-60/1 .....  | \$4549 |
| CCT-90 (87 + MEG) (New) .....   | \$5209 | CCT-90/1 .....  | \$5759 |
| CCT-125 (123 + MEG) (New) ..... | \$6399 | CCT-125/1 ..... | \$6949 |

Drive capacities shown are **after** formatting! We are working on tape cartridge back-up units.

### CCT-2.4 • Dual 8" DSDD FLOPPY SYSTEMS

Mitsubishi 2.4 Megabyte in Extra Heavy horizontal enclosure, removable filter air system, all cabling, A&T, Burned in. The fastest system available: ..... \$1229

### CCT-5 • 5 1/4" DSDD

IBM Compatible Tandon 320K. Extra Heavy Cabinet accommodates two drives, hard or floppy. All cabling, A&T, Burned-in. Perfect for our MS-DOS Package .... \$399

## ★ SUPER PRICES ★ COMPUPRO COMPONENTS ★ IN STOCK ★

|                                          |                                |                               |                                 |                       |
|------------------------------------------|--------------------------------|-------------------------------|---------------------------------|-----------------------|
| CCT-2 - \$6799                           | CCT-3 - \$6699                 | Disk 1A w/CP/M - \$619        | CPU 8086/87 - \$819             | M-Drive/H - \$1099    |
| CPU 8085/88 - \$349                      | CPU 8086 - \$559/10Mhz - \$599 | CPU 68K - \$519/10Mhz - \$639 |                                 |                       |
| CPU-Z - \$249                            | Disk 1A - \$519                | Disk 3 - \$499                | RAM 23/64K - \$309/128K - \$599 | RAM 21 (128K) - \$749 |
| ★ ★ RAM 16 CLOSE-OUT SPECIAL - \$249 ★ ★ |                                |                               |                                 |                       |
| RAM 22 (256K) - \$1,179                  | Interfacer 3 - \$459           | Interfacer 4 - \$349          | System Support 1 - \$329        |                       |
| Enclosure 2 Desk - \$649/Rack - \$699    | CP/M 80 (CCTHMX) - \$125       | CP/M 86 (CCTTMX) - \$175      |                                 |                       |
| CP/M 8-16 (CCTTMX) - \$199               | MP/M 8-16 (CCTSX) - \$499      | CP/M 68K (CCTCX) - \$279      |                                 |                       |

**16 Bit Upgrade Kit: CP/M 86, RAM 16, System Support 1, Cable \$709  CP/M 8-16 - Kit - \$733**

Operating System Updates/Remakes - \$30

**• FREE CONCURRENT DOS 8-16 UPGRADE (WHEN AVAILABLE) WITH PURCHASE OF MP/M 8-16 •**

### CCT-1 — ENTRY LEVEL S-100 BUSINESS SYSTEM

- Enclosure 2-Desk-20 Slot Mainframe
- CPU 8085/88 - 6Mhz 8085/8Mhz 8088
- Disk 1A - DMA Floppy Disk Controller
- RAM 16 - 64K Static RAM - 12Mhz
- Interfacer 4 - 3 Serial/2 Parallel I/O
- CCT-2.4-Dual 8" Mitsubishi DSDD Drive System - 2.4 Megabytes
- CP/M 80 - 2.2 HMx - CCT Modified
- All Cabling, Complete CCT Assembly, Testing, and Minimum 20 Hour Burn-in

**SPECIAL PRICE  
\$3,559**

**RUNS ALL STANDARD 8" CP/M SOFTWARE - INCLUDES OUR EXCLUSIVE 12 MONTH DIRECT WARRANTY**

### • 8" CP/M SOFTWARE SPECIALS •

|                                      |                     |       |
|--------------------------------------|---------------------|-------|
| dBASE II - Latest Version 2.4 .....  | \$349               |       |
| Supercalc 86 - for CP/M 86 & MP/M .. | \$ 99               |       |
| Wordstar .....                       | \$279 Pro-Pak ..... | \$379 |
| Microsoft BASIC ..                   | \$299 Compiler ..   | \$339 |
| Supersoft FORTRAN IV                 | \$339 C Comp        | \$399 |
| Peachtree Series 8 Modules .....     | each                | \$599 |

### • TOP SELLING PERIPHERALS •

|                                 |        |
|---------------------------------|--------|
| CCT-90K Parallel S-100 Terminal |        |
| Amber Screen - 90K Baud .....   | \$749  |
| Wyse 100-14" Green .....        | \$699  |
| Wordstar Prom Option .....      | \$ 75  |
| Wyse 50 .....                   | \$529  |
| 75 .....                        | \$609  |
| 200/300 .....                   | \$1069 |
| Visual 50 ...                   | \$599  |
| Televideo 925 ...               | \$749  |
| 950 .....                       | \$950  |
| 970 .....                       | \$1099 |
| Liberty Freedom 100 —           | \$479  |
| 200 —                           | \$679  |
| Okidata 82 —                    | \$329  |
| 83 —                            | \$619  |
| 84 —                            | \$899  |
| 92 .....                        | \$459  |
| 93 .....                        | \$719  |
| NEC 7710 .....                  | \$2150 |
| 7730 .....                      | \$2150 |
| Diablo 620 .....                | \$969  |
| 630 .....                       | \$1899 |

Prices & availability subject to change. All products new, and carry full manufacturer's warranties. Call for catalog. Free technical help to anyone. All products we sell are CCT individually tested and set up for your system - Plug-In & Go! Arizona residents add sales tax CCT<sup>®</sup> Trademark—Custom Computer Technology; MS-DOS<sup>®</sup> Trademark—Microsoft; IBM<sup>®</sup> Trademark—International Business Machines; CompuPro<sup>®</sup> Trademark—W.J. Godbout; CP/M<sup>®</sup> MP/M<sup>®</sup> Trademarks—Digital Research



**SUNTRONICS CO., INC.**  
12621 Crenshaw Blvd., Hawthorne, CA 90250

1-800-421-5775 (ORDERS ONLY) (213) 644-1140 (CA. Order & INF.)  
STORE HOURS : 9:00 a.m. to 6:00 p.m. (Mon.-Fri.) 10:00 a.m.-5:00 p.m. (Sat.)

**IBM XT Compatible**

**System I :** 2 Slimline DSDD, 128K RAM,  
1 Parallel Printer Port & Serial Port,  
Color Graphics Card, Monitor (Amber  
or Green) ..... **\$1,499.00**

**FREE!** Software (Personal Pearl : Data Base  
Management System)

**System II :** System I Plus 10MB Hard  
Disk Drive System ..... **\$2,399.00**

**Features:**

- ✓ Intel 8088 CPU
- ✓ Intel 8087 Math Co-Processor (Option)
- ✓ Expandable on-board to 256K
- ✓ 128K RAM w/Parity
- ✓ 8 IBM Compatible Expansion Slots
- ✓ 4 Channel DMA 8237
- ✓ 8 Channel Interrupt 8259
- ✓ Mother Board dimension same as IBM PC
- Mother Board w/128K RAM ..... **\$475.00**
- Computer Cabinet ..... **\$69.00**
- 83 Key full-funtion Keyboard ..... **\$120.00**
- 100 WATT Power Supply ..... **\$130.00**
- Monochrome Graphic Card  
w/Printer Port ..... **\$289.00**
- FDD Controller Card ..... **\$149.00**
- Parallel Printer Card ..... **\$59.00**
- ASYNC & RS232 Port ..... **\$75.00**
- 320KB DS/DD Slimline Disk Drive ..... **\$139.00**
- IBM Parallel Cable 10' ..... **\$19.95**
- IBM Prototype Board (SUN-208) ..... **\$9.50**
- MICROLOG Z-80B Co-Processor,  
Multi-funtion (Run CP/M80 Software,  
Require 64K RAM) ..... **\$499.00**
- Apparat EPROM Blaster ..... **\$129.00**
- IBM Up-Grade Kit (4164) ..... **\$35.00/per kit**

**Apple Compatible Products**

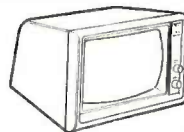
- SUN Z80 Card (w/o Software) ..... **\$55.00**
- SUN 80 Column Card (w/Soft switch) .. **\$97.00**
- Power Supply (5 Amp) ..... **\$59.95**
- Cooling Fan ..... **\$42.00**
- Parallel Printer Card ..... **\$39.00**
- Floppy Disk Controller ..... **\$47.00**
- EPROM Programmer (2716, 2732, 2764)  
..... **\$75.00**
- APPARAT PROM Blaster ..... **\$119.00**
- ALS Z-Card (Z80 CPU) ..... **\$149.00**
- ALS 80 Column Card ..... **\$159.00**
- AFDC-1 Floppy Disk drive Controller .. **\$55.95**
- Run DOS 3.3 with any standard Shugart  
compatible 5 1/4 Disk drive (2 drives per  
card, Does not read 1/2 track, Apple II &  
Apple II Plus)
- Apple Prototype Board (SUN-722) ..... **\$5.95**

**S-100 Products**

- 64K Static Memory Board (6116)  
w/o RAM A & T ..... **\$155.00**
- 64K Static Memory Board (6116)  
w/RAM A & T ..... **\$339.00**
- Uses 6116 CMOS RAMS, 1/2 Amp Max,  
w/64K @6MHz Extended Addressing, Bank  
Select 4-16K Blocks, 2716 EPROM can  
replace any 6116RAM, 8 Bit IEEE 696.
- UFDC-1 5 1/4 and 8 Floppy Disk Controller  
(BIOS available) A & T ..... **\$245.00**
- Clock/Calendar A & T ..... **\$115.00**
- Prototype Board (SUN-721) ..... **\$9.95**
- Mother Boards/Card Cages  
(6, 8 & 12 Slots) are available ..... **CALL**

**General Products**

**SAM WOO HIGH RESOLUTION DISPLAY**



- ✓ 22 MHz Bandwidth
- ✓ Composite Video
- ✓ Anti-glare Screen
- ✓ Passes FCC & UL Approved
- ✓ 1000 Lines or 132 Charactors Across
- 12" AMBER or GREEN ..... \$99.00**

**CHRISTMAS SPECIALS**

- ★ 10MB Hard Disk Drive (Internal)  
w/Controller for IBM PC. . . . **\$749.00**
- ★ 12" Green TTL Monitor  
(For IBM, 20MHz) ..... **\$135.00**
- ★ Personal Pearl (Data Base Management  
System) IBM Format ..... **\$99.00**
- ★ S-100 12 Slot Motherboard A & T . . . **\$55.00**
- Bare Board ..... **\$23.00**
- ★ IBM Prototype Board (SUN-208) . . . **\$9.50**
- ★ RAM 4164 (150ns) ..... **\$3.95**

TTLIC, ROM, RAM & CPU CHIPS, CONNECTORS &  
IC SOCKETS ARE AVAILABLE.

**TERMS :** VISA, MASTER Card, C.O.D (Cash or Certified  
Check Required). Check (Allow 2-3 WKS for Clearing) Ship-  
ping & H/C \$3.00 for 3 Lbs plus 50¢ for each add LB. Calif.  
residents add Calif. Sales Tax. \$10.00 Minimum Order.

IBM & Apple are registered trade marks of IBM  
& Apple

**WAVE MATE BRINGS MUSCLE TO YOUR  
IBM PC/XT WITH IT'S 80286 MOTHERBOARD**  
**BULLET-286 makes the XT perform with greater power and speed than the IBM PC/AT**

It's the new **BULLET-286** motherboard for the IBM PC/XT marketplace. This advanced-technology product utilizes the Intel microprocessor 80286 while maintaining both hardware and software compatibility with the IBM PC/XT. By simply replacing the existing XT board with our new **BULLET-286**, you get greater power and speed than the IBM PC-AT. Thus, existing PC/XT users can preserve their investment in hardware and software while moving a quantum leap beyond PC-AT performance.

The **BULLET-286** contains a 6 megahertz no wait state 80286 microprocessor in place of the XT's 4.77 MHz 8088. There is an 80287 math co-processor option, 8 IBM expansion slots, and enhanced ROM BIOS. The **BULLET-286** is equipped with 256K bytes of memory, expandable to 1 megabyte on-board.

The **BULLET-286** is compatible with the IBM PC/XT to a degree far beyond the IBM PC-AT

product. Application programs and operating systems (PC-DOS, CP/M, UCSD Pascal, Pick, Oasis, Unix-derivitives) available for the XT, can run without incompatibilities on the **BULLET-286**.

You can order now. The **BULLET-286** is available with 256K RAM, with options to 1 full megabyte. Prices start at \$1,995.

Quantity discounts available. OEM and dealer inquiries welcome.

**APOLLO MARKETING**

(a division of Cal. Digital)

22048 Sherman Way #316  
Canoga Park, CA 91303  
Tel: (818) 883-8390  
Telex: 194369

In Europe call: Brussels 32 2 649-1070

# This October, 1983 ad



pulled 2,391  
sales leads.  
On page 489.

This is not an exception. In the same issue on page 409, WYSE Technology's ad generated 1,792 inquiries and the Prometheus ad – way back on page 495 – garnered 1,588.

Advertisers in BYTE receive an average of over 1,000 inquiries per page of advertising, an average of 1,300 for full-page or larger ads. And not just in special, front-of-the-book positions, but all through the pages of BYTE.

Why? Because more than 400,000 high-tech computer sophisticates pay to read BYTE – cover to cover every month – for the microcomputer information they want and need. They'll send advertisers over 6 million ad inquiries this year, and over a half a million BYTE readers will buy products from ads they've seen in BYTE.

Including yours.

Talk to us – we're the people who wrote the book on microcomputer marketing. Just call Pete Huestis, Advertising Sales Manager, at (603) 924-9281.

**BYTE** THE INTERNATIONAL STANDARD



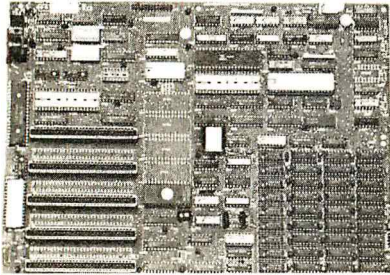
BYTE is published monthly by McGraw-Hill, Inc., with offices at 70 Main St., Peterborough, N.H. 03458

# YEAR END SPECIAL ON I.B.M. P.C.

## Enhance your I.B.M. For Less

Complete CPU Board with 64KB Memory, Serial Port, Parallel Port.  
Runs DOS, CPM/86 and more..... **\$399**

Assembled complete: Chassis with Cover, Fan, Power Supply, Filter,  
AC Outlet, Power Cord, Speaker..... **\$399**



- Power Supply 135 Watts . \$189
- Floppy Drive Controller . \$ 99
- Monochrome Card . . . \$129
- Color Graphics Card . . . \$149
- RAM Chips kit 64K . . . . \$ 39
- I.B.M. Compatible
- Keyboard . . . . . \$ 99
- P.C. DOS 2.1 . . . . . \$ 60
- A.S.T. Multifunction board Call
- Epson FX-100 . . . . . Call
- TEAC 55B . . . . . \$149
- Tandon TM 100-2 . . . . . \$179
- P.G.S. HX-12 . . . . . \$469



**IBM**  
PERSONAL  
COMPUTER

**Special  
of the  
Month!**

### IBM PC® COMPLETE LINE

256K RAM, 360KB Disk Drive, FDC, Video  
Monitor & Adaptor 10MB Hard Disk  
Sub-System ..... **\$2795**

Hard Disk for IBM PC Complete Sub-  
System Internal 10MB H, Winchester  
Drive ..... **\$775**

IBM PC 256K, Floppy Controller, 2 Disk  
Drives 320 KB Each, Monochrome Card  
Monochrome Monitor ..... **\$1895**

## Scientific Research Corp.

17895 Skypark Circle / Suite E • Irvine, CA 92714

**714/ 261-9137**

IBM PC is a registered trademark of IBM Corp.  
CPM/86 is a registered trademark of Digital Research, Inc.  
MS DOS is a registered trademark of Microsoft Corp.  
TEAC is a registered trademark of TEAC Corp.  
Taxan is a trademark of Taxan Corp.

All transactions subject to COD, Cashier Check or Prepaid  
Prices and Availability subject to change without notice.

*Warm Wishes  
for a Joyous  
Holiday Season*

**BYTE**

# Micro Products

Terms: We accept Visa, M/C, Pre-Pay by Check or Money Order. COD's are accepted by Telephone & Mail. COD Terms are: Cashier's Check for first time orders over \$100.00  
**714/898-0840**

# Merry Xmas Specials

**We Cater to IBM™ Dealers**  
**★ Hardware ★ Software**  
**★ Training Tapes**  
**Call for our Catalog now!**

## Stop Wasting Multi-Part Forms & Checks!

This Fantastic New Product has Feed Sprockets **BELOW** the Print Bar! This means you can print **ONE** check and tear off without feeding into the middle of the next one. It should pay for itself the first year in saved Forms.



- Print Speed: 150 cps
- Matrix: 9 x 9 • Lines/inch: 6 or 8
- Input Buffer: 400 (3K optional)
- Characters per Line: 136 • Copies: 6
- PRI-5550-00 ..... \$1650.00

## XPC-XT / IBM-PC KEYBOARDS

Keyboards with the Touch you have been searching for! (Even nicer than IBM!) L.E.D. indicator for CAPS and NUM Lock. Choose IBM type or Selectric Keyboard layout.



- KEY-1050-00 IBM ..... \$89.00\*
- KEY-1024-00 Selectric ..... \$195.00

## ADD-ON POWER SUPPLY

Power Supply with Fan and Power Filter. Uses 140 watts, runs Hard Disk & Tape Back-Up. IBM Replacement type for Hard Disk.



- New High Velocity Fan!**
- New Low Priced**
- POW-1040-00 ..... \$129.00\*

## IBM STYLE MOTHERBOARDS

Two IBM-style Motherboards to choose from, 5-slot and 8-slot. Both expandable to 256K. 5-slot has two serial slots and one parallel.



BOA-6000-00 5-Slot ..... \$395.00

BOA-6058-00 8-Slot ..... \$395.00

## POWER BACK-UP

Protect your Data with Datashield® in case of a Power failure. Datashield® is a battery operated, self-contained Power Generator which instantly supplies even uninterrupted AC Power to a Microprocessor in the event of a Power Drop or Outage. In addition provides Surge Protection, which filters and eliminates voltage spikes (surges) above 140 VAC.



- PC-200 200 watts ..... POW-2000-00 \$329.00
- PC-300 300 watts ..... POW-2050-00 \$495.00

## Do it Yourself!

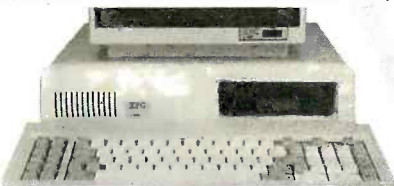
Think of this System as a "Do it Yourself" System. Start by choosing 5 or 8 Slots. Some of the standard Features: • 64K RAM expandable to 256K • 4 DMA Channels • Runs MS-DOS™ and CP/M-86™ (software not included) • Multi-function Keyboard & Cable • Hard Disk Ready Power Supply • Serial Ports • Parallel Ports • And MORE! ..... SYS-8000-00 Only \$895.00



- 5 Slot ..... CAB-3060-00 \$65.00\*
- 8 Slot ..... CAB-3075-00 \$65.00\*

## This is OUR Junior!

This "Driveless" workstation for low-cost networking. Features: • 4-slot IBM™ compatible Motherboard • 128K Standard Memory • 8088, 8087 Math Coprocessor • Optional Floppy Drive with Controllers. S-8100-00 ..... \$475.00  
 System w/Keyboard, Mono Monitor, Video Display Card, 128K RAM ..... SYS-8725-00 \$895.00



## \$1245 \* \$1245 \* \$1245 \* Complete System! XPC by XOR

**NEW IBM "AT" 1.2M Floppy In Stock - For your XPC! Can Read 3.0 or 2.1 DOS Formats! \*OEM Qty 11+**



10 Meg H.D. Complete System! \$1895.00\*

20 Meg Color Complete System! \$2375.00\*

40 Meg w/Tape Complete System! \$2845.00\*

- Software**
- BASICX
  - WORDX
  - COMX

### Standard Features:

- Full-Size, Feather-Touch, Capacitance Keyboard with 10 Function Keys and Calculator-Type Numeric Keypad
- Comes Standard with Parallel and Serial I/O
- 5 IBM compatible expansion slots
- 256K parity checked RAM on Motherboard
- Up to 32K of EPROM (full 8K supplied)
- Power Supply is Hard-Disk-Ready, no need to add-on additional power
- 2-Streamline 5 1/4" DS/DD 48 TPI 360K Drives
- Operating System Software Rebate
- DOS BIOS on EPROM
- 8088 16-bit CPU • 4 DMA & 3 Timer channels
- Supports PC-DOS - MS-DOS - CP/M-86
- High resolution 12" Monitor with Green Screen - 18 MHz bandwidth

## Add-On H.D. & Tape



10 Megabyte Irwin on the bottom, your choice of Hard Disk on the top. Super appearance! Requires one slot in your PC for SASI interface and an extension connector on the floppy card. Everything else is supplied by us.

- 10 Meg \$1295\*
- 20 Meg \$1495\*
- 40 Meg \$1995\*
- 65 Meg \$2895\*
- 105 Meg \$3695\*
- 140 Meg \$4595\*

## Add-On Hard Disk

Two ways to go. The internal system is cheaper because it does not need a P/S & Chassis. The same P/S & Chassis can be used for a 10 Meg Tape Back-up on your XT!

- 10 Megabyte \$795 int/\$995 ext
- 20 Megabyte \$1095 int/\$1295 ext
- 40 Megabyte \$1595 int/\$1795 ext
- 65 Megabyte \$2495
- 105 Megabyte \$3295
- 140 Megabyte \$4195

## Add-On 10 Meg Tape



If your IBM-XT needs a little help in the Back-up category, you won't be able to beat this price! Cables, software and everything - All for one low price!

SUB-8300-00

\$495.00\*

# Not enough room here - Call for Catalog

## December Dealer Honors



### ★★ Clinetics ★★

- R:dvm BASE III
- Custom Veterinary Software
- Designed by Veterinarians
- Interprets 10 Species
- 1 Meg Object Code supplied

more than 70 separate functions. It is the ONLY program which helps Veterinarians diagnose Animal diseases.

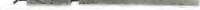
R:dvm BASE III takes full advantage of the Intel® family of microprocessor chips. It is compatible with all IBM PC and IBM compatible hardware including the new "AT."

Bob Cowden says, "The response to our Program has been overwhelming. To assure our supply of high-quality components, Clinetics endorses Micro Products. We evaluated many vendors and Micro Products alone provided Clinetics with consistently high-quality products at a reasonable price AND the best Warranty in the Industry - One Year Parts and Labor. As we expanded to meet the demand from Veterinarians, Micro Products expanded their lines of hardware to include ANS and remote terminals - ALL from one source!"

991 Dow Avenue, Tustin, California 92680 (714) 544-7991

## PROM LASER

This is the One! Our PROM Burner allows reading, storing-to-disk, recalling, and burning. Hi-speed algorithms burns 2764 in 45 seconds! Also handles 2716, 2732, 27128, 27256. Features: Zero insertion force sockets; On-board Voltage Generator; No Interference with normal computer operations. BOA-8640-00 ..... \$199.00



## 300 / 1200 BAUD MODEM

Does your computer communicate? If not, get one of ours - it's by *Quibie*! This little jewel mounts in the Short-Slot in your PC. Includes: Phone jack cables, PC Talk III Software, One Year parts and labor warranty, and a manual. BOA-8725-00 ..... \$289.00

Optional Async Com Port circuitry and connector. BOA-8726-00 ..... \$ 20.00



## ADD-ON MEMORY

This single Card will enable you to expand the smallest 64K PC to its full \*640K limits in increments of 64K. Includes RAM Disk and PrintSpool software and runs DOS 1.1 and 2.0 with no wait states. BOA-8650-00 ..... \$149.00



- \* Additional 64K Memory Chips
- ICC-7801-00 - (9) ..... \$ 35.00

## SAVE \$\$\$ ON CABLES



These three most popular Cables represent about a 50% savings over the best prices anywhere else. Fully shielded FCC type to fit IBM style computers.

- Serial 36" ..... CBL-8300-00 \$25.00
- Parallel ..... CBL-8305-00 25.00
- Kybrd Ext 6' ..... CBL-8310-00 7.95
- Kybrd Ext 9' ..... CBL-8312-00 8.95

## COLOR / MONOCHROME GRAPHICS

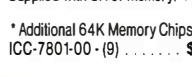
Full IBM compatibility. Parallel Port fits in XT "Short Slot". Features 320 x 200 Color graphics and 640 x 200 B/W graphics. BOA-8400-00 ..... \$245.00

Offers both text and graphics modes. Resolution 720x348v - Text mode 80 x 25. Features Blinking, Reverse video, Underline and includes Parallel Port, 64K RAM Screen Buffer and 2732A character generator. BOA-8500-00 ..... \$155.00



## SUPER 12 PAK MULTI-FUNCTION

This one is loaded! Two (2) IBM™ compatible Joystick Ports, Real-Time Chronograph / Calendar with Battery Back-up, Parallel Port, RS232-C Serial Port, \*64K to 384K of Parity-checked Memory, PrintSpool and RAM Disk Software. Supplied with OK of Memory. BOA-8680-00 ..... \$179.00



- \* Additional 64K Memory Chips
- ICC-7801-00 - (9) ..... \$ 35.00

Circle 261 on inquiry card.

**Micro Products • 15392 Assembly Lane • Huntington Beach, CA 92649 • 714/898-0840**

**8086  
8088**

**AMX**

8080  
280  
6809

### Real-Time Multitasking Executive

- ROMable (< 3K)
- No royalties
- Source code included
- Language interfaces
- Low interrupt overhead
- Inter-task messages

Options:

- C, Pascal, PL/M, Fortran interfaces
- CP/M-80 BDOS interface
- IBM PC DOS interface
- Extended memory (> 64K)
- Configuration Builder Utility
- Resource Manager
- Buffer Manager
- Integer Math Library
- Real-Time CLibrary

AMX, AMX86, Real-Time Care™ of KADAK Products Ltd. 25015 TM of Zilog Corp. CP/M-80 is TM of Digital Research Corp. IBM, PC DOS are TM of IBM Corp.

**KADAK Products Ltd.**  
206-1847 W Broadway  
Vancouver, B.C., Canada  
V6J 1Y5  
Telephone: (604) 734-2796  
Telex: 04-55670

AMX (for 8080) \$800 U.S.  
(for 6809) \$950 U.S.  
(for 8086) \$950 U.S.  
Manual only \$ 75 U.S.  
(specify processor)

Circle 213 on inquiry card.

**ONLY  
\$49.95**

Regular  
\$99.95

**Back Chair** is designed to help relieve stress on your spine and back muscle after long periods of sitting. Designed by medical experts, **Back Chair** is ideal for computer users. Made of multilayer hardwood with soft-cushioned seat and leg support. Try it, you'll like it!

Send check or money order to:  
**O.E.I. P.O. Box 53259, San Jose, CA 95153 Tel. (408) 370-6699**

Add \$9 for shipping and handling  
California residents add 6.1% Sales Tax

Circle 296 on inquiry card.

**BASF** qualimetric

**FlexyDisks®**

**5 1/4"**

Specify soft, 10 or 16 sector Minimum Order 20

Single side double density **1.35 ea.**

Double side double density **1.65 ea.**

**Hard sectors in Library box only add .15.**  
Certified Check - Money Order - Personal Check. Allow up to 2 weeks for personal checks to clear. Add \$3.00 per 100 or part to each order for U.P.S. shipping charges. NJ Residents add 6% sales tax.

**DATA EXCHANGE, INC.**

178 Route 206 South, P.O. Box 993  
Department C  
Somerville, N.J. 08876 • (201) 874-5050

Circle 108 on inquiry card.

## BLUE BOOK

Prices shown for thousands of computers, software, and peripherals.

Each listing includes suggested list, avg. retail, wholesale, and used prices for all the geographical regions of the United States.

Send \$12.95 + \$.50 postage to:

**NCDA**  
National Computer Dealers Association  
5420 Hwy. 6 North  
Houston, Texas 77084

Circle 66 on inquiry card.

## TAX PAK

TAX PROGRAM WITH:

| Forms                    | Schedules                 |
|--------------------------|---------------------------|
| 1040 Tax Return          | A Itemized Deductions     |
| 1040A Short Form         | B Interest & Dividends    |
| 2106 Employee Bus. Exp.  | C Business Profit or Loss |
| 2119 Sale of Residence   | D Capital Gains           |
| 2441 Child Care          | E Supplemental Income     |
| 3468 Investment Credit   | G Income Averaging        |
| 3903 Moving Expense      | SE Self Employment        |
| 4562 Depreciation        | W Married Cpl. Both Work  |
| 4684 Casualties & Thefts |                           |
| 5696 Energy Credit       |                           |

Formats: 8" CPM 2.2 IBM 3740 IBM PC-DOS

Suitable for multiple clients or evaluating alternate filing strategies. Produces transcribable IRS forms. \$33 for 1985 edition, return 1984 serialized disk and \$27.

**CANDELARIA WORKS**  
3955 Club Dr. Atlanta, GA 30319  
404/266-8759  
To order call toll-free  
**800-621-5839**  
Visa/MasterCard accepted

Circle 52 on inquiry card.

AVAILABLE WITH XYZ CARTESIAN AND POLAR SOFTWARE

## THE FORTH ROBOT

THE ROBOT THAT MIMICS THE BIG BOYS' IDEAL FOR ROBOTIC EVALUATION AND ROBOTIC USE

**CYBER 310 \$1399**

- Simple user interface in ENGLISH
- Supplied with step-by-step operating literature
- 5 degrees of freedom plus grip. Size and action like the human arm. Lift capacity, nominally, 1/2 lb.
- Speed and acceleration under user control
- Complete and ready to run when connected to a computer.
- Works with Acorn BBC, Vic 64, Apple and others.

Details from  
**Acorn Computers Corporation**  
400 Unicorn Park Drive, Woburn, Massachusetts 01801  
(617)-935-1190

Circle 102 on inquiry card.

## IBM-PC \$1699

256 K 2 DS/DD DRIVES

Other Configurations Available

EPSON FX-80/100... Best Price  
OKIDATA 92P/93P... Best Price  
BROTHER HR-15 ..... \$395  
HR-25 ..... \$690  
P.G.S. MAX-12 ..... \$175  
HX-12 ..... \$459  
TANDON (360 K) ..... \$155  
TEAC 55B (360 K) ..... \$132

We carry a large selection of hardware and software

**CALL US**

**COMPUTERLANE UNLTD. INC.**  
Exporting Div. Telex: 662841 SK COMP  
(818) 884-8644 HOURS DAILY  
22107 Roscoe Blvd. 10-7  
Canoga Park, CA 91304  
We Accept C.O.D. - P.O. - L.C.

Circle 89 on inquiry card.

## FOXBASE II™

Interpreter / Compiler

- dBASE II® source compatible
- Runs 3-20 times faster than dBASE II
- Up to 48 fields per record
- Full type-ahead capabilities
- Provides compact object code and program security
- Twice as many memory variables as dBASE II
- Sophisticated online manual and HELP facility

MS-DOS \$395 AOS/VS \$995

dBASE II is a registered trademark of Ashton-Tate

**FOX SOFTWARE INC.**  
13330 Bishop Road, P.O. Box 269  
Bowling Green, OH 43402 / 419-354-3981

Circle 159 on inquiry card.

**ICs PROMPT DELIVERY!!!**  
SAME DAY SHIPPING (USUALLY)

| DYNAMIC RAM |        |        |         |
|-------------|--------|--------|---------|
| 256K        | 256Kx1 | 120 ns | \$24.47 |
| 256K        | 256Kx1 | 150 ns | \$22.47 |
| 64K         | 64Kx1  | 120 ns | 3.87    |
| 64K         | 64Kx1  | 150 ns | 3.67    |
| 64K         | 64Kx1  | 200 ns | 3.56    |
| EPROM       |        |        |         |
| 27256       | 32Kx8  | 300 ns | \$45.97 |
| 27128       | 16Kx8  | 300 ns | 13.67   |
| 27C64       | 8Kx8   | 200 ns | 22.50   |
| 2764        | 8Kx8   | 250 ns | 6.50    |
| 2732        | 4Kx8   | 250 ns | 6.37    |
| 2716        | 2Kx8   | 450 ns | 3.50    |
| STATIC RAM  |        |        |         |
| 6264P       | 8Kx8   | 150 ns | \$23.67 |
| 6116P       | 2Kx8   | 150 ns | 4.37    |

Open 6 1/2 days: We can ship via Fed-Ex on Sat.  
MasterCard/VISA or UPS CASH COD  
Factory New, Prime Parts JIP  
MICROPROCESSORS UNLIMITED  
24100 South Peoria Ave (918) 267-4961  
BEGGS, OK 74421

Prices shown above are for November 3, 1984  
Please call for current prices & volume discounts. Prices subject to change. Please expect higher prices on some parts due to world wide shortages. Shipping and insurance extra. Cash discount prices shown. Small orders received by 6 PM C.S.T. can usually be delivered to you by the next morning, via Federal Express Standard Air @ \$6.75!

QUANTITY ONE PRICES SHOWN

Circle 263 on inquiry card.



# HOW TO AVOID THE CHRISTMAS RUSH

Christmas is coming and everyone is hurrying to take advantage of the end of the year bargains. As the malls fill to overload capacities and traffic jams are as common as mistletoe, your local computer store will become even more of a zoo. Why not have a cool Christmas and shop with the experts at PROGRESSIVE. Choose from literally hundreds of the newest and finest product lines available, and at prices that would put a smile on Santa's face. A call is all it takes to have your sleighfull of PC goodies delivered to your door, quicker than Donner and Blitzen. Let the experts at PROGRESSIVE take the rush out of Christmas. **CALL US NOW AT 1-800-446-7995 and we'll show you why we're called PROGRESSIVE.**

**✓ PRICE    ✓ STOCK    ✓ SERVICE    ✓ SUPPORT**

## NEW IBM PC PRICES!!

|                                                                                       |        |
|---------------------------------------------------------------------------------------|--------|
| IBM PC w/256K, 2 360K drives, controller, Monochrome/ Printer adapter, Amdek 310A     | \$2195 |
| IBM PC w/256K, 2 360K drives, controller, Color/Graphics adapter, HX-12 color monitor | \$2495 |
| IBM PC w/256K, 2 1/2 ht. 360K drives, controller, 10MB hard disk w/auto boot          | \$2795 |

(These systems are brand new, fully tested and burned in, fully warranted for 90 days AND ARE ALWAYS IN STOCK!)

**Disk Drives For Less:  
TANDON TM 100-2 ...\$179**

**HALF HEIGHTS** each \$149

## Printers:

### NEW EPSON & OKIDATA PRICES!!!

|                                                         |                 |
|---------------------------------------------------------|-----------------|
| EPSON JX-80 (160cps, 10", 8 colors)                     | BEST PRICE      |
| EPSON FX-80 (160cps, 10")                               | \$425           |
| EPSON FX-100 (160cps, 15")                              | \$625           |
| EPSON RX-80 (100cps, 10")                               | \$245           |
| EPSON RX-80F/T (100cps, 10" w/platten)                  | \$295           |
| EPSON RX-80F/T PLUS (100cps, 10" w/platten, near LQ)    | \$295           |
| EPSON RX-100 (100cps, 15" while they last)              | \$425           |
| EPSON LQ-1500 (LQ dot matrix w/ parallel interface)     | BEST PRICE      |
| OKIDATA ML92 (160cps, 10")                              | NEW LOW PRICE   |
| OKIDATA ML93 (160cps, 10")                              | NEW LOW PRICE   |
| OKIDATA ML84 (200cps, 15")                              | \$795           |
| OKIDATA PACEMARK 2410 (350cps, 15")                     | \$1995          |
| GEMINI 10X (120cps, 10")                                | \$275           |
| GEMINI 15X (120cps, 15")                                | \$395           |
| DATAPRODUCTS 8010 (180cps, dot matrix, 10")             | CALL            |
| DATAPRODUCTS 8020 (180cps, dot matrix, 15")             | CALL            |
| DATAPRODUCTS 8050 (200cps, dot matrix, 15")             | BEST PRICE      |
| DATAPRODUCTS 8070 (400cps, dot matrix, 15", LQ)         | BEST PRICE      |
| TOSHIBA P1340 (LQ dot matrix, 10")                      | \$745           |
| TOSHIBA P1351 (LQ dot matrix, 15")                      | \$1295          |
| TI-855 (LQ dot matrix w/ont cartridge)                  | PRICE REDUCTION |
| DIABLO 630API (40cps LQ)                                | \$1595          |
| DIABLO 630ECS (192 chars on wheel)                      | \$1995          |
| NEC 2050 (Durable, low cost LQ)                         | BEST PRICE      |
| NEC 3550 (33cps LQ)                                     | NEW LOW PRICE   |
| NEC 7730 (55cps LQ)                                     | NEW LOW PRICE   |
| NEC 8850 (Fast LQ from the people who set the standard) | CALL            |
| C.ITOH A10 (New letter quality)                         | CALL            |
| C.ITOH STARWRITER (40cps LQ)                            | \$1025          |
| C.ITOH PRINTMASTER (55cps LQ)                           | \$1325          |
| QUME LETTER PRO 20 (New, nice)                          | CALL            |
| QUME SPRINT 1140 (40cps LQ)                             | CALL            |
| QUME SPRINT 1155 (55cps LQ)                             | CALL            |
| BROTHER HR-15 (13cps LQ, 10")                           | \$395           |
| BROTHER HR-25 (23cps LQ, 15")                           | \$675           |
| BROTHER HR-35 (32cps LQ, 15")                           | \$895           |
| COMREX, DYNAX PRINTERS                                  | CALL            |

**CALL FOR ADD-ON TRACTORS & CUTT FEEDER SHEETS**

## Hard Disk Drives:

|                                                |        |
|------------------------------------------------|--------|
| PEACHTREE PERIPHERALS 10MB internal & external | CALL   |
| EVEREX 10MB internal                           | CALL   |
| MAYNARD 10MB internal                          | CALL   |
| MAYNARD 30MB internal                          | \$2195 |
| MITSUBISHI (10MB & 25MB w/tape)                | CALL   |
| SYSGEN 10MB HARD DISK (w/tape back up)         | \$2395 |
| SYSGEN 20MB HARD DISK (w/tape back up)         | \$2895 |
| SYSGEN IMAGE 10 minute XT tape back up         | \$795  |

**CALL FOR TECMAR, DAWG, AND TALLGRASS PRICES**

## Multifunction Boards:

|                                                |            |
|------------------------------------------------|------------|
| EXPANDED QUADBOARD (64K-384K, S,P,G,C/bracket) | \$269/459  |
| AST 6-PAK (64-384K, S,P,C,opt G)               | \$269/459  |
| AST MEGAPLUS (64-512K, S,C,C,opt S,P,G,K)      | from \$269 |
| AST 1/0 PLUS (S,C,C,opt S,P,G)                 | from \$139 |
| ORCHID BLOSSOM (64-384K, S,P,C, opt PC Ne)     | from \$249 |

|                                                     |            |
|-----------------------------------------------------|------------|
| TECMAR CAPTAIN (64-384K, S,P,C/C)                   | from \$259 |
| BABY BLUE I (64-256K, Z80B, 2S, P,C/C)              | from \$429 |
| PERSYST Time Spectrum (64-384K, S,P,c/c, 2yr. wnty) | \$279      |
| PROFIT RAM ELITE & PLUS (64-512K, 2S or S&P/C/C)    | CALL       |
| MAYNARD SANDSTAR MODULAR BOARDS                     | CALL       |

## Modems:

|                                            |            |
|--------------------------------------------|------------|
| HAYES 300 baud external                    | \$209      |
| HAYES 1200 (300 or 1200 baud external)     | \$469      |
| HAYES 1200B (300 or 1200 baud int w/soft)  | \$399      |
| HAYES Compatibles                          | CALL       |
| SIGNALMAN MARK 12 (1200 baud at 300 price) | \$259      |
| VENTEL HALF CARD                           | BEST PRICE |

## Display Cards:

|                                                            |       |
|------------------------------------------------------------|-------|
| EVEREX GRAPHIC EDGE (Simult color & mono, w/dports & more) | \$399 |
| TSENG UltraPAK (132 mono, S, P, C/C, opt RAM, FDC, color)  | \$439 |

|                                                                                     |            |
|-------------------------------------------------------------------------------------|------------|
| PARADISE MODULAR GRAPHICS CARD (Color/graphics in mono with modular ports options!) | from \$339 |
| PERSYST BoB (finally clear text on a color monitor)                                 | CALL       |
| STB GRAPHX PLUS II (Mono, color, par)                                               | \$369      |
| PROFIT MULTIGRAPH (Mono, color, opt par)                                            | \$369      |
| TECMAR GRAPHICS MASTER (640x400 + mono)                                             | \$489      |
| QUAD COLOR I (Upgrades to hires w/QuadcolorII)                                      | \$199      |
| HERCULES COLOR CARD (New from old faithful)                                         | \$189      |
| AST MonoGraphPlus (LOTUS mono, serial, parallel, clock)                             | \$399      |
| PLANTRONICS Colorplus (Hi/res w/color magic)                                        | \$379      |

## Monitors:

|                                                     |             |
|-----------------------------------------------------|-------------|
| AMDEK COLOR 710 (No glare, no flicker ultra hires)  | \$579       |
| AMDEK COLOR 700 (New ultra hires RGB)               | \$495       |
| AMDEK COLOR 600 (New hires RGB w/audio)             | \$429       |
| AMDEK 300 A and G (Amber or green)                  | \$149/\$139 |
| AMDEK COLOR 500, 400, 300 (New hires RGB)           | CALL        |
| AMDEK 310A (Amber, dark non-glare tube)             | \$169       |
| PGS SR-12 (690x480 non-interlaced)                  | \$599       |
| PGS HX-12 (690x480 interlaced)                      | \$479       |
| PGS MAX-12 (720x350 mono)                           | \$189       |
| WYSE 50,75,100 TERMINALS (Programmable funct. keys) | CALL        |
| TAXAN, NEC, ZENITH MONITORS                         | CALL        |

**Chips (Always in stock):**  
64K RAM CHIP MEMORY UPGRADE (set of 9) full 90 day warranty **\$39**  
WE ARE CHIP BROKERS, ASK FOR QUANTY PRICES

## Networks:

ORCHID PC NET PLUS NODE CARDS . . . . . BEST PRICES-CALL  
OTHER BRAND NAMES AVAILABLE. WE CARRY ONLY THE BEST

## Miscellaneous:

|                                                  |             |
|--------------------------------------------------|-------------|
| ORCHID PC TURBO (80186 coprocessor-runs at 8MHz) | CALL        |
| INTEL 8087 (High speed math coprocessor)         | \$169       |
| KEYTRONIC 5151 KEYBOARD (Sep. cursor keys)       | \$199       |
| MOUSE SYSTEMS (Optical mouse, runs LOTUS)        | \$139       |
| MICROSOFT SERIAL OR BUS MOUSE (w/software)       | \$139       |
| ISOBAR SURGE PROTECTORS (4 & 8 plug)             | \$49/\$69   |
| POWER BACK-UP (200 & 425 watts)                  | \$269/\$499 |
| MICROFAZER (8-128K print buffer)                 | from \$139  |
| BRET SALTER'S new debug board w/soft ware        | CALL        |

## Verbatim Diskettes:

|           |           |       |
|-----------|-----------|-------|
| SS/DD Box | \$24-Case | \$199 |
| DS/DD Box | \$29-Case | \$249 |

## Software:

|                                            |                 |
|--------------------------------------------|-----------------|
| SYMPHONY (New from LOTUS)                  | BEST PRICE-CALL |
| FRAMEWORK (New from ASHTON-TATE)           | BEST PRICE-CALL |
| MULTIMATE (Emula es WANG dedicated WP)     | \$279           |
| SAMNA WORD III ("Ultra-WANG")              | \$295           |
| WORDSTAR PRO-PAK (WS/Cs/MM/SI/Tutor)       | \$279           |
| MICROSOFT WORD w/MOUSE (4th generation WP) | \$289           |
| VOLKSWRITER DELUXE w/Tex merge             | \$179           |

|                                                    |                   |
|----------------------------------------------------|-------------------|
| BANK STREET WRITER                                 | \$59              |
| EASYWRITER II SYSTEM (-writer, -speller, -mailier) | CALL              |
| SUPERCALC 3 (Better graphs than LOTUS)             | BEST PRICE        |
| PFS Write, File and Graph                          | each \$99, Report |
| OPEN ACCESS (Proven Integrated Package)            | CALL              |
| DBASE II & III (From Ashton-Tate)                  | \$299/375         |
| KNOWLEDGEMAN (Version 1.06)                        | \$299             |
| RBASE 4000 & 6000 (Use w/CLUT, REPORT WRITER)      | CALL              |
| POWER BASE (Relational, hierarchical)              | \$279             |
| OP (New and fantastic!)                            | CALL              |
| DAYFLOW (Enhance with REPORTFLO)                   | CALL              |
| OZ (from Fox & Geller)                             | CALL              |
| NUTSHELL by Leading Edge                           | CALL              |
| LIFEBOAT LATTICE C COMPILER (w/8087 support)       | \$289             |
| LIFEBOAT LATTICE C-FOOD SMORGASBORG                | CALL              |
| MICROSOFT C,BASIC,FORTRAN,PASCAL,COBOL             | CALL              |
| BORLAND TURBO PASCAL & TOOLBOX                     | CALL              |
| DIGITAL RESEARCH (All products)                    | CALL              |
| DOW JONES (All products)                           | CALL              |
| IUS A/R, A/P, G/L                                  | \$299             |
| OPEN SYSTEMS ACCOUNTING MODULES                    | BEST PRICE        |
| STATE OF THE ART (G/LA/R, A/P, INV, PP)            | BEST PRICE        |
| BPI GENERAL ACCOUNTING AND MODULES                 | CALL              |
| DOLLARS AND SENSE by Monogram                      | \$119             |
| MANAGING YOUR MONEY by Tobias/Meca                 | \$129             |
| HARVARD PROJECT MANAGER                            | BEST PRICE        |
| TAX PREPARATION PACKAGES                           | CALL FOR THE BEST |
| DECISION RESOURCES CHART MASTER                    | \$259             |
| BPS BUSINESS GRAPHICS                              | \$259             |
| Z-SOFT PC PAINTBRUSH w/FRIEZE GRAPHICS             | \$99              |
| PROKEY VERSION 3.0 by Rosesoft                     | \$95              |
| SET-EX for your EPSON                              | \$45              |
| NORTON UTILITIES                                   | \$59              |
| COPY II PC by CENTRAL POINT                        | \$495             |
| COPYWRITE by Quaid (Copies all IBM software)       | \$35              |
| COMPUSEVE STARTER KIT                              | \$35              |
| SIDEWAYS by FUNK SOFTWARE                          | \$49              |
| CROSSTALK XVI by MICROSOFT                         | \$109             |
| HAYES SMART COM II                                 | \$95              |
| TRACE 86 by Morgan (Assembly language debug)       | CALL              |
| FLIGHT SIMULATOR                                   | \$39              |

# PROGRESSIVE MICRO DISTRIBUTORS

"IBM PC System Enhancement Is Our Business ...Personal Service Is Our Commitment."

**FOR ORDERS ONLY**  
**1-800-446-7995**  
for further information and technical support  
**1-404-446-7995**

**HOURS: 9AM to 9PM EST**  
**(Sat/Sun-12PM to 5PM EST)**  
7000 Peachtree Industrial Blvd.  
Norcross, Georgia 30071  
All prices are subject to change without notice.  
IBM is a registered trademark of International Business Machines.

**NO SURCHARGE FOR MC/VISA**  
**MOST ORDERS SHIPPED NEXT DAY**

# Buy and sell stocks with your personal computer.

For more information, call today!  
Toll-free  
**1-800-544-6666**

**FIDELITY**  
**INVESTORS EXPRESS**

FIDELITY BROKERAGE SERVICES, INC.  
Member NYSE SIPC

Circle 153 on inquiry card.

# wabash®

When it comes to  
**Flexible Disks, nobody  
does it better than  
Wabash.**

MasterCard, Visa Accepted  
Call Free: (800) 235-4137



**PACIFIC  
EXCHANGES**  
100 Foothill Blvd.  
San Luis Obispo, CA  
93401 (In Cal. call  
(805) 543-1037)

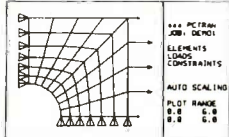
Circle 300 of inquiry card.

## COMPUTER SCIENCE:

Kutztown University of Pennsylvania invites applications for a permanent tenure-track position in Computer Science. Minimum requirements include M.S. in Computer Science and appropriate teaching or industrial experience. Ph.D. preferred. Requires broad training in Computer Science, ability to teach several upper division courses and strong verbal communication skills. Rank and salary commensurate with qualifications. Salary and fringe benefits highly competitive. Starting date, September 1985. Send letter of application and resume, undergraduate and graduate transcripts and 3 letters of recommendation to Professor R.J. Buff, Department of Mathematics and Computer Science, Kutztown University, Kutztown, PA 19530. All materials due February 1, 1985.

*Kutztown University is an equal opportunity/Affirmative Action employer and actively solicits application from qualified minority applicants.*

## Finite Element Analysis



PCTRAN™ is an 2-D finite element code for the IBM-PC and all compatibles. Interactive graphics pre and postprocessing aid in model building and result verification. The solution routine comes with an 8087 option. Training program and extensive documentation make this code ideal for those unfamiliar with F.E.M. \$329.

Call for technical information and free demonstration program.

**Brooks Scientific, Inc.**  
228 Harvard Street  
Medford, MA 02155  
(617) 395-9060

Circle 45 on inquiry card.

## Lotus™ User?

Free Mail Order Catalog for Lotus Software users, includes:

- Lotus Programs
- Lotus Enhancement Software
- Books and Training Aids
- Hardware and Utilities

We are a unique mail order company specializing in Lotus related products.

4-5-6 WORLD  
Dept. A-108  
P.O. Box 22657  
Santa Barbara, CA 93121  
(800) 524-5678 Toll Free  
(805) 564-2424 In California



Your definitive Lotus enhancement source

Circle 3 on inquiry card.



- powerful motion commands
- RS232 interface
- acceleration/deceleration
- 4 axis moves

**STEPPING MOTOR TIPS COOKBOOK \$8**  
**BIG STEPPER Standard Version \$935**  
- with on-board BASIC \$985  
- with on-board CNC commands \$1950

**CENTROID (814) 237-4535**  
**Box 739, State College, PA 16804**

Circle 56 on inquiry card.

## PC EXPANSIONS

|                               |        |
|-------------------------------|--------|
| Qume 142A                     | \$199  |
| Teac FD55B                    | \$149  |
| Tandon TM100-2                | \$179  |
| Tandon TM101-4                | \$295  |
| CDC 9409                      | \$179  |
| Amdak AmdiskV                 | \$119  |
| Case and PS                   | \$ 45  |
| Maynard Disk Controller       | \$114  |
| Sandstar Series               | \$call |
| Internal 10MB HD systems: WS1 | \$899  |
| WS2                           | \$1079 |
| Quadboard (64K)               | \$269  |
| Quadboard (384K)              | \$469  |
| Quadcolor I                   | \$199  |
| AST SixPakPlus (64K)          | \$269  |
| SixPakPlus (384K)             | \$469  |
| MegaPlus (64K)                | \$269  |
| I/O Plus                      | \$129  |
| AST-3780                      | \$659  |
| PCnet - starter kit           | \$809  |
| MonoGraphPlus-S               | \$389  |
| HERCULES graphics board       | \$349  |
| HAYES Modems: 300             | \$209  |
| Smartmodem 1200               | \$489  |
| Smartmodem 1200B              | \$435  |
| Set of 9 chips (64K)          | \$ 39  |
| 256K chips (each)             | \$ 23  |
| 8087 chip                     | \$169  |
| Verbatim DataLife DS, DD (20) | \$ 49  |

**VLM Computer Electronics**  
10 Park Place • Morristown, NJ 07960  
(201) 267-3268 Visa, MC, Check or COD.

Circle 228 on inquiry card.

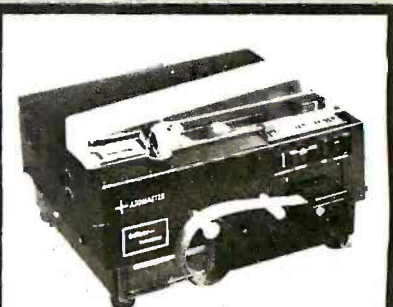
# LISP

**BYSO™ LISP** has powerful file handling, a responsive full screen editor with 4 pretty printing styles, arrays, macros, and complete access to all system functions. Clearly documented. Fast and well tested. Compatible with both LISP 1.5 & MacLISP. Much more than just a learning environment. Order from

**LEVIAN INSTRUMENT CO.,**  
Box 31M, McDowell, VA 24458.  
(703) 396-3345.



**\$89.95**  
IBM PC (128K)



A word for this Punch/Reader Combo is  
.....  
.....  
.....  
**Speed!** Model 510 punches paper tape at 110cps; reads at 150cps. This rugged machine is computer compatible offering RS232C, current loop, parallel inputs. The ASCII-to-Baudot code conversion permits direct keyboard entry for Telex/TWX transmission. Plus: 256 character storage, 75-9600 baud rate, 5-8 level tape, stock. **ADDMASTER CORP** 416 Junipero Serra Dr., San Gabriel, CA 91776 • 213/285-1121.

Circle 10 on inquiry card.

# AB Computers

THE VALUE LEADER SINCE 1976

## COMPUTERS

IBM PC and PC XT in stock  
available at special prices . . . . . CALL



Zenith—All Zeniths fully software & hardware compatible with the PC and XT...superior keyboard:

| Computer   | Ram  | Drive          | Ports      | Price |
|------------|------|----------------|------------|-------|
| ZF-151-21  | 128K | 360            | 1PL/2 SER. | CALL  |
| ZF-151-52  | 320K | 720 (2 drives) | 1PL/2 SER. | CALL  |
| ZW-151-52  | 320K | 10.6 MB + 360  | 1PL/2 SER. | CALL  |
| ZF-161-21* | 128K | 360            | 1PL/2 SER. | CALL  |
| ZF-161-52* | 320K | 720 (2 drives) | 1PL/2 SER. | CALL  |

\*Portable

★ SPECIAL—Buy a Zenith 150/160 PC before Dec. 31 and get both Microsoft Word & Multiplan... a \$570. value... FREE!

Sanyo—We have Sanyo 550 & 555 PC's. Built-in software includes MDOS Version II, Wordstar, CalcStar, Basic, more. Great Prices.

| Computer | Ram   | Drive           | Price  |
|----------|-------|-----------------|--------|
| 550-1    | 128K* | 180K (1 drive)  | \$895. |
| 550-2    | 128K* | 360K (1 drive)  | 950.   |
| 555-1    | 128K* | 360K (2 drives) | 1075.  |
| 555-2    | 128K* | 720K (2 drives) | 1275.  |

\*EXPANDABLE TO 256

ALSPA 8" CPM Computers. 64 K memory workhorse at super special prices.

1/SS . . . . . as low as \$500.  
2/SS . . . . . \$700. 2/DS . . . . . \$1,000.

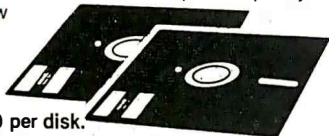
## DISKS AND ACCESSORIES

VERBATIM—Verbatim DATALIFE® Minidisks are super quality, super durable. Price per 5 1/4" minidisk (sold in boxes of 10)

|       | Qty. 10 | Qty. 50 | Qty. 100 |
|-------|---------|---------|----------|
| SS/DD | 1.95    | 1.90    | 1.85     |
| DS/DD | 2.60    | 2.55    | 2.50     |

30 Mcintosh 3 1/2" diskettes in Amaray diskbank . . \$135.

\*AB's OWN DISKETTES—top disk quality at a low, low price... buy 100 (DS/DD) and pay only \$1.60 per disk.



Plus, before December 30, get a free Amaray Mediamate 5 disk file in the bargain!

AB carries all major brands...3M, Verbatim, Maxell, Wabash, BASF, Sentinel, Dysan... in all popular sizes and configurations. CALL for super prices.

### DISK STORAGE

Mini Flip 'N File (50 5" disks) . . . . . \$17.45  
Rolltop 100 (100 disks, 10 dividers) . . . . . 28.99

Mini Kas-ette/10 (for 5" disks) 1/2.25 10/2.05 ea

\*Amaray Mediamate 5 . . . . . 11.99

PLUS—"HEAD" disk cleaning kit (w/2 disks) . . . . . 11.99

IBM drive analyzer (Verbatim) . . . . . 22.50

## SOFTWARE

|                                 |        |
|---------------------------------|--------|
| Lotus 1-2-3 . . . . .           | \$315. |
| Lotus Symphony . . . . .        | 479.   |
| Multi-Mate . . . . .            | 325.   |
| Multiplan (Microsoft) . . . . . | 129.   |

★ SPECIAL—All Electronic Arts Games... Buy any 2, get 3rd FREE . . . . . CALL  
Wordstar . . . . . 335.  
dBASEII (Ashton-Tate) . . . . . CALL  
dBASE III (Ashton-Tate) . . . . . CALL

Get Organized! By ELECTRONIC ARTS™ (NEW) . \$159.  
Spotlight by Software Arts (NEW) . . . . . 120.  
Microsoft "WORD" (with MOUSE) . . . . . 325.  
Peachtree Peachtext 5000 . . . . . 189.  
Spinnaker Software—full line . . . . . CALL  
UNIX Operating System for PC . . . . . CALL  
Copy PC . . . . . 29.

★ Personal Pearl (pearlsoft) — Database filing/reporting system for personal productivity. Manipulate database thru simple English sentence commands. Great for beginner or pro. Super business aid. Includes functions for bookkeeping, general ledger, billings management, mail list, sales analysis, budget planning, more. . . . . \$235.

### FREE CATALOG!

This ad space can accommodate only a few of the exceptional values available from AB. Our latest catalog is packed with fantastic buys, top brands, thousands of items. For a free copy call or write.

## MONITORS

USI—20 MHz band width, 1000 lines resolution. Easily capable of 80 character display.

★ 1200G (Pi-2)-12" green phosphor SPECIAL \$85.

★ 1200A (Pi-3)-12" amber phosphor SPECIAL 89.

### AMDEK

Video 310A-12" amber, 18 meg. TTL-IBM . . \$155.  
Color I, 13" color . . . . . 239.  
Color I + , 13" color (non-glare) w/Headphones 249.  
Color II + -13" RGB TTL input . . . . . 435.

### ZENITH

ZVM-124-12" amber—22 MHz, TTL for IBM . . . \$150.  
ZVM-135-High res. RGB + composite monitor . . 470.  
ZVM-135-1-Cable for RGB monitor . . . . . 23.

### COMMODORE SPECIALS

We have all sorts of accessories to unlock the power in your C64...make it a machine to be reckoned with.

WC 6420 Auto Modem (also available for Atari & Apple at slightly higher price) . . . . . \$ 65.  
Tech Sketch Light Pen & Micro Illustrator . . . . . 44.

MSD Superdrives, single and dual . . . . . CALL

CBC 4/12 Analog to Digital 4 Chan/12 Bit . . . . . 179.

Typing Tutor III with Letter Invaders . . . . . 35.  
(Also for Apple & IBM)

Paper Clip Word Processor CBM/C64 . . . . . 60.

80 Column Display Card . . . . .

By "Batteries Included" . . . . . 149.

Oracle (Consultant) Data Base . . . . . 89.

By Batteries Included

BusCard II by "Batteries Included" . . . . . 149.

Cable from BusCard to Parallel Printer . . . . . 25.

All other "Batteries Included" items in stock . CALL

FORTH for PET/C64 . . . . . 50.

(Full Fig. Model) by Cargile/Riley

Ditto Disk 64 (copy discs even if original is copy protected) . . . . . 36.

STAT for PET/CBM/C64 . . . . . 95.

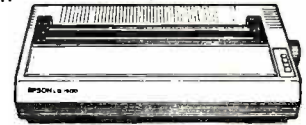
Comprehensive Statistical Analysis Routines

★ AB'S C64 Upgrade Kit:  
Includes BusCard II, IEEE Cable & MSD Superdrive . . . . . 319.



## OUTPUT DEVICES

Printers by Star, Epson, Amdek, Okidata, Brother:



Star Micronics Gemini 10X . . . . . \$258.

— 10" carriage, FIT 120 CPS

Epson LQ-1500-NEW 24-pin . . . . . CALL

letter qual. dot matrix

Epson RX-80-Tractor Feed, Graftrax + . . . . . 289.

Okidata 92 . . . . . CALL

Amdek Printers

5025-25 CPS Daisywheel, 2K Buffer . . . . . 720.

5040-40 CPS Daisywheel, 2K Buffer . . . . . 1356.

5055-55 CPS Daisywheel, 2K Buffer . . . . . 1595.

Brother HR-35 Daisywheel-25 PS Bi-Directional . . . 915.

Brother HR-25 Daisywheel-23 CPS Bi-Directional . . 675.

Brother HR-15 Daisywheel-13 CPS Bi-Directional . . 399.

Panasonic 1090 Printer . . . . . 239.

with Correspondence Mode

PLOTTERS BY AMDEK, SWEEP-P:

Amdek Amplot II—Six Pen . . . . . 890.

★ SWEET-P 100—Single Pen (with 4 color pens) . . . . . SPECIAL, CALL

IBM Parallel Printer Cable . . . . . 19.

## /ETC.

Panasonic, Amdek, Hitachi & Other—

1/2 height, double side drives . . . . . from \$149.

★ Data Technology TeamMate Drive—super new system. Puts 3.3 MB on 5 1/4" floppy... Formats to 2.8. For PC XT owners, an alternative to hard disk. 4 disks back-up 10 megabytes . . . . . CALL

★ Winchester Drives (10 MB) . . . . . 895.

Quadram Quadboard—Parallel port, serial port, clock/calendar.

No RAM-\$299, w/64K-\$279, w/384K-\$499

★ AMDEK MAI graphics card for IBM PC . . . . . 200.

Hercules graphics board . . . . . 359.

Votrax speech synthesizers—

Personal Speech System . . . . . 249.

AST—full line of IBM cards & boards . . . . . CALL

Keytronics 5150 keyboard . . . . . 179.

Hewlett Packard calculators, all models:  
LOW, LOW PRICES . . . . . CALL

POWER DEVICES

Datashield back-up power source

200 PC-200 watt . . . . . \$265.

300 XT-300 watt . . . . . 390.

"BITS" Power back-up-250W, . . . . . 695.

True uninterruptable

Brooks 6 Outlet—

Surge Suppressor/Noise Filter . . . . . 54.

COMMUNICATIONS

Mark X Auto Dial/Auto Answer . . . . . \$119.

Anchor Mark XII Smart modem . . . . . 265.

Hayes Smartmodem 1200B . . . . . 459.

(includes Smartcom II software)

Hayes SmartModem 1200/300 . . . . . 529.

"Crosstalk" software . . . . . 135.

★ Voad keyboard-phone software for IBM PC and compatibles. Features mail merge, call reporting, "Note Pad" and more . . . . . CALL

### AB SATISFACTION GUARANTEE

Every product sold by AB Computers is factory packed and comes with the manufacturers warrantee. However, if an item is defective when received, you may return it to us within 15 days for repair, adjustment or replacement at our option. Returns must be accompanied with copy of your invoice, letter detailing defect, blank warrantee card and all original factory packing. To expedite handling, please call for return authorization number. (Sorry, no returns on computer software, once opened.)

Ordering Information: Order by check, Mastercard or VISA. Personal checks take 15 days to clear; no waiting on certified checks or money orders. Add 3% shipping and handling on all orders (minimum \$2.00). Mail, APO/FPO, Air may require additional charges. PA residents add 6% sales tax; MA residents add 5%. All items subject to availability. Prices subject to change. Additional discounts available to qualified educational institutions. Requests for bid on volume requirements invited.

## AB Computers

252 BETHLEHEM PIKE

COLMAR, PA 18915

OR USE OUR ORDER LINE, MON. SAT.

9 A.M. — 6 P.M. EST

# 800-822-1211

(IN PA, 215-822-7727)

# HOFACKER

Books • Software • Hardware Add-Ons • for your ATARI 600XL/800 XL, Commodore-64, VIC-20, Sinclair, Timex, Apple II, Osborne-OS/2

**BLITZTEXT** — More than just a word processor for the C-64! More than 70 commands, screen-oriented, use any printer, terminal software included for electronic mail and networking. The best wordprocessor for the C-64.  
Order No. 4965 \$89.00

**MACROFIRE** — Editor/Assembler for the C-64  
The best macro assembler you can buy!  
Order No. 4963 \$89.00

**SUPERBOOKS** for your C-64  
The Great Book of Games, Vol. 1  
45 programs for the Commodore 64  
Order No. 182 \$9.95  
Programs from this book on disk \$19.95

**MORE ON THE SIXTYFOUR**  
Tips, tricks, hints, very important sub-routines.  
Order No. 183 \$9.95  
Programs from this book on disk \$19.95

**How to program in 6502 Machine Language on your C-64**  
Order No. 184 \$12.95  
Commodore 64 Tune-up, Vol. 1  
How to expand your C-64  
Order No. 185 \$12.95  
Small Business Program for the C-64  
Order No. 186 \$12.95

**HARDWARE ADD-ONS** for your C-64  
Parallel printer interface, KIT  
Order No. 4990 \$19.95  
Universal Experimenter Board  
Order No. 4970 \$9.95  
Expansion Board KIT — Holds up to 4 Exp. boards (bare board)  
Order No. 4992 \$29.95

Dealers and Distributor inquiries are invited.  
**ELCOMP PUBLISHING, INC.**  
53 Redrock Lane  
Pomona, CA 91766  
Phone: (714) 823-8214, Tlx.: 298191

Wordprocessor for all ATARI computers. No one can provide better performance for this price!  
ATEXT-1  
This wordprocessor is an excellent buy for your money. It features screen oriented editing, scrolling, string search (even nested), left and right margin justification. Over 30 commands! Text can be saved on disk or cassette.  
Order No. 7210 cassette \$29.95  
Order No. 7215 disk \$34.95  
Order No. 7217 cartridge \$69.00  
Games for the ATARI Computer  
This book describes advanced programming techniques like player missile graphics and use of the hardware registers. Contains many ready to run programs in BASIC and one called GUNFIGHT in machine language.  
Order No. 182 \$7.95  
How to program your ATARI in 6502 Machine Language  
Introduction to machine language for the BASIC programmer.  
Order No. 169 \$9.95  
**FORTH on the ATARI** — Learning by Using  
Introduction, programs, applications, learning exercises.  
Order No. 172 \$9.95  
All programs from book No. 170 on disk.  
Order No. 7319 \$22.00 only!

**HACKERBOOK** for Your Atari computer  
Tips, tricks — Very important sub-routines in 6502 machine language. How to make bootable cassettes, disks, and EPROMs. Complete construction article and software on how to build an EPROM burner.  
Order No. 172 \$9.95

Copyright © 1983 by Elcomp Publishing Inc.  
PAYMENT: Check, VISA, MC, CA residents add 6.5% sales tax. Outside USA add 15% for shipping.  
In Singapore contact telax RS 22-256  
In Germany contact telax 52897

Circle 141 on inquiry card.

## How to turn a shy computer into a smooth talker.

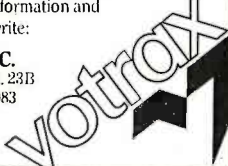
It's simple to give your computer a voice with the Personal Speech System (PSS) from Votrax, Inc. The PSS is:

- a truly phonetic voice synthesizer
- an unlimited speech output synthesizer
- able to create sound effects and music
- an easy to operate, easily installed synthesizer
- adaptable to most personal computers

Call 313-583-9884 to hear an actual voice demonstration of the PSS over the phone. Suggested retail price — \$395.

For more information and specifications, write:

**VOTRAX, INC.**  
1394 Rankin, Dept. 23B  
Troy, Michigan 48063  
1-800-521-1350  
313-588-0341  
(in Michigan)



Circle 381 on inquiry card.

# TAPE WORLD


1-800-245-6000

|                 |                                 |                              |
|-----------------|---------------------------------|------------------------------|
| <b>maxell.</b>  | MD-1 ... 5 1/4", SSDD ... 1.69  | 104/1D ... 5 1/4" ... 1.99   |
|                 | MD-2D ... 5 1/4", DSDD ... 2.39 | 104/2D 5 1/4", DSDD ... 2.69 |
|                 | FD-1 ... 8", SSDD ... 2.69      | 3740/1d 8", SSDD ... 2.69    |
|                 | FD-2 ... 8", DSDD ... 3.29      | 3740/2D 8", DSDD ... 3.29    |
| <b>TDK</b>      | 5 1/4" SSDD ... 1.99            | 5 1/4" SSDD ... 1.99         |
|                 | 5 1/4" DSDD ... 2.59            | 5 1/4" DSDD ... 2.59         |
| <b>BASF</b>     | 5 1/4" SSDD ... 1.99            | 5 1/4" SSDD ... 1.99         |
|                 | 5 1/4" DSDD ... 2.59            | 5 1/4" DSDD ... 2.59         |
| <b>VERBATIM</b> | 5 1/4" SSDD ... 1.89            | 5 1/4" SSDD ... 1.99         |
|                 | 5 1/4" DSDD ... 2.49            | 5 1/4" DSDD ... 2.59         |

**IBM**  
**SCOTCH**  
**ELEPHANT**

**WE WILL BEAT ANY PRICE!**  
Prices per case of 10. Shipping 3.75 any size order  
Pre-paid, COD, or credit card. COD add 1.65  
ALL ORDERS SHIPPED WITHIN 48 HOURS.  
Also, TDK and Maxell audio and video cassettes.  
220 SPRING ST. BOX 361 BUTLER, PA 16001  
412-283-8621 M-F 8:30-5:00

Circle 363 on inquiry card.




**Solve your disc problems. buy 100% surface tested Dyan diskettes. All orders shipped from stock, within 24 hours. Call toll FREE (800) 235-4137 for prices and information. Visa and MasterCard accepted.**



**PACIFIC EXCHANGES**  
100 Foothill Blvd.  
San Luis Obispo, CA  
93401. (In Cal. call (805) 543-1037.)

Circle 300 on inquiry card.

## COMPUTER SWITCH



**ELIMINATE CABLE SWAPPING** at a price NO ONE can beat!

PI-SWITCH lets you safely share your computer among multiple SERIAL or PARALLEL printers, modems, terminals, etc., all with just a flick of the wrist!

- Serial switch has female RS-232 connectors with gold plated pins. Uses lines 1-7 & 20 or can easily be reset by user.
- Parallel switch has female centronics connectors.
- All models have an attractive aluminum case.
- 30-day satisfaction guarantee.
- One Year Warranty.
- Send for FREE leaflet that describes its many uses.

|         |                              |        |
|---------|------------------------------|--------|
| PI-02-S | Serial - Shares(2) devices   | 59.95  |
| PI-03-S | Serial - Shares(3) devices   | 89.95  |
| PI-05-S | Serial - Shares(5) devices   | 109.95 |
| PI-02-P | Parallel - Shares(2) devices | 94.95  |
| PI-04-P | Parallel - Shares(4) devices | 184.95 |
| CA-05-S | Serial Cable 5'              | 15.00  |
| CA-05-P | Parallel Cable 5'            | 25.00  |

TERMS: VISA, MC, Check, MO or COD. Add \$2.00 each for ground or \$4.00 each for 2nd Day Air shipping.  
Dealers and Custom Switch Orders Invited-Please Call

**SAB LINK** 7301 NW 41 ST.  
MIAMI, FL 33166  
(305) 592-6092  
FREE SHIPPING DURING DECEMBER

Circle 331 on inquiry card.

**Logo is the simplest programming language you can use.**

**Terrapin™ is the simplest Logo to use.**



**Terrapin™**  
The Original Logo People  
(617) 492-8816

Circle 369 on inquiry card.

# VT102

## CONNECT YOUR PC TO YOUR DEC SYSTEM

PC100 turns your IBM PC/XT into a VT100/52 terminal. PC102 adds VT102 printer and file transfer support. PC102-132 supports true 132 columns. Guaranteed compatibility with all VT100/52 applications including: **EDT, WORDII, ALL-IN-ONE, DEC-CALC AND UNIX. PRICED FROM \$89.**

- 110 through 9600 baud operations
- Complete keyboard and screen emulation
- Optional 4010 graphics support

**GENERAL MICROSYSTEMS**  
6440 Flying Cloud Dr., Suite 205  
Eden Prairie, Minnesota 55344  
(612) 944-0593

**CALL FOR FREE INFORMATION PACKAGE.**

Circle 164 on inquiry card

## DUST COVERS

For Personal Computers and Small Business Systems, Peripherals, Game Units — Protective, Long-Lasting Vinyl Resists Both Dust and Liquids

— CHOICE OF COLORS —

|           |                   |
|-----------|-------------------|
| Amdek     | Franklin Ace      |
| Apple     | IBM               |
| Atari     | Kaypro            |
| BMC       | Okidata           |
| Columbia  | Rana Systems      |
| Commodore | Star Micronics    |
| Corona    | Televideo         |
| Eagle     | Texas Instruments |
| Epson     | PLUS OTHERS       |

GROUP/VOLUME DISCOUNTS AVAILABLE

FOR FREE BROCHURE WRITE:  
ENCHANTED FOREST  
P.O. Box 5261, Newport Beach, CA 92662  
(118 Onyx)  
Dealer Inquiries Invited

Circle 147 on inquiry card.

## DISKETTES Holiday Special

FREE Head-Cleaning Kit, \$9.60 Value

FREE: Plastic Library Case with each box of 10 5 1/4" soft sector Datallife Diskettes

SS/DD \$19.95 DS/DD \$29.95

Gemini 10X, 120 CPS Bi-directional \$244  
Gemini 15X, 120 CPS Bi-directional \$365

**Powertype Daisy Wheel Letter Quality,**  
Dual interface, Bi-directional, Reverse paper feed \$345

Shipping and Handling \$3.00 for any size order of diskettes. \$9.00 for printers. C.O.D. orders add \$1.65. We accept credit cards at NO extra charge. Illinois residents please add 7% sales tax.

Call now TOLL FREE ANYWHERE in the US

|               |                |
|---------------|----------------|
| Nationwide    | 1 800 336-6875 |
| Illinois      | 1 800 942-5200 |
| International | 1 312 256-4456 |

9 a.m. - 6 p.m. (Central) Mon. through Fri.

**SMART DATA INC.**  
P.O. Box 297  
Wilmette, IL 60091  
(312) 256-4456

Circle 342 on inquiry card.

# PRIORITY ONE ELECTRONICS STOCKING STUFFERS

**DATAGARD**  
**SGL WABER**

6 Outlet Noise  
& Surge Suppressor  
BLWBRDG115S (Sh. wt 3 lbs.)

**\$29.95**

Double Sided  
Double Density  
5 1/4" Diskettes

Pack of 10 in Library Case

**\$19.95**

BLPDBSRW510  
(Sh. wt. 1 lb.)

**PROMETHEUS**  
PRODUCTS INCORPORATED

**PROMODEM 1200**

1200 Baud Auto Dial/  
Answer Stand Alone  
with Chronograph

**\$329**

BLPRMPM1200 (Sh. wt 4 lbs.)

**EPSON**  
**PRINTERS**

**SANYO**  
**COMPUTERS**

**CALL TODAY**  
**WE WILL**  
**BEAT ANY PRICE**  
**IN THIS MAGAZINE**

BL111HPC110  
(Sh. wt. 15 lbs.)

International  
Instrumentation  
Incorporated

**10M Byte**  
**Hard Disk**  
**Subsystem**

For IBM PC™ and Compatibles

**\$749**

**PRACTICAL**  
**PERIPHERALS**

**64K MicroBuffer**  
**Stand Alone**  
**Print Buffer**

BLPRPMB1S64 (3 lbs.)  
(SERIAL INTERFACE)

BLPRPMB1P64 (3 lbs.)  
(PARALLEL INTERFACE)

**\$249**



**PRIORITY ONE ELECTRONICS**

9161 Deering Ave., Chatsworth, CA 91311-5887

**VISA**

**ORDER TOLL FREE (800) 423-5922 - CA, AK, HI CALL (818) 709-5111**

Terms U.S. VISA, MC, BAC, Check, Money Order, U.S. Funds ONLY. CA residents add 6 1/2% Sales Tax. Include MINIMUM SHIPPING & HANDLING of \$3.00 for the first 3 lbs., plus 40¢ for each additional pound (20¢ if within California). Orders over 70 lbs. sent freight collect. Just in case, include your phone number. Prices subject to change without notice. We will do our best to maintain prices through December, 1984. Credit card orders will be charged appropriate freight. We are not responsible for typographical errors. Sale prices for prepaid orders only.

# IN LESS THAN 3 MINUTES

Your IBM Model 50, 60, 65, 75, 85 or 95 Electronic Typewriter can be a computer printer or terminal using our interface modules:

Model 5060 RS232 Serial  
Model 5060-CP Centronics Parallel

Both Versions can be easily installed and require NO modifications to the typewriter. A 2K buffer is standard, 8K optional.



**CMC CALIFORNIA MICRO COMPUTER**

9323 Warbler Ave., Fountain Valley, CA 92708  
(714) 964-9301

# 6809 Single Board Computer



6809 MPU, 2 serial ports, 4 parallel ports, RAM, EPROM, real-time clock, watchdog timer, 44-pin 4.5" x 6.5" PCB  
EXPANSION MODULES: RAM, EPROM, CMOS RAM/battery, analog I/O, serial I/O, parallel I/O, counter/timer, IEEE-488, EPROM programmer, floppy disks, cassette, breadboard, keyboard/display.

**WINTERK**

Winterk Corp.  
1801 South Street  
Lafayette, IN 47904  
317-742-8428

# HARD DISK BOOT + DATA SECURITY

FiXT ends boot hassles, stops data thieves—

DATAMAC, DAVONG,  
GREAT LAKES, IOMEGA,  
XEBEC, ZOBEX, others.

No-Slot Installation for  
IBM PC, COMPAQ, COLUMBIA  
\$70 - \$95 + tax/shpg



**GOLDEN BOW SYSTEMS**  
Box 3039  
San Diego  
CA 92103  
619/298-9349

Circle 388 on inquiry card.

Circle 168 on inquiry card.



# Verbatim Datalife Diskettes

5 Year Warranty - 100% Certified

\$1.69 each 5 1/4" SSDD \$2.20 each 5 1/4" DSDD

Regular 10 packed sleeves, reinforced hubs with identification labels and write protect tabs included.

### OTHERS AVAILABLE

|             |            |         |        |
|-------------|------------|---------|--------|
| 5 1/4" SSDD | MD 577-01  | #18212  | \$2.93 |
| 5 1/4" DSDD | MD 577-01  | #18239  | 3.87   |
| 8" SSDD     | FD 34-9000 | #18113  | \$2.30 |
| 8" DSDD     | DD 34-4001 | #18071  | 2.75   |
| 3 1/2" SSDD | MF 350-01  | #90036M | 3.50   |

### DATALIFE HEAD ALIGNMENT & CLEANING

|                                    |        |         |
|------------------------------------|--------|---------|
| 5 1/4" Head Cleaners Kit           | #2144  | \$ 5.00 |
| 5 1/4" Refill Kit for 10 Cleanings | #2145  | 8.00    |
| 5 1/4" Disk Drive Analyzer         |        |         |
| Apple Version                      | #26355 | \$20.00 |
| IBM Version                        | #27660 | \$20.00 |

24 Hour Order Desk



TOLL FREE NATL  
**1-800-634-2248**

Visa, MasterCard, Cert. chk., M/O, C.O.D. cash  
Get immediate shipment. Schools & govt. on P.O. #  
Personal or company checks held 14 days  
APO, FPO, Can. and other non-UPS delivered, add \$5.

\*Free delivery on minimum orders of \$50 or more. Others add \$2 for S & H.

**Software Services™**

132233rd St South, Suite C, Fargo, ND 58103 1-701-280-0121

# FREE PC BOOK

\*\*\* GET ONE BOOK FREE FROM THIS AD WITH EVERY \$ 20.00 PURCHASE \*\*\*

**Small Business Programs for the IBM PC**  
Easy ready to run programs for your PC: mailing list, cost proposal, mortgage, invoicing and a very powerful BUSIPACK combining invoice writing, mailing list and inventory control. Inventory file is automatically updated by the invoice writing part. All this plus twelve more programs to increase productivity on your PC.

**Book and disk package**  
Want to save 8 hours? Go ahead and get the combination package "PC-COMBO".  
Order No. 521 (Book+disk) \$ 39.00  
Order No. 52 (Book only) \$ 12.96  
Order No. 520 (Disk only) \$ 29.96

**MSDOS Introduction and Applications**  
How to get the most out of your IBM PC or Compatible. Use this book and keep it right beside your computer. It contains: numerous "how to do" information, application programs, how to add your own commands, and how to use the assembler.  
Order No. 56 (Book only) \$ 9.96

**Book and disk package** containing all the programs from book No 56 on disk.  
Order No. 561 (Book+disk) \$39.00

Dealer and Distributor inquiries are invited.

ELCOMP PUBLISHING, INC.  
2174 W. Foodst. Blvd., Unit E  
Upland, CA 91788  
Phone: (714) 623-0314, Telex: 29 91 81

**Statistics on the IBM PC**  
Fundamentals of data in bar graphs and pie charts, probability, Markov Analysis, discrete distribution, normal distribution, Gauss Distribution, statistical test (off significance), t-distribution, non-parametric test, variance, linear regression, auto correlation, forecasting and trend, statistics and gambling.  
Each subject contains an introduction, a program in BASIC, and a practical application.  
Order No. 47 (Book only) \$ 12.96  
Order No. 470 (Disk only) \$ 29.96  
Order No. 471 (Book+disk) \$ 39.00

**BASIC in 90 Minutes**  
An easy way to learn BASIC on the APPLE IIc, IBM PC & Compatibles, Commodore and ATARI. Each command with a practical sample and cross reference. 150 pages.  
Order No. 36 (book) \$ 7.96

**Small Business Programs for the Commodore-64**  
Ready to use and easy to run programs including: bargraph, invoice writing, mortgage, economic order quantity and break-even analysis. Plus 9 other powerful programs.  
Order No. 106 (Book) \$ 12.96  
Order No. 1060 (Disk only) \$ 29.96  
Order No. 107 (Book+disk) \$ 39.00

**PAYMENT:** Check, VISA, MC  
CA residents add 6% sales tax.  
Add \$ 2.00 for shipping.  
Outside USA: add 15% for shipping  
In Singapore contact: telex 22 458  
In Germany contact: telex 52 98 73

Circle 142 on inquiry card.

# NEW! BREAK-OUT-BOX Tests, Monitors, Re-wires RS-232 Interfaces

Opens signal lines, re-wires or monitors in one unit. Nine two-color LED's monitor 7 lines plus two spares. Wires included. 24 switches open any RS-232 line except pin 1. Requires no battery. Order Direct! Only \$149.95. All cash orders postpaid (IL res. add 6% sales tax); we accept MC, Visa. Free: New illustrated catalog of RS-232 interface and testing equipment. Phone: 815-434-0846.



Model 232BOB

**B & B electronics**  
MANUFACTURING COMPANY  
P.O. Box 1008B, OTTAWA, IL 61350

Circle 37 on inquiry card.

# Need Low Cost I/O?

FOR: HP • COMMODORE  
SAGE • OSBORNE



The 6450 General Purpose Parallel Interface will connect to your computer via the IEEE-488 Bus and give you:

8 Input Bits, 8 Output Bits, Clear and Trigger pulses, a Service Request Interrupt, and more.

All IEEE-488 Functions are supported. The 6450 also allows connecting Centronics type printers to the IEEE-488 Bus. Two versions are available: PC board and complete unit. Application notes describing interfacing to A/D converters, UARTs, and multiple byte data are included.

Call or Write for Details:



Seitz Technical Products, Inc.  
PO Box 76, New London, PA 19360  
(215) 255-5111

# PROGRAMMABLE COMMUNICATIONS TRANSLATOR

THE PCT-100 IS A CONFIGURABLE IN-LINE RS-232 PROTOCOL AND DATA TRANSLATOR. THE PCT-100 CAN PROVIDE:

- \* TERMINAL OR PRINTER EMULATION
- \* DEC OR IBM SYSTEM COMPATIBILITY
- \* MACRO-FUNCTION KEYS
- \* "TYPE-AHEAD" AND DATA BUFFERING
- \* BAUD RATE CONVERSION
- \* HANDSHAKE PROTOCOL TRANSLATION (E.G. CTS/RTS, XON/XOFF)

THE PCT-100 IS CONFIGURED USING A BUILT-IN COMMUNICATIONS TRANSLATION LANGUAGE. PROGRAMS CAN BE EASILY ENTERED & EDITED FROM ANY ASCII DEVICE.

PCT-100-PCB (PCB ONLY) . . . . \$ 359  
PCT-100-ASM (PCB w/ CASE) . . . \$ 433  
PCT-512-MOD (POWER SUPPLY) . \$ 62

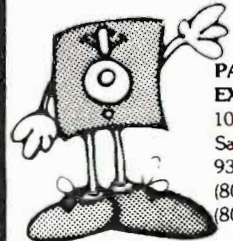
MSI

METHOD SYSTEMS INCORPORATED  
3511 LOST NATION RD. STE. 202  
WILLOUGHBY, OHIO 44094  
(216) 942-2100

Circle 251 on inquiry card.

# MEMOREX FLEXIBLE DISCS

WE WILL NOT BE UNDER-SOLD!! Call Free (800)235-4137 for prices and information. Dealer inquiries invited and C.O.D.'s accepted.



**PACIFIC EXCHANGES**  
100 Foothill Blvd.  
San Luis Obispo, CA  
93401. In Cal. call  
(800)592-5935 or  
(805)543-1037

Circle 300 on inquiry card.

Circle 338 on inquiry card.

# Merry Christmas from Computer Connection We'll Ship Blue Label FREE \*

\* You pay for Ground shipping and we'll ship Blue Label FREE for all orders placed by December 18th

**COMPUTER CONNECTION**  
**TOLL FREE ORDER LINE**

## PRINTERS

|                             |        |
|-----------------------------|--------|
| <b>OKIDATA</b>              |        |
| ML82A, 10" Para. & Ser.     | \$ 299 |
| ML83A, 15" Para. & Ser.     | 535    |
| ML92P, 160cps               | 389    |
| ML92 IBM Graphics Comp.     | 399    |
| ML92S, 160cps               | 499    |
| ML92 Apple Mac. 2K Graphics | Call   |
| ML93P, 160 cps              | 599    |
| ML93 IBM Graphics Comp.     | 629    |
| ML93S, 160 cps              | 769    |
| ML84P, 200 cps              | 679    |
| ML84S, 200 cps              | 779    |

|                                     |        |
|-------------------------------------|--------|
| <b>RITEMAN</b>                      |        |
| Riteman Plus 120 cps w/Tractor      | \$ 257 |
| Riteman Blue Plus 140cps IBM        | 342    |
| Riteman II 160 cps, 8K mem. w/Trac. | 369    |
| Riteman 15, 160cps, 15" carr.       | 549    |

|                                           |        |
|-------------------------------------------|--------|
| <b>QUME</b>                               |        |
| Letterpro 20P Prop. Spc. Enh Pmnt         | \$ 567 |
| Sprint 1140 +, 2K, 40 cps, 132 col. width | 1299   |

|                          |        |
|--------------------------|--------|
| <b>STAR MICRONICS</b>    |        |
| Gemini 10X, 10", 120cps  | \$ 265 |
| Gemini 15X, 15", 120 cps | 367    |
| Delta 10, 10", 160cps    | 399    |

|                            |        |
|----------------------------|--------|
| <b>EPSON</b>               |        |
| RX80, 120 cps              | \$ 275 |
| RX80FT, Friction & Tractor | 299    |
| FX80, 10" 160cps           | 415    |
| RX100, 15" Carriage        | 499    |
| FX100, 160 cps             | 667    |
| LQ 1500                    | 1095   |

|                                    |        |
|------------------------------------|--------|
| <b>C. ITOH</b>                     |        |
| Prowriter 8510 AP, 120 cps         | \$ 325 |
| Prowriter 8510 BC2, 120 cps        | 429    |
| Prowriter 8510 SP, 180 cps         | 455    |
| Prowriter II 1550 P, 15" 120cps    | 527    |
| Prowriter II 1550 BCD, 15" 120 cps | 557    |
| Starwriter F10-40PU, 40cps         | 949    |
| Starwriter A10, 18 cps             | 479    |
| Printmaster F10-55PU, 55 cps       | 1199   |

|                |        |
|----------------|--------|
| <b>BROTHER</b> |        |
| HR25           | \$ 669 |

|                               |        |
|-------------------------------|--------|
| <b>DYNAX</b>                  |        |
| DX15 By Brother, Same as HR15 | \$ 379 |

|                                       |        |
|---------------------------------------|--------|
| <b>JUKI</b>                           |        |
| 6100, L.Q. 18 cps w/proportional spc. | \$ 399 |

|                                                                                 |        |
|---------------------------------------------------------------------------------|--------|
| <b>TOSHIBA</b>                                                                  |        |
| P1351 Dot Matrix, 192 cps, letter quality 100cps, does graphics. 3 in 1 printer | \$1289 |
| P1340 same as above but 10" carr.                                               | 757    |

|                         |        |
|-------------------------|--------|
| <b>MANNESMANN-TALLY</b> |        |
| 160L, 160cps            | \$ 559 |
| 180L, 180cps            | 765    |

|                                    |        |
|------------------------------------|--------|
| <b>PANASONIC</b>                   |        |
| 1091 w/Tractor, 120cps, 1 yr. war. | \$ 309 |

## SOFTWARE

|                                |        |
|--------------------------------|--------|
| <b>LOTUS DEVELOPMENT CORP.</b> |        |
| Lotus 1-2-3                    | \$ 295 |
| Symphony                       | 437    |

|                    |        |
|--------------------|--------|
| <b>ASHTON TATE</b> |        |
| D Base II          | \$ 329 |
| D Base III         | 419    |

|                               |        |
|-------------------------------|--------|
| <b>MICROPRO INTERNATIONAL</b> |        |
| ProPak (WS/MM/SS/Star Index)  | \$ 399 |
| Option Pak (MM, C/S, S/I)     | 199    |

|                  |        |
|------------------|--------|
| <b>MICROSOFT</b> |        |
| Softcard (CP/M)  | \$ 239 |
| Microsoft Word   | 315    |

**MOST ORDERS SHIPPED SAME DAY**

## PRINTER ACCESSORIES

|                                                                                  |        |
|----------------------------------------------------------------------------------|--------|
| <b>ORANGE MICRO</b>                                                              |        |
| Grappler +                                                                       | \$ 115 |
| Buffered Grappler +, 16K exp. 64K                                                | 165    |
| Mir. Chips for PC & XT, Par. Ser. Clock & Cal. .64K Realworld I/F, BSR line I/F. | 389    |
| <b>TOSHIBA</b>                                                                   |        |
| Bi-Directional Tractor                                                           | \$ 159 |
| Font Disk for Downloading P1351                                                  | 48     |

|                                  |       |
|----------------------------------|-------|
| <b>MICROTEK</b>                  |       |
| Dumpling GX (same as Grappler +) | \$ 75 |
| Dumpling GX w/16K buffer         | 149   |
| Dumpling GX w/32K buffer         | 165   |
| Additional Buffering 16K         | 16    |

|                             |       |
|-----------------------------|-------|
| <b>FOURTH DIMENSION</b>     |       |
| Par. Card & Cable for Apple | \$ 49 |

|                       |       |
|-----------------------|-------|
| <b>OKIDATA</b>        |       |
| Plug and Play for IBM | \$ 35 |
| Okigraph I for 82A    | 43    |
| Okigraph I for 83A    | 43    |
| Tractor for 82A & 92  | 49    |

|                            |       |
|----------------------------|-------|
| <b>CABLES</b>              |       |
| IBM PC to Parallel Printer | \$ 16 |
| Serial Cable               | 18    |

## DISPLAY MONITORS

|                                   |       |
|-----------------------------------|-------|
| <b>NEC</b>                        |       |
| JB 1260, 12" Green                | \$ 99 |
| JB 1201, 80 col., 20MHz           | 129   |
| JB 1205(A) 12" Amber, 20MHz       | 135   |
| JC 1215 Color Composit w/audio    | 245   |
| JC 1216 RGB, Hi-Res/IBM 640 x 300 | 365   |

|                             |        |
|-----------------------------|--------|
| <b>AMDEK</b>                |        |
| V300                        | \$ 135 |
| V300A                       | 139    |
| V310A for IBM PC            | 169    |
| Color I +, Composite 13"    | 279    |
| Color II +, Hi-Res. 13"/IBM | 389    |
| Color 600                   | Call   |
| Color 700                   | Call   |
| Color 710                   | Call   |

|                           |        |
|---------------------------|--------|
| <b>TAXAN</b>              |        |
| IBM Green Monochrome #121 | \$ 139 |
| IBM Amber Monochrome #122 | 145    |
| RGB IBM w/Cable #420      | 439    |
| RGB Super Hi-Res. #415    | 393    |
| RGB/Comp. Med. Res. #210  | 259    |

|                           |        |
|---------------------------|--------|
| <b>PRINCETON GRAPHICS</b> |        |
| HX-12 for use with IBM PC | \$ 455 |
| Max 12 Amber for IBM      | 179    |

## HOLIDAY SPECIALS!! Order NOW for Christmas

|                                |                                  |
|--------------------------------|----------------------------------|
| <b>MICRO-SCI Drive for IIC</b> | <b>PARADISE Modular Graphics</b> |
| \$199                          | \$289                            |

|                    |                             |
|--------------------|-----------------------------|
| <b>DUMPLING GX</b> | <b>RANA SYSTEMS Elite I</b> |
| \$75               | \$219                       |

|                        |                                |
|------------------------|--------------------------------|
| <b>OKIDATA 92P IBM</b> | <b>TECHMAR Graphics Master</b> |
| \$399                  | \$459                          |

|                                               |                         |
|-----------------------------------------------|-------------------------|
| <b>LOTUS 1-2-3</b>                            | <b>C. ITOH 8510AP</b>   |
| \$295                                         | \$325                   |
| <b>Symphony</b>                               | <b>64K MEM. UPGRADE</b> |
| \$437                                         | [150 ns]                |
| <b>ANCHOR AUTOMATION Mark XII Hayes Comp.</b> | <b>\$35</b>             |
| \$229                                         |                         |

## IBM PC ACCESSORIES

|                       |        |
|-----------------------|--------|
| <b>PARADISE</b>       |        |
| Modular Graphics Card | \$ 289 |
| Module A              | 85     |
| Module B              | 195    |

|                                                                                 |        |
|---------------------------------------------------------------------------------|--------|
| <b>PC PEACOCK</b>                                                               |        |
| Color Graphics Card w/Par. Printer Port, Compat. w/All IBM Software, 2 yr. war. | \$ 219 |

|                           |       |
|---------------------------|-------|
| <b>64K MEMORY UPGRADE</b> |       |
| 64K (9chips) 150ns        | \$ 35 |

|                     |        |
|---------------------|--------|
| <b>AST RESEARCH</b> |        |
| Six Pak +           | \$ 249 |
| Mega Plus II        | 265    |

|                    |        |
|--------------------|--------|
| <b>QUADRAM</b>     |        |
| Quad Color 1 Board | \$ 199 |

|                                                                                                                                                     |        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| <b>VUTEK</b>                                                                                                                                        |        |
| Vutek CPS, Fully IBM PC Software & Hardware Compatible. RGB & Composite Outputs. Parallel Printer Port. Serial Port 50-9600 Baud. Two Year Warranty | \$ 249 |

|               |        |
|---------------|--------|
| <b>STB</b>    |        |
| Graphics + II | \$ 349 |

|                 |        |
|-----------------|--------|
| <b>TECHMAR</b>  |        |
| Graphics Master | \$ 459 |

|                         |        |
|-------------------------|--------|
| <b>PERSYST BOARD</b>    |        |
| Bob Hi-Res Display Adp. | \$ 459 |

|                   |        |
|-------------------|--------|
| <b>KEYTRONICS</b> |        |
| KB5151            | \$ 195 |

## APPLE & FRANKLIN ACCESSORIES

|                                |       |
|--------------------------------|-------|
| <b>ACCESSORIES</b>             |       |
| System Saver                   | \$ 69 |
| Fan for Apple II & IIE w/surge | 37    |

|                   |        |
|-------------------|--------|
| <b>APPLE</b>      |        |
| Super Serial Card | \$ 139 |

|                                                  |        |
|--------------------------------------------------|--------|
| <b>MICROMAX</b>                                  |        |
| Viewmax 128K extended 80 col. card for Apple IIE | \$ 129 |
| 80col. card for Apple II & II +                  | 139    |

## PERSONAL SYSTEMS

|                                                                                             |        |
|---------------------------------------------------------------------------------------------|--------|
| <b>APPLE</b>                                                                                |        |
| Apple IIE Starter System incl: Apple IIE, Tilt Monitor, 1 Drive w/controller, 80 col. card. | \$1229 |
| Apple IIc Lightweight Portable                                                              | 999    |

|                                 |        |
|---------------------------------|--------|
| <b>IBM</b>                      |        |
| IBM PC Bare w/cont. & keyboard  | \$1199 |
| IBM PC 64K, 1 Drive             | 1325   |
| IBM PC 64K, 2 Drives            | 1499   |
| IBM PC, 2 Drives w/256K         | 1599   |
| IBM XT, 128K, 10 Meg., 360K Dr. | 3495   |

Call About All "AT" Systems

|               |        |
|---------------|--------|
| <b>KAYPRO</b> |        |
| Kaypro II     | \$1179 |
| Kaypro 4      | 1645   |
| Kaypro 10     | 2295   |

|                                           |        |
|-------------------------------------------|--------|
| <b>SANYO</b>                              |        |
| MBC 550-2 w/1 320K Drive & sftwr.         | \$ 895 |
| MBC 555-2 w/2 320K Drives & more software | 1095   |
| Serial Port for Sanyo                     | 69     |

|                                                                         |        |
|-------------------------------------------------------------------------|--------|
| <b>TAVA</b>                                                             |        |
| TAVA PC1 Par. & 1 Ser. Ports, 128K, 2-320K Drives, Color Card & Monitor | \$1550 |
| TAVA XT same as above including 10 meg. Hard Disk Drive                 | \$2495 |

|                       |        |
|-----------------------|--------|
| <b>COMPAQ</b>         |        |
| 256K, w/2-320K Drives | \$2195 |

## DISK DRIVES

|                |        |
|----------------|--------|
| <b>SIEMENS</b> |        |
| FD 100-8       | \$ 145 |

|                          |        |
|--------------------------|--------|
| <b>TANDON</b>            |        |
| TM100-2 for IBM PC       | \$ 149 |
| TM65-2, 1/2 Height, 320K | 189    |

|                                                          |        |
|----------------------------------------------------------|--------|
| <b>ALPHA OMEGA</b>                                       |        |
| 10 Meg HD for IBM & Comp. w/Cont. Card 13 Month Warranty | \$ 875 |

|                        |        |
|------------------------|--------|
| <b>TEAC</b>            |        |
| 558 Double Sided 360K  | \$ 135 |
| 2 for 255 Quad Density | 189    |

|                  |        |
|------------------|--------|
| <b>PANASONIC</b> |        |
| 1/2 Height, 360K | \$ 139 |

|                                                     |        |
|-----------------------------------------------------|--------|
| <b>Drives For Apple &amp; Franklin RANA SYSTEMS</b> |        |
| Elite I                                             | \$ 219 |
| Elite II                                            | 339    |
| Elite III                                           | 399    |
| Controller add.                                     | 85     |

|                     |        |
|---------------------|--------|
| <b>MICRO-SCI</b>    |        |
| A-2                 | \$ 179 |
| A-5 for IIC w/cable | 199    |
| Controller Add      | 70     |

## MODEMS

|               |        |
|---------------|--------|
| <b>ANCHOR</b> |        |
| Mark XII      | \$ 229 |

|                       |        |
|-----------------------|--------|
| <b>HAYES MICRO</b>    |        |
| 300 Baud Smart Modem  | \$ 205 |
| 1200 Baud Smart Modem | 459    |
| 1200 B for IBM PC     | 389    |
| Micro Modem IIE       | 259    |
| Chronograph           | 189    |

**GIVE US A CHANCE TO BEAT THE COMPETITION'S ADVERTISED PRICE. IF YOU SEE IT ADVERTISED FOR LESS, CALL COMPUTER CONNECTION FIRST FOR LOWEST QUOTE!**

**MAIL ORDER:**  
12841 S. Hawthorne Blvd., No. 585  
Hawthorne, California 90250



NO SURCHARGE FOR CREDIT CARDS

We accept VISA, MasterCard, COD (w/ deposit), Certified Checks or Wire Transfers. Minimum Shipping Charge \$4.00. Some items subject to back order. California Res. add 6 1/2% Sales Tax. Prices subject to change without notice.

**TOLL FREE ORDER LINE (800) 732-0304**

(Outside California)  
**(213) 514-9019**  
(Inside California)

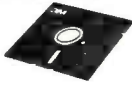
**TECH. SALES & INFO.:**  
**(213) 514-9019**

Mon.-Fri. 8 a.m. to 6 p.m.  
Saturday 11 a.m. to 3 p.m.

**COMPUTER CONNECTION**

# 3M

diskettes



## 5 1/4"

Specify soft,  
10 or 16 sector

Minimum Order 50

Single sided  
double density

### 1.55 ea.

Double sided  
double density

### 2.08 ea.

Certified Check - Money Order - Personal Check. Allow up to 2 weeks for personal checks to clear. Add \$3.00 per 100 or part to each order for U.P.S. shipping charges. NJ Residents add 6% sales tax.

## DATA EXCHANGE, INC.

178 Route 206 South, P.O. Box 993  
Department C  
Somerville, N.J. 08876 • (201) 874-5050

Circle 109 on inquiry card.

# The Statistician

CPM IBM-PC  
TRS-DOS XENIX

- Multiple Regression
- Stepwise Ridge
- All Subsets
- Backward Elimination
- Time Series Analysis
- Descriptive Statistics
- Transformations
- Survey Research
- Nonparametrics
- XY Plots
- ANOVA
- Random Samples
- Data Base
- Search & sort
- Hypothesis tests

Please call **TOLL FREE**  
**1-800-334-0854 (Ext. 814)**



for more information  
or write:  
Quant Systems  
Box 628  
Charleston, SC 29402  
VISA/M/C Accepted

Circle 320 on inquiry card.

## 5 Year Warranty

# SAVE 50% ON

## Verbatim Datalife Diskettes

### SPECIAL DISKETTE OFFER

Verbatim Datalife Disks have 6 data-shielding improvements for greater disk durability and longer data life.

**PLUS!** If you call, write, or utilize reader service in response to this ad—we'll send you our full-range catalog of computer supplies with Special Offers good for further savings on Verbatim diskettes and many other quality products.

Call or write for our discount catalog.

### LYBEN COMPUTER SYSTEMS

1250-E Rankin Dr., Troy, MI 48083  
Phone: (313) 589-3440

**DATALIFE • THE NAME IS THE PROMISE  
THE WARRANTY IS THE PROOF**

Circle 237 on inquiry card.

## Introducing . . .

# TurboTax™

the **ULTIMATE**  
personal tax program

- IBM PC or 100% compatible
- 33 forms, schedules & worksheets
- **FAST!** Complete return in 3sec.
- Windows!
- Exceeds IRS print specs.
- Full depreciation support
- Much more!
- CA / AZ available December-\$30

Req. 192K \$65 plus \$5 ship/hand  
(CA residents add 6 1/2% sales tax)

## ChipSoft, Inc.

5674 Honors San Diego, CA 92122  
(619) 453-8722  
(800) 621-0852 ext. 355

Circle 58 on inquiry card.

## IN STOCK MODEMS 2 DAY SHIP

- ★ Hayes Compatible ★
- ★ Free Communications Software ★

|                                  |        |
|----------------------------------|--------|
| HAYES 1200                       | ★\$449 |
| U.S. ROBOTICS Password           |        |
| 300/1200 Auto A/D w/cables, spkr | ★\$314 |
| ANCHOR AUTOMATION SIGNALMAN      |        |
| Mark I 300 Baud                  | \$ 69  |
| Mark X 300 Baud Auto A/D         | ★\$119 |
| Mark XII 1200/300 Auto A/D       | ★\$239 |
| QUBIE                            |        |
| Internal 300/1200 Auto A/D       | ★\$269 |
| External 300/1200 Auto A/D       | ★\$289 |

### DIRECT CONNECT DEVICES

P.O. Box 13256, San Luis Obispo, CA 93406

CALL FOR FREE CATALOG CALL TO ORDER: (805) 543-6308

Dealer Inquiries Invited

Circle 118 on inquiry card.

## 6 times faster

Super Fast Z80 Assembly Language Development Package

### Z80ASM

- Over 6000 line/minute
- Generates COM, HEX, or REL files
- Cross-Reference
- Zilog mnemonics
- Time and Date In listing
- Long labels

### SLRKC

- One or two pass operation
- Cross-reference
- COM or HEX output
- Flexible address control

Most formats available for Z80 CP/M, CDOS, and TURBODOS

### \$199.95

## SLR Systems

For more information or to order, call:  
1-800-833-3061 in Pa. (412) 282-0864  
1622 North Main Street, Butler, PA 16001  
VISA or Mastercard

Circle 341 on inquiry card.

## AFFORDABLE M-68000 COMPUTER SYSTEM



|                                                                                                                                                                          |          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <b>M68KCPU</b> 6.10 MHz CPU, 20K static RAM, 16K EPROM, on board monitor, two RS-232 serial ports, 16-bit parallel port, 5 timer/counters expansion bus. Bare board..... | \$ 99.95 |
| Complete Kit.....                                                                                                                                                        | \$595.00 |
| <b>MD512K</b> 128-512K static RAM, floppy disk controller & hard disk interface Bare Board.....                                                                          | \$ 99.95 |
| Complete Kit (128K).....                                                                                                                                                 | \$725.00 |
| <b>M68KE</b> Enclosure with power supply, fan, filter, 4 slot card cage.....                                                                                             | \$249.00 |
| <b>M68KASM</b> M68000 Macro Cross Assembler for CP/M80, IBM PC, TRS-80 and Apple II computers.....                                                                       | \$199.00 |
| UPS shipping & handling                                                                                                                                                  | \$ 4.00  |
| COD orders add                                                                                                                                                           | \$ 3.00  |
| Foreign orders add                                                                                                                                                       | \$20.00  |
| California residents add 6.5% tax                                                                                                                                        |          |

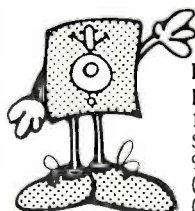
**EMS** Educational Microcomputer Systems  
P.O. Box 16115 • Irvine, CA 92713  
(714) 854-8545

Circle 140 on inquiry card.



## FLEXIBLE DISCS

**WE WILL NOT BE UNDER-SOLD!!** Call Free (800)235-4137 for prices and information. Dealer inquiries invited and C.O.D.'s accepted.



**PACIFIC EXCHANGES**  
100 Foothill Blvd.  
San Luis Obispo, CA 93401. In Cal. call (800)592-5935 or (805)543-1037

Circle 300 on inquiry card.

## FREE Comm.64 Book

GET ONE BASIC BOOK FREE WITH EVERY ORDER

\*\*\*\*\*  
**BLIZTEXT 1.1** Wordprocessor for C64  
 This wordprocessor has all the features that you expect from a good wordprocessor plus some additional features. The standard features include:  
 Full screen oriented editing with horizontal and vertical scrolling, dynamic formatting, window control modes can be inserted anywhere within the text, for underlining, shift to a different font and whatever else your printer can perform, works with all printers (parallel, serial, IEEE), single keystroke for disk directory and error channel, global or local search and replace, left and right margin justification, centering, page numbering, foot notes heading, calculations within the text, different screen and border color/define, copy & paste to move/duplicate portions of the text, double line spacing, definable form length and width, indent paragraph, text can be saved on disk or cassette, in normal format or in Commodore format, text can be used either in all format commands, or in a formatted form, so that it can be checked by a slitting checker, lines can be up to 250 characters long, 40 columns can be entered at a time.  
 The additional features of BLIZTEXT 1.1 are:  
 AN INCLUDE function for large texts that cannot be held in memory at the same time, you can include textfiles on up to four disk drives. This gives you control over every large text, you can print a whole book that way. Also, if 2500 characters can be in memory at the same time, in addition to that you have room for more than 4000 characters in the core register.  
 The terminal facility built into the BLIZTEXT 1.1 program allows you to send/receive electronic messages via the phone system and a modem (VIC, HES, or Smart Modem). This gives you tremendous opportunities, for example, you can receive and at the same time store data from a data base, or a writer can provide texts at home and then send them to a typesetting machine. The terminal mode also can be used to send/receive information from another computer via a RS232 signal. Everything can be defined with the terminal mode like the number of stop bits, the word length, the baudrate, parity, full or half duplex, 3 line or 4 line, (evening is available on disk and on cassette (opt. specialty).  
 Order No. 4965 only \$ 49.00

**BLIZTEXT COMBO PACKAGE**  
 This package consists of the BLIZTEXT 1.1 wordprocessor plus the following tools working in conjunction with BLIZTEXT: A complete mailing list program with an option allowing you to merge addresses with a letter created by BLIZTEXT.  
 A program which allows you to convert a sequential file into a BASIC program file, so that you can use BLIZTEXT to edit BASIC programs.  
 A printer driver which allows you to use all CENTRONICS compatible printers.  
 Order No. 4966 \$ 89.00

Dealer and Distributor inquiries are invited.  
**ELCOMP PUBLISHING, INC.**  
 2174 West Foothill Blvd., Unit E, Dept. 36  
 Upland, CA 91786  
 Phone: (714) 625-8314, 11x: 29 81 81

**PAYMENT:** Check, VISA, MC  
 C.A.R.E. clients add 5% sales tax.  
 Add \$ 2.00 for shipping.  
 Outside USA: add 15% for shipping  
 In Singapore contact: telex 222456  
 In Germany contact: telex 526973

Circle 143 on inquiry card.



# ADVANCED COMPUTER PRODUCTS, INC.

SINCE 1976

1985 CATALOG  
Send \$1.00

MAIL ORDER PRICING ONLY

**\$5,000,000 SALE CELEBRATION**  
**SAVE NOW AT NEW LOW PRICES!**  
**9th Year Anniversary SALE!**

Corporate Buyers ...  
Call For Volume Quotes!

**IF YOU DON'T SEE IT TOLL FREE CALL TOLL FREE**

## APPLE COMPATIBLE PERIPHERALS

|                               |             |
|-------------------------------|-------------|
| ALS CP16 PLUS CARD            | SALE \$1900 |
| COEX 16M RAM CARD             | SALE 99.95  |
| COEX PAR PRINTER CARD w/CABLE | 49.95       |
| COEX 80 COLEX 64K CARD        | SALE 99.95  |
| 5 INPK50 IO (16 IN)           | 139.95      |
| KENNINGTON SYSTEM SAVER       | 69.95       |
| KENNINGTON PC SAVER           | 39.95       |
| KRAFT JOYSTICK                | 36.95       |
| HOT SPEED DEMON               | 249.95      |
| MICROSOFT 2.0 SOFTCARD        | 24.95       |
| GRAPPLER PLUS                 | 119.95      |

|                                |               |
|--------------------------------|---------------|
| BUFFERED GRAPPLER              | \$349.95      |
| GRAPPLER SUPER SERIAL          | SALE \$119.95 |
| VIDEO 7 RGB I/O                | 169.95        |
| APPLE IIC SERIAL CABLE         | 36.95         |
| APPLE IIC KEYBOARD             | 59.95         |
| APPLE IIC POWER SUPPLY         | 49.95         |
| APPLE IIC DISK CONTROLLER      | 49.95         |
| APPLE IIC COOLING FAN SYSTEM   | 49.95         |
| STREET TECHNO II SPEECH SYSTEM | 99.95         |
| TITAN ACCELERATOR II CARD      | 449.95        |
| WIZARD 80 COLUMN CARD          | SALE 99.00    |

## FARADAY IBM PC®

Compatible CPU Board w/MS DOS  
**\$349.95**

**MOST MAJOR LINES IN STOCK CALL TOLL FREE**

## IBM PC® HARDWARE

|                            |          |
|----------------------------|----------|
| AGT "COMBOPLUS" 64K        | \$199.00 |
| SIGMA "MAXIMIZER" 64K      | 249.95   |
| SIGMA DISK CONTROLLER      | 169.95   |
| 10 MB INTERNAL HARD DISK   | 79.95    |
| 10 MB EXTERNAL HARD DISK   | 89.50    |
| 15 MB EXTERNAL HARD DISK   | 99.50    |
| 15 MB EXTERNAL HARD DISK   | 109.50   |
| 80 WATT BOOSTER SUPPLY     | 149.95   |
| 130 WATT IBM SUPPLY        | 174.95   |
| PC COMPATIBLE KEYBOARD     | 39.00    |
| IBM PC CHASSIS             | 129.95   |
| PLANTRONICS "COLORPLUS"    | 369.95   |
| 10 MB INT. TAPE ST. REAMER | 119.00   |
| PERYSYST MONO CARD         | 409.95   |
| PARADISE MONO/COLOR        | 369.00   |
| HERCULES MONO CARD         | 369.00   |

|                            |               |
|----------------------------|---------------|
| KEYTRONIC 5150/51          | 156.00/199.00 |
| MOUSE SYSTEMS MOUSE W/5W   | 149.95        |
| QUADBOARD w/64K            | 263.00        |
| APPLE IIIC GRAPHICS MASTER | 545.00        |
| TECMAR CAPTAIN 64K         | 319.00        |
| CURTIS PC PEDESTAL         | 39.00         |
| PCS or QUADROHE ADAPTOR    | 9.00          |
| TILT AND SWIVEL STAND      | 21.00         |
| SYSTEM STAND               | 21.00         |
| EXTENSION CABLE IBM MONO   | 36.00         |
| KEYBOARD EXTENSION CABLE   | 28.00         |
| SURGE SUPPRESSORS          | 21.00         |
| DIAMOND (LEMONT)           | 39.00         |
| EMERALD (LIME)             | 49.00         |
| SAPPHIRE (PEACH)           | 28.00         |
| RUBY (ORANGE)              | 69.00         |

## PRINTERS

|                             |               |
|-----------------------------|---------------|
| BROTHER HR-15P/5 (11cps)    | SALE \$399.00 |
| BROTHER HR-25P/5 (23cps)    | SALE 639.00   |
| BROTHER HR-35P/5 (36cps)    | 979.00        |
| NEW BROTHER M2024 (24ppm)   | 1299.00       |
| EPSON 80/80 (80cps)         | SALE 149.00   |
| EPSON RX-80BPT (110cps)     | SAVE 150.00   |
| EPSON MX-80T (100cps)       | SAVE 150.00   |
| EPSON FX-80 (160cps)        | SAVE 150.00   |
| EPSON FX-120 (160cps)       | SAVE 150.00   |
| MACINTOSH or its SERIAL IO  | 115.00        |
| OKidata 92P (180cps)        | SALE 399.95   |
| OKidata 3P (180cps)         | 799.00        |
| OKidata 64P (200cps)        | 1295.00       |
| OKidata 235P (350cps)       | 1895.00       |
| TOSHIBA P1351 (24ppm)       | 1295.00       |
| STAR GEMINI 101 (120cps)    | 329.00        |
| STAR GEMINI 10XP            | 379.00        |
| STAR GEMINI 15XP            | 449.00        |
| SPECIAL STAR 57X 80 THERMAL | 399.00        |
| NEC 8027A PORTABLE PRINTER  | 1499.00       |
| PANASONIC 1001              | SALE 459.00   |

## 64K STATIC RAMCARD \$199.95

PLUS MAJOR OEM PURCHASE WHILE SUPPLY LASTS  
ALL NEW SOME W/O DOCUMENTATION  
\* TURBO BOARD SALE 99.95  
\* FRONT PANEL BD (IMSAI) SALE 79.95  
\* 8080 MPU BOARD SALE 49.95  
\* 8" FLOPPY CONTROLLER (Morrow) 149.95  
\* S-10 EXTENDER CARD 24.95

## CAPACITORS

|                            |            |
|----------------------------|------------|
| 01uF DISC BYPASS CAPACITOR | 100/\$5.50 |
| 1 uF DISC BYPASS CAPACITOR | 100/\$6.50 |
| 01uF MONOLITHIC CAPACITOR  | 100/\$1.25 |
| 1 uF MONOLITHIC CAPACITOR  | 100/\$1.25 |

## OPTO ISOLATORS

|         |      |       |         |
|---------|------|-------|---------|
| MCT-2   | 5.99 | 4N33  | \$ 8.99 |
| MCT-8   | 1.19 | 4N35  | \$ 1.25 |
| MCT-66  | 5.59 | 4N37  | \$ 1.25 |
| MCA-255 | 1.69 | 4N38  | \$ 1.99 |
| 4N26    | 6.89 | TL18  | \$ 7.99 |
| 4N27    | 3.19 | SPK33 | \$ 2.99 |
| 4N28    | 6.99 |       |         |

## EDGE CONNECTORS

|                   |      |       |          |
|-------------------|------|-------|----------|
| S-100ST           | 5.99 | 100   | \$ 9.99  |
| S-100 W           | 4.75 | 41.00 | \$ 33.25 |
| 44 Pin ST         | 2.75 | 2.60  |          |
| UP2404 (100 pins) | 4.75 | 4.25  |          |
| 72 Pin ST         | 7.25 | 6.95  |          |

## DISK DRIVES

|                 |          |
|-----------------|----------|
| TEAC 55B        | \$149.95 |
| MITSUBISHI 4651 | 149.05   |
| SHUGART 455     | 159.85   |
| TANDON TM1002   | 169.95   |

## DRIVE CABINETS

|                                 |         |
|---------------------------------|---------|
| 5 1/4" CASE POWER SUPPLY        | \$69.95 |
| 5 1/4" DUAL 1/4" w/POWER SUPPLY | 164.95  |
| 8" DUAL CASE w/POWER SUPPLY     | 279.95  |
| 8" THINLINE DUAL w/POWER SUPPLY | 199.95  |
| 5 1/4" HARD DISK w/POWER SUPPLY | 199.95  |
| 5 1/4" 1/2" DUAL HARD DISK      | 199.95  |

## APPLE DISK DRIVES

|                                |          |
|--------------------------------|----------|
| APPLE IIC COMPATIBLE           | \$174.95 |
| APPLE IIC COMPATIBLE 1/4 HIGH  | 164.95   |
| MICROSOFT APPLE IIC DRIVE      | 219.95   |
| APPLE IIC to APPLE IIC ADAPTOR | 19.95    |
| APPLE IIC DISK CONTROLLER      | 49.95    |

## TEXT/ZIP/286 ZIP INSERTION

|                                |              |       |         |
|--------------------------------|--------------|-------|---------|
| 16 Pin S-75                    | 24 Pin ST/85 | 29.95 | \$89.95 |
| We Stock All Types of Sockets! |              |       |         |

## 68000

|          |         |                        |         |      |         |
|----------|---------|------------------------|---------|------|---------|
| 68000    | \$48.95 | 6810                   | \$ 2.85 | 6850 | \$ 3.25 |
| 68000L10 | 69.95   | 6820                   | 3.70    | 6852 | 5.65    |
| 6800     | 2.90    | 6821                   | 2.90    | 6856 | 7.90    |
| 6802     | 7.75    | 6822                   | 14.50   | 6875 | 6.75    |
| 6803     | 16.95   | 6840                   | 11.50   | 6880 | 2.20    |
| 6809E    | 14.50   | (CALL FOR 8008 FAMILY) |         |      |         |

## 6500

|       |        |      |        |      |        |
|-------|--------|------|--------|------|--------|
| 6502  | \$4.50 | 6504 | \$6.75 | 6522 | \$6.75 |
| 6509A | 6.95   | 6507 | 9.75   | 6532 | 9.50   |
| 6502B | 9.50   | 6520 | 4.25   | 6551 | 11.50  |

## 000

|         |         |       |         |       |         |
|---------|---------|-------|---------|-------|---------|
| 8039    | \$ 5.75 | 8214  | \$ 3.75 | 8259  | \$ 6.75 |
| 8004    | 9.95    | 8216  | 1.95    | 8271  | 69.95   |
| 8085A   | 4.90    | 8226  | 1.95    | 8279  | 8.75    |
| 8008C8A | 9.95    | 8228  | 3.40    | 8282  | 6.25    |
| 8006    | 24.50   | 8237  | 14.75   | 8283  | 6.25    |
| 8087    | 169.95  | 8253  | 18.95   | 8284  | 5.00    |
| 8088    | 29.50   | 8238  | 4.25    | 8286  | 6.45    |
| 8099    | 89.95   | 8243  | 3.95    | 8287  | 6.45    |
| 8105    | 6.75    | 8244  | 6.25    | 8288  | 14.95   |
| 6156    | 8.75    | 8251  | 4.25    | 8289  | 4.45    |
| 8185    | 26.95   | 8251A | 6.95    | 8292  | 12.95   |
| 8202    | 23.95   | 8253  | 6.75    | 8741  | 27.95   |
| 8203    | 37.95   | 8255  | 4.25    | 8742  | 26.50   |
| 8205    | 3.25    | 8255A | 6.95    | 8749  | 24.95   |
| 8212    | 1.95    | 8257  | 5.75    | 8755A | 34.95   |

## 2.5MHz "AA" 4.0MHz "B" 6.0MHz

|          |       |       |       |
|----------|-------|-------|-------|
| Z80-CPU  | 3.75  | 4.35  | 9.50  |
| Z80-CTC  | 3.75  | 4.75  | 12.25 |
| Z80-DMA  | —     | 9.50  | 17.95 |
| Z80-DART | 12.95 | 11.95 | 17.95 |
| Z80-PIO  | 11.25 | 12.25 | 12.50 |
| Z80-SIO1 | 11.95 | 12.75 | —     |
| Z80-SIO2 | 11.95 | 12.75 | 36.95 |

## DISK CONTROLLER

|              |       |          |       |          |       |
|--------------|-------|----------|-------|----------|-------|
| UP705\$24.95 | 1797  | \$296.95 | 6843  | \$329.95 |       |
| 1771         | 15.95 | 2791     | 49.95 | 8272     | 24.95 |
| 1781         | 24.75 | 2793     | 49.95 | 8274     | 24.95 |
| 1793         | 26.50 | 2795     | 49.95 | 2143     | 12.95 |
| 1795         | 26.50 | 2797     | 49.95 | 9216     | 12.95 |

## CRT CONTROLLERS

|       |         |      |         |         |         |
|-------|---------|------|---------|---------|---------|
| 6845  | \$14.74 | 8275 | \$26.50 | TMS919B | \$39.50 |
| 6845  | 17.95   | 8220 | 39.95   | TMS939B | 39.95   |
| 6647  | 11.50   | 5027 | 17.95   | 6545    | 21.50   |
| 4650  | 14.75   | 5037 | 21.95   | 8002    | 19.95   |
| 68047 | 24.50   |      |         |         |         |

## UARTS/USART

|       |        |        |         |         |         |
|-------|--------|--------|---------|---------|---------|
| 1602B | \$3.95 | 2350   | \$ 8.95 | IM403   | \$ 8.75 |
| 1013A | 3.95   | 8250   | 10.50   | TMS5501 | 14.95   |
| 1015A | 6.75   | IM6402 | 7.75    | 2851    | 6.95    |

## EPROMS

|              |         |                  |         |
|--------------|---------|------------------|---------|
| 17021(1Ms)   | \$ 3.90 | 2732A (450ns)    | \$ 6.50 |
| 2708 (450ns) | 3.65    | 2732A(250ns)     | 8.95    |
| 2756 (5V)    | 5.50    | 2752A (200ns)    | 12.50   |
| 2716 (450ns) | 3.75    | 2764 (450ns)     | 6.50    |
| 2716 (350ns) | 5.50    | 2764 (200ns)     | 7.50    |
| 2516 (5V)    | 5.50    | 2764 (200ns)     | 17.50   |
| TMS2716      | 5.50    | TMS2564 (450ns)  | 12.95   |
| TMS2532      | 5.90    | MCM68764 (450ns) | 34.95   |
| 2732 (450ns) | 4.00    | MCM68766 (350ns) | 39.95   |
| 2732 (450ns) | 6.25    | 2712B (300ns)    | 21.50   |
| 2732 (200ns) | 10.95   | 2712B (250ns)    | 22.95   |

## STATIC RAMS

|                 |        |                     |        |
|-----------------|--------|---------------------|--------|
| 2101 (450ns)    | \$2.29 | MK4118              | \$4.95 |
| 2102 (450ns)    | .99    | TM2M2018 (200ns)    | 14.00  |
| 2102 (250ns)    | 1.39   | TM2M2018-15 (150ns) | 9.95   |
| 2111 (450ns)    | 2.75   | HM6116P (400ns)     | 4.75   |
| 2112 (450ns)    | 2.75   | HM6116P-3 (150ns)   | 4.95   |
| 2114 (450ns)    | 1.45   | HM6116P-2 (120ns)   | 3.95   |
| 2114 (450ns)    | 1.69   | HM6116P-4 (LP)      | 5.00   |
| 2114L (300ns)   | 1.79   | HM6116P-3 (LP)      | 6.75   |
| 2114L-2 (300ns) | 1.89   | HM6116P-2 (LP)      | 9.95   |
| 2147 (450ns)    | 4.00   | HM6116P-2 (120ns)   | 12.95  |
| 4044 (450ns)    | 3.25   | HM6264P-15 (150)    | 32.95  |
| 4044 (300ns)    | 3.75   | HM6264P-15 (LP)     | 36.95  |
| 4044-2 (200ns)  | 4.35   | 74S199 (35ns)       | 1.85   |
| UP2404 (100ns)  | 3.75   | 93415 (50ns)        | 3.95   |
| 5101 (CMOS)     | 3.50   | 93425 (50ns)        | 3.95   |

## DYNAMIC RAMS

|                   |        |                  |       |
|-------------------|--------|------------------|-------|
| 4027 (150ns)      | \$1.79 | TMS4116 (150ns)  | 39.75 |
| 1103 (300ns)      | 1.95   | 41256-150 (150n) | 29.95 |
| 4116M-2 (200ns)   | 1.80   | 41256-200 (200n) | 24.95 |
| 4116M-3 (200ns)   | 1.65   | 41256-300 (300n) | 24.95 |
| 4116M-4 (200ns)   | 1.45   | 41256-400 (400n) | 1.85  |
| 4164M-150 (150ns) | 3.94   | 95M280 (300ns)   | 1.85  |
| 4164M-200 (200ns) | 95M930 | UPD411 (300ns)   | 1.85  |
| 4164M-120 (120ns) | 6.49   | MMS290 (250ns)   | 1.85  |
| TMS4164 (150ns)   | 7.95   |                  |       |

## COEX 80/F/PRINTER

|      |          |
|------|----------|
| 80/F | \$149.95 |
| 80/F | \$149.95 |

## SUPER SAVER IBM PC®

|                       |          |
|-----------------------|----------|
| Comp. OS/2 Disk Drive | \$124.95 |
|-----------------------|----------|

## HI-TECH SPECIALS

|              |         |
|--------------|---------|
| TMS99532NL   | \$14.95 |
| 300BA MDD51C | \$14.95 |

## DATA ACQUISITION

|                 |                |                |
|-----------------|----------------|----------------|
| ADC0804 \$14.95 | ADC0817 \$9.75 | 140816 \$1.85  |
| ADC0804 \$4.95  | DAC0808 \$9.40 | DAC0808 \$9.40 |
| ADC0809 \$4.95  | DAC1022 \$9.95 | DAC0817 \$1.85 |
| ADC0816 \$4.25  | DAC1020 \$7.85 | DAC0817 \$1.85 |

## TOLL FREE

**800-854-8230**  
970-595-1565

## LINEAR

|                 |         |        |        |        |        |
|-----------------|---------|--------|--------|--------|--------|
| LM108AH         | \$39.95 | NE590  | \$2.45 | LM3914 | \$2.95 |
| LM300H          | 99      | NE592  | 2.70   | LM3915 | 2.95   |
| LM301N          | 35      | LM709N | 55     | LM3916 | 2.95   |
| LM304A          | 1.89    | LM709H | 1.90   | MC4024 | 3.75   |
| LM304B          | 1.45    | LM712H | 6.80   | MC4044 | 4.35   |
| LM308H          | 4.75    | LM711  | 7.75   | RC131  | 3.75   |
| LM307N          | 4.00    | LM715  | 3.95   | RC136  | 1.90   |
| LM308N          | 1.85    | LM723H | 7.75   | CA3023 | 7.75   |
| LM310CN         | 1.65    | LM723H | 7.75   | CA3023 | 7.75   |
| LM313CN         | 1.65    | LM733  | 9.85   | CA3039 | 1.25   |
| LM312H          | 1.75    | LM739  | 1.85   | CA3048 | 1.25   |
| LM313H          | 1.45    | LM712H | 6.80   | CA3051 | 1.60   |
| LM316H          | 1.55    | LM741H | 2.90   | CA3060 | 2.65   |
| LM319H          | 1.19    | LM741H | 2.90   | CA3085 | 1.69   |
| LM320 (see V9)  | LM747   | 65     | CA3080 | 1.10   |        |
| LM322           | 55      | LM748  | 6.95   | CA3081 | 1.60   |
| LM330N          | 55      | LM1014 | 1.15   | CA3082 | 1.80   |
| LM330N          | 55      | LM1014 | 1.15   | CA3083 | 1.55   |
| LM330N (see V9) | LM1303  | 1.90   | CA3083 | 1.55   |        |
| LM349N          | 95      | LM1310 | 1.45   | CA3088 | 8.00   |
| LM353N          | 68      | LM131  |        |        |        |

## LOW-COST STEPPING MOTOR CONTROLLER



MAXWELL ELECTRONICS' NEW SMC-102A IS A READY-TO-USE STEPPING MOTOR CONTROLLER THAT PROVIDES MANUAL OR COMPUTER CONTROL OF UP TO TWO STEPPING MOTORS.

- Manual control using front panel speed and direction controls or optional Joystick.
  - Digital motor position display available.
  - Computer control using built-in parallel bus or optional RS-232C port.
  - Power supplies and motor drives included.
- Prices for the SMC-102A start at \$495. Other Stepping Motor Controllers also available.

**M** MAXWELL ELECTRONICS INC.  
P.O. BOX 582 MARTINSVILLE, NJ 08836  
800-922-0460 201-647-7441

Circle 245 on inquiry card.

## I.B.M. Compatible Apple Compatible

|                                              |                                                                                                                             |
|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Case \$125.00                                | TTL IC Tester Card \$125.00                                                                                                 |
| KeyBoard \$189.00                            | Z-80 Card \$30.00                                                                                                           |
| Motherboard with ICS (no Ram) \$240.00       | 80 Column Card \$40.00                                                                                                      |
| Motherboard with IC (1 m add. 128K) \$500.00 | Disk Drive \$149.00                                                                                                         |
| Power Supply 130 Watt \$175.00               | (APPLE OR I.B.M.) 14 inch Monitor \$89.00                                                                                   |
| Multi Function Card \$250.00                 | PROM 8200 (FAST UNIVERSAL TYPE EPROM & PROM PROGRAMMER) Call EPROM: 2716, 2732, 2732A, 2764, 27128, 27256, 2516, 2532, 2564 |
| Color Graphic Board \$209.00                 | Floppy Disk Control Card \$170.00                                                                                           |
|                                              | Prom: ANY KIND                                                                                                              |

ALL PHONES  
CALL NOW (312) 280-7610

**DIST. WANTED  
CUSTOM PRODUCTS**

**HOFFMAN INT'L**  
600 N McClurg CT. STE. 309A  
Chicago, Illinois 60611

Circle 178 on inquiry card.

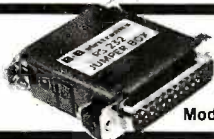
## PRINTER RIBBONS

|                          | PRICE | PER RIBBON | PER DOZEN |
|--------------------------|-------|------------|-----------|
| ANADEX 9500              | ..... | 10.50      | 109.80    |
| APPLE OMP                | ..... | 5.25       | 52.20     |
| C. ITOH PROWRITER        | ..... | 5.25       | 52.20     |
| EPSON MX-FX 70/80        | ..... | 5.00       | 48.00     |
| EPSON MX-FX 100          | ..... | 6.75       | 69.00     |
| GEMINI 10-10X-15-15X     | ..... | 2.50       | 23.40     |
| IBM HARMONICA 1/2"       | ..... | 6.75       | 78.00     |
| IBM HARMONICA 3/4"       | ..... | 7.95       | 92.40     |
| IBM 4-COLOR              | ..... | 15.75      | 180.00    |
| IBM MICROPRISM-480       | ..... | 5.75       | 58.80     |
| IOS PAPER TIGER 460/560  | ..... | 6.75       | 78.00     |
| IDS PRISM                | ..... | 7.95       | 92.40     |
| IOS 4-COLOR              | ..... | 15.75      | 180.00    |
| NEC - 3500 M/S Non Flip  | ..... | 6.25       | 69.00     |
| NEC - 3500 NYLON         | ..... | 9.00       | 96.00     |
| NEC PC-8023A             | ..... | 5.25       | 52.20     |
| OKI DATA 80/82/83/92     | ..... | 2.50       | 23.40     |
| OKI DATA - 84            | ..... | 5.00       | 57.00     |
| RADIO SHACK OMP-2100     | ..... | 7.50       | 87.00     |
| RADIO SHACK LP VI & VIII | ..... | 5.75       | 58.80     |
| SILVER REED EX 550 S/S   | ..... | 5.00       | 57.00     |
| SILVER REED EX 550 NYLON | ..... | 9.00       | 105.00    |
| TOSHIBA - 1350           | ..... | 7.50       | 87.00     |
| XEROX 610/620 M/S        | ..... | 5.95       | 66.00     |

Add \$3.00 Ship. & Hand. — To Order Call  
Toll Free 1-800-742-1122  
In MI (313) 569-3218 or Write for our Catalog  
**DWIGHT COMPANY, INC.**  
15565 Northland Drive - West Tower  
Southfield, Michigan 48075-6496

Circle 133 on inquiry card.

## Custom Wire Your RS-232 Interface



Model 232DJB

B&B's RS-232 JUMPER BOX is a compact unit with male and female connectors, each with 25 pins going to 25 solder pads. Custom wiring permits building of many different interfaces, null modems, pin reversers, etc. Unit has 20 jumper wires. **ORDER NOW. Only \$24.95.** All cash orders postpaid (IL res. add 6% sales tax). MC, Visa accepted. Ask for Free Catalog. Phone: (815)-434-0846.

**B & B electronics**  
MANUFACTURING COMPANY  
P.O. Box 1008B, OTTAWA, IL 61350

Circle 38 on inquiry card.



## Sure it's insured?

SAFWARE Insurance provides full replacement of hardware, media and purchased software. As little as \$35/yr covers:

- Fire • Theft • Power Surges
- Earthquake • Water Damage • Auto Accident

For information or immediate coverage call:

**1-800-848-3469**

In Ohio call (614) 262-0559



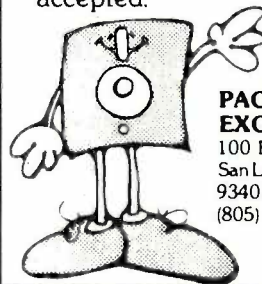
SAFWARE, THE INSURANCE AGENCY INC.

Circle 332 on inquiry card.



## flexible disks

Call Free (800)235-4137 for prices and information. Dealer inquiries invited. C.O.D. and charge cards accepted.



**PACIFIC EXCHANGES**  
100 Foothill Blvd.  
San Luis Obispo, CA  
93401 (In Cal. call  
(805) 543-1037)

Circle 300 on inquiry card.



## SAVE MORE THAN EVER ON 3M Scotch® DISKETTES

\$153 ea. 5 1/4" SSDD Qty. 20 **LIFETIME WARRANTY!** 5 1/4" DSDD \$206 ea. Qty. 20

5 1/4" SSDD-96TPI \$2.29 ea. 5 1/4" DSDD-96TPI \$2.90 ea.  
8" SSDD \$1.96 ea. 8" SSDD \$2.42 ea.  
8" DSDD \$.276 ea.

All diskettes are boxed in 10's with Tyvek sleeves, reinforced hubs or 5W", user identification labels and write-protect tabs. Shipping: 5 1/4" DISKETTES—Add \$3.00 per 100 or fewer diskettes. 8" DISKETTES—Add \$4.00 per 100 or fewer diskettes. Payment: VISA and MASTERCARD accepted. COD orders only, add \$3.00 handling charge. Taxes: Illinois residents only, add 8% sales tax.

**WE WILL BEAT ANY NATIONALLY ADVERTISED PRICE ON THE SAME PRODUCT AND QUANTITIES!**

MINIMUM ORDER \$35.00

For orders only: 1-800-621-6827

(In Illinois: 1-312-944-2788)

(All other calls: 1-312-944-2788)

Hours: 9AM-5PM Central, Mon.-Fri.

**DISK WORLD, Inc.**

Suite 4806 • 30 East Huron Street • Chicago, Illinois 60611

Authorized Distributor Information Processing Products



Circle 126 on inquiry card.

## CROSS SOFTWARE for the NS32000

### INCLUDES:

- \* Cross Assembler \*
- \* Cross Linker \*
- \* Debugger \*
- \* N.S. ISE Support \*
- \* Librarian \*
- \* Pascal Cross Compiler \*
- \* C Cross Compiler \*

U.S. prices start at \$500

## SOLUTIONWARE

1283 Mt. View-Alvino Rd.

Suite B

Sunnyvale, Calif. 94089

408/745-7818 • TLX 4984264

Circle 348 on inquiry card.

## \*IBM® Compatible



E-PROMS — Call! Lowest Prices Anywhere

|                             |               |       |
|-----------------------------|---------------|-------|
| *4164-150/200               | .....         | 399   |
| 2764-250                    | .....         | 575   |
| 6116-LP3                    | .....         | 499   |
| 256K                        | .....         | 2650  |
| TTL & HCT Parts — now avail | Call 8087-3-6 | 8900  |
| *TM-100-2                   | .....         | 16995 |
| *Teac Half-Heights          | .....         | 16495 |
| *MPC DSDD                   | .....         | 13995 |

**Excess Inventories Wanted**

Add \$3.95 shipping to all orders • Prices subject to change • P.O.'s on approval • C.O.D. OK • All new, no surplus, no seconds, QUANTITY DISCOUNTS.

4920 Cypress St., Ste. 100, Tampa, FL 33607

In FL and for info, call 813-875-0299

**FOR ORDERS ONLY, 800-237-8910**



TELEX 330690

Circle 303 on inquiry card.

**74LS00**

|         |    |         |      |
|---------|----|---------|------|
| 74LS00  | 22 | 74LS166 | 1.50 |
| 74LS01  | 24 | 74LS168 | 1.35 |
| 74LS02  | 25 | 74LS169 | 1.35 |
| 74LS03  | 25 | 74LS170 | 1.35 |
| 74LS04  | 30 | 74LS173 | 1.35 |
| 74LS05  | 25 | 74LS174 | .85  |
| 74LS08  | 30 | 74LS175 | .90  |
| 74LS09  | 30 | 74LS181 | 2.50 |
| 74LS10  | 25 | 74LS190 | 1.45 |
| 74LS11  | 30 | 74LS191 | 1.45 |
| 74LS12  | 30 | 74LS192 | 1.45 |
| 74LS13  | 75 | 74LS193 | 1.45 |
| 74LS14  | 75 | 74LS194 | 1.45 |
| 74LS15  | 35 | 74LS195 | 1.45 |
| 74LS20  | 25 | 74LS196 | 1.35 |
| 74LS21  | 30 | 74LS197 | 1.35 |
| 74LS22  | 30 | 74LS221 | 1.35 |
| 74LS26  | 30 | 74LS240 | 1.85 |
| 74LS27  | 30 | 74LS242 | 1.85 |
| 74LS28  | 30 | 74LS243 | 1.85 |
| 74LS40  | 30 | 74LS244 | 2.25 |
| 74LS42  | 35 | 74LS245 | 2.95 |
| 74LS48  | 35 | 74LS247 | 1.65 |
| 74LS51  | 35 | 74LS248 | 1.65 |
| 74LS54  | 35 | 74LS249 | 1.65 |
| 74LS55  | 35 | 74LS251 | 1.75 |
| 74LS73  | 35 | 74LS253 | 1.75 |
| 74LS74  | 45 | 74LS258 | 1.50 |
| 74LS75  | 45 | 74LS259 | 2.95 |
| 74LS76  | 45 | 74LS260 | 1.15 |
| 74LS78  | 75 | 74LS261 | 3.75 |
| 74LS83A | 75 | 74LS266 | 1.35 |
| 74LS85  | 75 | 74LS273 | 1.75 |
| 74LS86  | 35 | 74LS275 | 1.95 |
| 74LS90  | 75 | 74LS279 | 75   |
| 74LS92  | 75 | 74LS283 | 75   |
| 74LS93  | 75 | 74LS290 | 75   |
| 74LS95  | 75 | 74LS293 | 1.25 |
| 74LS96  | 75 | 74LS295 | 1.65 |
| 74LS107 | 35 | 74LS298 | 1.65 |
| 74LS109 | 45 | 74LS323 | 2.95 |
| 74LS113 | 75 | 74LS324 | 1.15 |
| 74LS114 | 75 | 74LS347 | 1.55 |
| 74LS122 | 95 | 74LS348 | 1.45 |
| 74LS123 | 95 | 74LS352 | 1.65 |
| 74LS124 | 95 | 74LS353 | 1.95 |
| 74LS125 | 75 | 74LS363 | 1.95 |
| 74LS126 | 75 | 74LS365 | 1.25 |
| 74LS132 | 95 | 74LS366 | 1.25 |
| 74LS133 | 75 | 74LS367 | 95   |
| 74LS136 | 75 | 74LS368 | 95   |
| 74LS138 | 95 | 74LS373 | 1.95 |
| 74LS139 | 95 | 74LS374 | 1.95 |
| 74LS145 | 95 | 74LS375 | 95   |
| 74LS148 | 95 | 74LS377 | 95   |
| 74LS151 | 75 | 74LS378 | 1.55 |
| 74LS153 | 75 | 74LS379 | 1.55 |
| 74LS154 | 95 | 74LS381 | 1.95 |
| 74LS155 | 75 | 74LS385 | 1.95 |
| 74LS156 | 75 | 74LS386 | 1.25 |
| 74LS157 | 75 | 74LS390 | 2.55 |
| 74LS158 | 75 | 74LS393 | 1.55 |
| 74LS160 | 75 | 74LS395 | 1.55 |
| 74LS161 | 75 | 74LS424 | 1.95 |
| 74LS162 | 75 | 74LS640 | 1.95 |
| 74LS163 | 75 | 74LS668 | 2.75 |
| 74LS164 | 95 | 74LS645 | 1.95 |
| 74LS165 | 95 | 74LS670 | 1.50 |
|         |    | 74LS690 | 1.50 |

**74S00**

|        |      |
|--------|------|
| 74S00  | 30   |
| 74S02  | 30   |
| 74S03  | 30   |
| 74S04  | 35   |
| 74S05  | 35   |
| 74S08  | .65  |
| 74S09  | .65  |
| 74S10  | .95  |
| 74S11  | .95  |
| 74S15  | .95  |
| 74S20  | .95  |
| 74S22  | .95  |
| 74S30  | .95  |
| 74S32  | .95  |
| 74S38  | .95  |
| 74S40  | .95  |
| 74S51  | .95  |
| 74S64  | .95  |
| 74S65  | .95  |
| 74S74  | .95  |
| 74S86  | .95  |
| 74S112 | .95  |
| 74S113 | .95  |
| 74S114 | 1.25 |
| 74S124 | 3.65 |
| 74S133 | .95  |
| 74S134 | 1.25 |
| 74S135 | 1.65 |
| 74S136 | 2.25 |
| 74S138 | 1.25 |
| 74S139 | 1.25 |
| 74S140 | 1.25 |
| 74S151 | 1.25 |
| 74S153 | 1.95 |
| 74S157 | 1.95 |
| 74S158 | 1.95 |
| 74S160 | 1.95 |
| 74S161 | 1.95 |
| 74S163 | 2.95 |
| 74S174 | 2.25 |
| 74S175 | 2.25 |
| 74S188 | 3.55 |
| 74S194 | 2.55 |
| 74S195 | 2.55 |
| 74S196 | 2.55 |
| 74S225 | 7.75 |
| 74S240 | 2.95 |
| 74S241 | 2.95 |
| 74S242 | 2.95 |
| 74S243 | 2.95 |
| 74S251 | 2.25 |
| 74S253 | 2.25 |
| 74S257 | 1.95 |
| 74S258 | 1.95 |
| 74S260 | 1.25 |
| 74S280 | 2.95 |
| 74S283 | 3.95 |
| 74S287 | 3.95 |
| 74S288 | 3.95 |
| 74S289 | 4.95 |
| 74S373 | 3.95 |
| 74S374 | 3.95 |
| 74S387 | 3.95 |
| 74S471 | 4.95 |
| 74S472 | 7.95 |
| 74S473 | 7.95 |
| 74S474 | 9.95 |
| 74S475 | 9.95 |

**GENERAL PURPOSE BOARDS**

**BLANK BOARD — HOLES ON 100" GRID, No ETCHED CIRCUIT EXCEPT CONTACT FINGER**

| No. Contacts | Size  | Contact Centers | Price       |
|--------------|-------|-----------------|-------------|
| P 441-1      | 22/44 | 4.5" x 6"       | .156" 9.95  |
| P 442-1      | 22/44 | 4.5" x 9"       | .156" 10.95 |
| P 721-1      | 36/72 | 4.5" x 6"       | .100" 9.95  |
| P 722-1      | 36/72 | 4.5" x 9"       | .100" 10.95 |

**D— SUBMINIATURE CONNECTORS**

| Description | Solder Cup |        | Right Angle PC Mounting |        | Hood   |       |
|-------------|------------|--------|-------------------------|--------|--------|-------|
|             | Pin        | Socket | Pin                     | Socket | Grey   | Black |
| Part No.    | DXXP       | DXXS   | RDXP                    | RDXS   | DXXCGY | DXXC  |
| Contacts    | 9          | 2.05   | 2.65                    | 3.90   | 3.20   | 1.55  |
|             | 15         | 2.05   | 3.60                    | 3.70   | 5.40   | 1.55  |
|             | 25         | 2.50   | 3.25                    | 4.50   | 4.80   | 1.55  |
|             | 37         | 4.75   | 7.10                    | 9.40   | 10.95  | 2.95  |
|             | 50         | 6.00   | 9.25                    | ----   | 3.50   | ----  |

**MODEMS**

|       |                                                  |        |
|-------|--------------------------------------------------|--------|
| HAYES | IBM PC SMARTMODEM 1200B, Plug-in                 | 449.00 |
|       | SMARTCOM II COMMUNICATIONS SOFTWARE              | 99.00  |
|       | SMARTMODEM 300, AUTO ANS/DIAL, 300 BAUD, RS232   | 199.00 |
|       | SMARTMODEM 1200, AUTO ANS/DIAL, 1200 BAUD, RS232 | 475.00 |
|       | SMARTMODEL Ite. 300 BAUD, AUTO ANS/DIAL, Plug-in | 249.00 |
|       | SMARTCOM I COMMUNICATIONS SOFTWARE               | 79.00  |

**RESISTORS**

| WATT     | 5% CARBON FILM | FROM 1 OHM TO 10M OHM |  |
|----------|----------------|-----------------------|--|
| 50 pcs   | .99            | .02 ea                |  |
| 100 pcs  | 1.89           | .019 ea               |  |
| 1000 pcs | 9.50           | .010 ea               |  |
| 5000 pcs | 42.50          | .009 ea               |  |

| WATT     | 5% CARBON FILM |         |  |
|----------|----------------|---------|--|
| 50 pcs   | 1.25           | .025 ea |  |
| 100 pcs  | 2.35           | .024 ea |  |
| 1000 pcs | 11.50          | .012 ea |  |
| 5000 pcs | 52.50          | .011 ea |  |

**JOYSTICK FOR APPLE II \$19.95**

**Joy Stick for IBM P/C \$22.95**

**8087 MATHEMATICS \$189.00 CO-PROCESSOR**

**Apple II/Ie Compatible Disk Drive \$139.00**

**FOR APPLE II & Ie 16K RAM CARD \$39.95**

Compatible with DOS 3.3 CP/M Visicalc, PASCAL 1 YR. WARRANTY

**Speedy EPROM Programmer for Apple II \$149.00**

Programming 2716, 2732, 2732A, 2764, 27128, 2516, 2532, 2564 in 30 seconds, software control programming, no additional hardware required.

**CONTROLLER CARD \$44.95**



**New Multichannel Hobby Microwave Antenna System Freq. Range: 2.1 - 2.7 GHz**

Includes:

1. Wide Band Probe With Down Converter
2. 20" White Painted Dish
3. 60' and 3' Coax Cable Set
4. Steel Case 5 - 20 DCV Tuneable Power Supply
5. Mounting Accessories and Instructions

**ALL FOR \$97.95**

**IC SOCKETS**

WW = WIRE WRAP

|           |      |     |
|-----------|------|-----|
| 8 PIN WW  | .55  | 45  |
| 14 PIN WW | .65  | 55  |
| 16 PIN WW | .65  | 55  |
| 18 PIN WW | .89  | 79  |
| 20 PIN WW | 1.00 | 90  |
| 22 PIN WW | 1.15 | 105 |
| 24 PIN WW | 1.19 | 109 |
| 28 PIN WW | 1.45 | 135 |
| 40 PIN WW | 1.89 | 169 |

LP = LOW PROFILE

|           |      |    |
|-----------|------|----|
| 6 PIN LP  | .10  | 09 |
| 8 PIN LP  | .12  | 10 |
| 14 PIN LP | .14  | 12 |
| 16 PIN LP | .16  | 14 |
| 18 PIN LP | .18  | 16 |
| 20 PIN LP | .28  | 26 |
| 22 PIN LP | .28  | 24 |
| 24 PIN LP | .30  | 26 |
| 28 PIN LP | .40  | 32 |
| 40 PIN LP | .48  | 38 |
| 64 PIN LP | 4.10 |    |

**U/V EPROM ERASER General Industries \$37.50**

**SUPER COOLING FANS For APPLE WITH SURG \$37.50**

**MOSS EPRON**

|           |       |
|-----------|-------|
| 2708      | 5.95  |
| 2716-450  | 3.95  |
| 2732-450  | 5.95  |
| 2732-250  | 6.95  |
| 2764-450  | 7.95  |
| 2764-250  | 9.95  |
| 2764-300  | 9.95  |
| 27128-250 | 25.95 |
| TMS2516   | 4.95  |
| TMS2716   | 7.95  |
| TMS2532   | 5.95  |

**STATIC RAM**

|          |      |
|----------|------|
| 2101     | 2.95 |
| 5101     | 4.95 |
| 2114-450 | 1.95 |
| 2114-200 | 2.15 |
| 2147     | 4.95 |
| 6116-4   | 5.75 |
| 6116-3   | 6.75 |
| 6116-2   | 7.95 |
| 6116LP-4 | 6.75 |
| 6116LP-3 | 6.95 |
| 6116LP-2 | 8.95 |

**SOUND CHIPS**

|          |       |
|----------|-------|
| 76477    | 2.95  |
| 76489    | 8.95  |
| AY3-8910 | 9.95  |
| AY3-8912 | 12.95 |



**CRYSTALS**

|           |      |
|-----------|------|
| 32.758khz | 1.75 |
| 1.0mhz    | 3.95 |
| 1.8432    | 3.95 |
| 2.0       | 2.95 |
| 2.097152  | 2.95 |
| 2.4576    | 2.95 |
| 3.2768    | 2.95 |
| 3.579535  | .95  |
| 4.0       | 2.95 |
| 5.0       | 2.95 |
| 5.0688    | 2.95 |
| 5.185     | 2.95 |
| 5.7143    | 2.95 |
| 6.0       | 2.95 |
| 6.144     | 2.95 |
| 6.5536    | 2.95 |
| 8.0       | 2.95 |
| 10.0      | 2.95 |
| 10.738635 | 2.95 |
| 12.00     | 2.95 |
| 14.31818  | 2.95 |
| 15.0      | 2.95 |
| 16.0      | 2.95 |
| 17.430    | 2.95 |
| 18.0      | 2.95 |
| 18.432    | 2.95 |
| 20.0      | 2.95 |
| 22.1184   | 2.95 |
| 32.0      | 2.95 |

**1984 IC Master Manual \$79.95 plus \$5.00 shipping**

**DYN. RAM**

|          |      |
|----------|------|
| 4116-200 | 1.95 |
| 4116-150 | 2.25 |
| 4116-120 | 2.95 |
| 4164-200 | 6.75 |
| 4164-150 | 6.95 |

**MISC**

|         |        |
|---------|--------|
| 8031    | 24.95  |
| 8035    | 5.95   |
| 8039    | 12.50  |
| 8085    | 14.95  |
| 8086    | 24.95  |
| 8087    | 189.00 |
| 8088    | 24.95  |
| 8155    | 12.95  |
| 8212    | 3.25   |
| 8237A   | 22.95  |
| 8250    | 14.95  |
| 8251    | 9.95   |
| 8253    | 9.95   |
| 8255    | 9.95   |
| 8257    | 5.95   |
| 8259    | 5.95   |
| 8279    | 9.95   |
| 8284    | 9.95   |
| 8286    | 24.95  |
| 8288    | 21.95  |
| 8748    | 55.00  |
| 6502    | 4.95   |
| 68000   | 39.95  |
| Z80ACPU | 3.95   |

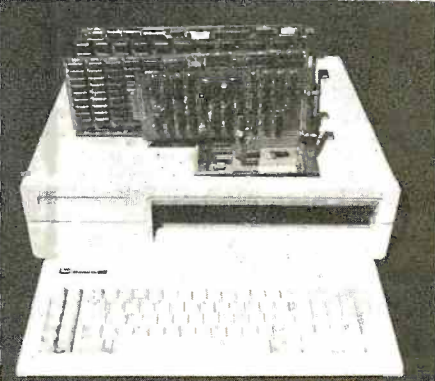
**Build Your IBM™ PC/XT Compatible at Competitive Prices \$1,379**

DEALER AND OEM ARE INVITED

Completed Unassembled System Hardware Only

**MULTIFUNCTION BOARD**

- 2 serial ports, 1 parallel port real time clock, 64k RAM up to 256k RAM ..... 219.00
- Floppy disk drive controller board ..... 119.00
- Hard disk controller board/DTC 5150BX ..... 299.00
- Color graphic board ..... 199.00
- Monochrome + color + graphic board ..... 299.00
- Panasonic disk drive, 320k, half height ..... 129.00
- Hard disk drive 10 MB/Shugart SA712 ..... 549.00
- 100W power supply with fan ..... 129.00
- Case ..... 109.00
- Manual ..... 25.00
- Keyboard ..... 119.00
- High resolution color RGB monitor/Taxan ..... 399.00
- High resolution green monitor/Taxan ..... 119.00
- Monitor stand ..... 19.95
- Hayes 1200B modem ..... 399.00
- Hayes 1200 modem ..... 475.00
- Tandon TM100-2A ..... 160.00
- 64k Memory Expansion Kit ..... 45.00
- 50 5 1/4 Diskett Store ..... 19.95



**MOTHER BOARD:**

- 8088 CPU with socket for co-processor 8087
- 8088 is supported by 8259A interrupt controller and 8237 DMA controller
- 2 (two) 28 pin sockets for ROM
- 8 (eight) expansion slots
- No RAM on board (RAM is on multifunction board)
- Bare Board ..... 69.00
- Ready Board ..... 179.00
- (With IC sockets, resistors, capacitors, connectors, crystals, transistors soldered)
- Tested Board (w/o ROM) ..... 299.00
- IC kit ..... 120.00

IBM is the trademark of International Business Machines. Prices subject to change without notice.

**7400 SERIES CALL FOR PRICE**

**CAPACITORS**

- \* Ceramic Disc
- \* Electrolytic
- \* Tantalum
- \* Mylar
- \* Monolithic

TERMS: For shipping include \$2.50 for UPS Ground or \$3.50 for UPS Blue Label Air. Items over 2 lbs. require additional shipping charges \$10.00 minimum order. COD Additional \$2.00 Fee.

IBM is a trademark of International Business Machines Corporation. Apple is a trademark of Apple Computer.

Price is subject to change without notice.

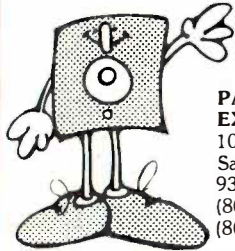
**Handwell Corp**

4962 EL CAMINO REAL • LOS ALTOS, CA 94022 • (415) 962-9265

TELEFAX (415

# Verbatim flexible disks

Call Free (800) 235-4137 for prices and information. Dealer inquiries invited. C.O.D. and charge cards accepted.



**PACIFIC EXCHANGES**  
100 Foothill Blvd.  
San Luis Obispo, CA 93401. In Cal. call (800) 592-5935 or (805) 543-1037.

Circle 300 on inquiry card.

# FREE FORTH



• GET ONE FORTH OR BOOK FREE WITH EVERY \$20.00 ORDER •

FORTH Applications on the IBM PC Application programs in FigFORTH for your PC Screens show programs from input/output, binary trees, artificial intelligence, assembler, spreadsheet routine, keyword index, a little game, mailing list with invoice writing and a complete business package containing invoice writing, mailing list and inventory control, professional programs for the advanced FORTH programmer.  
Order No. 61 (Book) \$12.95

POWER FORTH for APPLE IIe, ATARI 800XL, Commodore 64  
Extended! Fig FORTH incl editor and many useful utilities Very powerful  
FigFORTH for Apple II c  
Order No. 6155 \$19.95

FigFORTH for Commodore 64  
Order No. 4960 \$39.00  
FigFORTH for ATARI 800XL  
Order No. 7055 \$39.00

Dealer and Distributor inquiries are invited.  
ELCOMP PUBLISHING, INC.  
2174 West Foothill Blvd. Unit E  
Upland, CA 91786  
Phone: (714) 623-8314, TX 29 81 81

Learn-FORTH - a subset for the beginner  
Learn-FORTH I Atari 600/800XL (Disk or cassette)  
Order No. 7053 \$19.95

Learn FORTH for APPLE IIc  
Order No. 6153 \$9.95

FORTH on the ATARI - Learning by using FORTH application examples for the novice and expert programmer. 118 pages. This book discusses the use of FORTH for generating sound, plotting graphs, and handling text and strings. Includes assembly programs illustrating input and output, math, use of the game port and a sampling list.  
Order No. 170 (Book) \$7.95

FORTH Introduction on your APPLE IIc (The Apple in your Hand)  
A complete introduction to FORTH on your APPLE. Includes many FORTH application programs and machine language course.  
Order No. 178 (Book) \$12.95

PAYMENT: Check, VISA, MC  
CA residents add 6% sales tax.  
Add \$2.00 for shipping.  
Outside USA add 15% for shipping  
In Singapore contact: tele 22-556  
In Germany contact: tele 526973

Circle 144 on inquiry card.

# EPROM PROGRAMMER



APPROTEK 1000 ONLY

**\$249.95**

COMPLETE WITH PERSONALITY MODULE

117 AC POWER-RS 232  
-6 BAUD RATES - HANDSHAKE TO HOST  
**ALLOWS READ, WRITE, VERIFY & COPY**  
Comes complete with CPM & BASIC Driver Program Listings for most small micros

## Full 1 Year Warranty

Programs the following: 5 Volt 24 or 28 pin devices. 27xx series through 27256. 25xx series, 68766 plus others. Specify Personality Module desired with order. Additional Personality Modules only \$15.00 ea.

TO ORDER: CALL OR WRITE

## APROPOS TECHNOLOGY

1071-A AVENIDA ACASO Add  
CAMARILLO, CA 93010 \$4.00 Shipping-USA  
(805) 482-3604 VISA or MC Add 3%

Circle 32 on inquiry card.

1  
800  
292-1492

# Lifetime Guarantee!! DISKS

Fuji - Memorex and Others...

Order 2 Boxes and **SAVE!**

Call Disk Works for our latest prices on Memorex, Fuji and 3M diskettes.

1-800-292-1492 Nationwide or (312) 368-0359 in Illinois

5 1/4 SSDD \$1.79 each  
5 1/4 DSDD \$2.29 each  
3 1/5 DSDD \$3.80 each

Prices are per disk in quantity 2 boxes of 10. Add \$2.50 shipping and handling. Call for quantity pricing and shipping. All orders shipped same day via UPS ground.

## DISK WORKS

11 S. LaSalle St., Suite 2601  
Chicago, IL 60603

Circle 120 on inquiry card.

**NEW!**

## SafeSkin

### KEYBOARD PROTECTOR

Remains in place during keyboard use. Prevents damage from liquid spills, dust, ashes, etc. Fits like a second skin, excellent feel. Homerow and numeric locators. Available for: IBM-PC, Apple IIe, Radio Shack Model 100, Commodore 64. Send \$29.95, check or M.O., Visa & MC include exp. date. Specify computer type. Dealer inquiries invited. Free brochure available.

**MERRITT Computer Products, Inc.**  
2925 LBJ, #180 / Dallas, Texas 75234  
(214) 942-1142

Circle 249 on inquiry card.

## Get What You've Always Wanted -

Get type-set quality true proportional spaced printing from your WordStar and NewWord document files.

PropStar prints on most daisy-wheel printers including Diablo, Gume, NEC, and compatibles with ps type-wheels.

PropStar is a stand-alone program, not a patch to your w.p. program, gives higher quality print than modified WordStar, never crowds caps. PropStar supports most of the common WordStar and NewWord print enhancements. For CP/M-80 systems on 8" and 5-1/4" media, also for MS-DOS systems on PC media. Only \$49.95, Visa & M/C o.k. Specify computer and printer model.

**CIVIL COMPUTING CORPORATION**

2111 Research Drive, Suite 1  
Livermore, California 94550 (415) 455-8086

Circle 61 on inquiry card.

## Buy/Sell Used Hardware Without Risk!!!

In addition to receiving a monthly newsletter containing latest computer information and sales, membership allows you 1 free ad plus additional ads at reduced prices. Buyer selects ad, sends purchase price to Computer Swap Shop who holds same in escrow and notifies seller who ships to buyer. Buyer has 7 days to examine the equipment and if satisfied, seller receives sales price less small commission; otherwise, money is refunded. You must be a member to buy or sell with Computer Swap Shop Inc.

**NO RISK! BONDED.**

Send \$20 subscription fee to:

**Computer Swap Shop, Inc.**  
Box 2988  
Delray Beach, FL 33444

Circle 87 on inquiry card.

**NOW INCLUDES TINY BASIC**  
**FORTH AVAILABLE**

## SIBEC 51

### 8051/52 DEVELOPMENT BOARD

8051-Based Single-Board Computer with Monitor/Debugger

- 4 28-pin byte-wide sockets; monitor will program EEPROMS.
- Perfect for System Development and Educational Applications

**\$335**

**Binary Technology**  
P.O. BOX A-59 • HANOVER, NH 03755 • 603/643-2881

Circle 42 on inquiry card.

## ANALOG I/O CAPABILITY FOR HP 150

- 16 CHANNEL A/D SINGLE ENDED
- 8 CHANNEL A/D DIFFERENTIAL
- 2 CHANNEL D/A
- 12 BIT RESOLUTION

- DISPLAY 1 TO 4 CHANNELS OF DATA ON SCREEN IN REAL TIME.

- BOARD MOUNTS IN ACC. SLOT OF HP 150.

- COMPLETE LOW COST SOFTWARE HANDLER AND EXAMPLE PROGRAMS AVAILABLE.

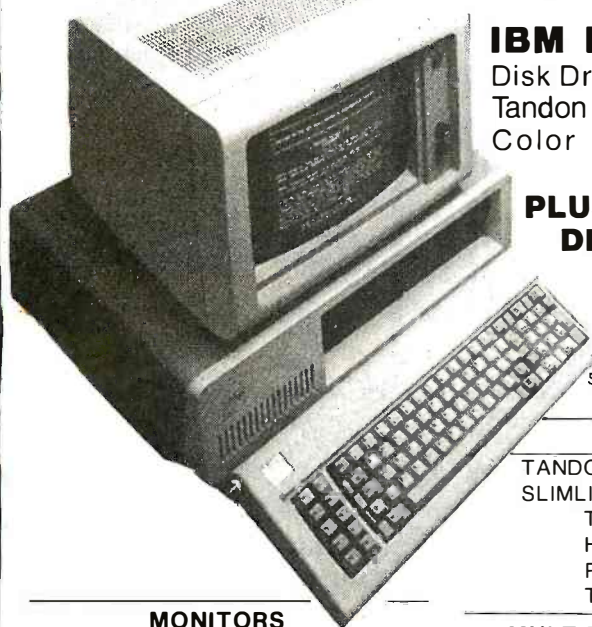
**\$995 QTY 1-5**

CLINICAL MICROSYSTEMS, INC.

Box 1055  
Melbourne, Florida 32936  
(305) 723-5475

Circle 62 on inquiry card.

# SOMEBODY Has To Have The Lowest Prices!



**IBM PC, 256k, 320k**  
Disk Drive, (Toshiba Half or  
Tandon Full-High), Persyst  
Color Card, Amdek 300  
Monitor, Dos 2.1

**PLUS!-A 10MB HARD  
DISK SUB SYSTEM**

All For Only:  
**\$2699.<sup>00</sup>**

*(We configure and test the  
system for you at no extra cost)*

## MONITORS

|                        |            |
|------------------------|------------|
| AMDEK 300              | \$135.00   |
| AMDEK 300A             | \$149.00   |
| AMDEK 310A             | \$165.00   |
| AMDEK COLOR I          | BEST PRICE |
| AMDEK COLOR II         | BEST PRICE |
| PGS HX-12              | \$475.00   |
| PGS MAX-12             | \$195.00   |
| PGS SR-12              | \$625.00   |
| IBM MONOCHROME DISPLAY | \$260.00   |
| IBM COLOR DISPLAY      | \$590.00   |
| QUADCHROME C. DISPLAY  | \$590.00   |

## PRINTERS

|                        |            |
|------------------------|------------|
| EPSON FX 80            | \$489.00   |
| EPSON FX 100           | \$689.00   |
| EPSON RX 80            | \$295.00   |
| EPSON RX 80 FT         | \$349.00   |
| OKIDATA 82A            | \$299.00   |
| OKIDATA 83A            | \$569.00   |
| OKIDATA 92P            | \$399.00   |
| OKIDATA 93P            | \$649.00   |
| OKIDATA 84P            | \$799.00   |
| OKIDATA 2410P          | \$1999.00  |
| OKIDATA 2350P          | \$1849.00  |
| TOSHIBA P1351          | \$1399.00  |
| TOSHIBA 1340           | \$825.00   |
| NEC SPINWRITER 3550    | \$1650.00  |
| NEC SPINWRITER 7730    | \$1750.00  |
| NEC PINWRITER 80 COL.  | \$720.00   |
| NEC PINWRITER 136 COL. | \$960.00   |
| QUAD INK JET PRINT     | \$799.00   |
| CITOH 40 CPS           | BEST PRICE |
| CITOH 55 CPS           | BEST PRICE |
| GEMINI 10X             | \$290.00   |
| GEMINI 15X             | \$390.00   |
| BROTHER HR-25          | \$719.00   |
| BROTHER HR-35          | \$925.00   |
| SILVER REED 500P       | \$465.00   |
| SILVER REED 550P       | \$570.00   |
| SILVER REED 770P       | \$995.00   |

ACCESSORIES ON NEC & OKIDATA  
PRINTERS AVAILABLE.

## DRIVES

|                  |          |
|------------------|----------|
| TANDON TM-100-2  | \$199.00 |
| SLIMLINE DRIVES: |          |
| TOSHIBA          | \$165.00 |
| HITACHI          | \$165.00 |
| PANASONIC        | \$165.00 |
| TEAC 55B         | \$165.00 |

## MULTIFUNCTION BOARDS

|                                                          |            |
|----------------------------------------------------------|------------|
| AST I/O+1 SER & 1 PAR                                    | \$179.00   |
| AST SIX PACK 64K, 1 SER,<br>1 PAR                        | \$269.00   |
| AST MEGA+64K, 1 SER                                      | \$269.00   |
| AST COMBO                                                | \$269.00   |
| QUADBOARD 64K                                            | \$269.00   |
| (EXPANDABLE TO 256K)                                     |            |
| QUADBOARD 64K, 1s, 1p, GAME PORT<br>(EXPANDABLE TO 384K) | \$299.00   |
| IBM COLOR GRAPHIC<br>ADAPTER                             | \$225.00   |
| IBM MONO/PRINTER<br>ADAPTER                              | \$230.00   |
| PERSYST COLOR<br>ADAPTER                                 | \$199.00   |
| PERSYST MONO/PRINTER<br>ADAPTER                          | \$215.00   |
| HERCULES GRAPHIC                                         | \$349.00   |
| PLANTRONICS<br>COLOR PLUS                                | BEST PRICE |
| PARADISE MULTIFUNCTION<br>CARD                           | BEST PRICE |
| ORCHID BLOSSOM                                           | BEST PRICE |
| 64K RAM UPGRADE KIT                                      | \$50.00    |
| PEACOCK COLOR<br>CARD W/PP                               | \$215.00   |

|                                |            |
|--------------------------------|------------|
| STB RIO PLUS 64K               | BEST PRICE |
| STB SUPER RIO 64K              | BEST PRICE |
| STB PIGGYBACK FOR<br>SUPER RIO | BEST PRICE |
| STB GRAPHIX PLUS II            | \$375.00   |

## MODEMS

|                                   |          |
|-----------------------------------|----------|
| HAYES<br>SMART MODEM 1200         | \$469.00 |
| HAYES<br>SMART MODEM 300          | \$209.00 |
| HAYES 1200B<br>PLUG IN MODEM CARD | \$429.00 |
| QUBIE PC 212A/1200<br>INTERNAL    | \$275.00 |
| QUBIE 212E/1200<br>EXTERNAL       | \$299.00 |

## HARD DISKS

|                                                                              |           |
|------------------------------------------------------------------------------|-----------|
| 10MB HARD DISK SUB SYSTEM<br>INCLUDES:<br>SOFTWARE, CONTROLLER, CABLES, ETC. |           |
| INTERNAL                                                                     | \$850.00  |
| EXTERNAL                                                                     | \$1025.00 |
| TALLGRASS TECHNOLOGY<br>12MB W/TAPE BACKUP                                   | \$2750.00 |
| 20MB W/TAPE BACKUP                                                           | \$3199.00 |
| 35MB W/TAPE BACKUP                                                           | \$4350.00 |
| INTERFACE IBM                                                                | \$125.00  |
| POWER BACK-UP SYSTEM                                                         | \$479.00  |

## GENERAL

|                              |             |
|------------------------------|-------------|
| MAXELL<br>DISKETTES MD2      | \$35.00/box |
| CONTROL<br>DATA DISKETTES    | \$30.00/box |
| MICROSOFT MOUSE              | \$130.00    |
| MOUSE W/WORD                 | \$339.00    |
| KEYTRONIC<br>KEYBOARD KB5151 | \$199.00    |
| PARALLEL CABLES              | BEST PRICE  |
| IBM PC DOS 2.1               | BEST PRICE  |

We also carry  
**CORONA, APPLE IIe,  
APPLE IIc,  
MACINTOSH,  
TECHMAR.**

Many other products available, Please call for Low, Low Prices!

*Microshop*  
COMPUTER PRODUCTS

**(714) 838-7530**

2640 Walnut Avenue, Unit K, Tustin, California 92680

Prices & availability subject to change without notice - IBM is a registered trademark of IBM Corp.

## Fast ANALOG I/O BOARD

For Apple II, Commodore 64, TRS 80 Color, Timex and others. Connects to CPU bus, 8 channels A/D & 8 channels D/A 1.6 uS A/D convert time, 8 bit res. Easy to program. Box & cable available. \$220.

### Software for Apple II & Commodore:

**SCOPE**  
Dual trace. 256 samples taken at rates from 3 to 72000 Hz. Trigger & cursor. Disk and printer utilities. Averaging. Usable subroutines.

**F.F.T.**  
128 spectrum lines. Displays 0 Hz to 1/2 sample freq. Mag & phase done in 1 sec! Needs CPM card.

Commodore Scope/FFT disk & manual.... \$85.  
Apple II Scope/FFT disk & manual..... \$100.  
Timex Scope/FFT Eprom Card..... \$85.  
Please call or write for **FREE CATALOG.**

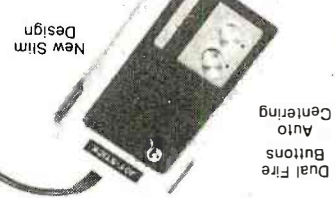
**Computer Continuum**

75 Southgate Ave., Suite 6  
Daly City, CA 94105 (415) 755-1978

602-820-8819

MEMORY PLUS DISTRIBUTORS  
2323 W. Baseline  
Mesa, Arizona 85202  
All Orders Add \$3.00 Shipping  
Visa/M.C. O.K.  
DEALERS AND CLUBS INVITED!  
Other Products Available Call or Write  
New Tilt & Swivel Monitor Stand \$34.95

Trim Pots  
ONLY \$36.95 + SHIPPING



New Slim Design  
Dual Fire Buttons  
Auto Centering  
For Apple II & Ite

DEALERS  
**TURN YOUR PROFITS.**

# BASF DISKETTES

BASF Diskettes at competitive price. Call TOLL FREE (800) 235-4137 for prices and information. Visa and Master Card accepted.



**PACIFIC EXCHANGES**  
100 Foothill Blvd  
San Luis Obispo, CA  
93401 (In Cal call  
(805) 543-1037)

Circle 247 on inquiry card.

Circle 300 on inquiry card.

## INSIGHT™

Advices, Forecasts, Simulates, Tutors, Decides, Evaluates, Solves, Reports.

Lets you Design, create and run problem solving expert systems on the IBM-PC or DEC Rainbow. No programming, uses English language knowledge base.

\$95.



4980 S-A 1A, Melbourne Bch. FL 32951  
305/729-9046  
CREDIT CARD ORDERS ACCEPTED

Circle 227 on inquiry card.

|                         |           |            |
|-------------------------|-----------|------------|
| DISKETTES               | 3M        | MEMOREX    |
| SSSD - 8 IN.            | \$2.20/50 | \$2.15/100 |
| SSDD - 8 IN.            | \$2.70/50 | \$2.60/100 |
| SSDD - 5 1/4 IN.        | \$1.90/50 | \$1.90/100 |
| OSDD - 5 1/4 IN.        | \$2.70/50 | \$2.40/100 |
| OSDD - 96 TPI 5 1/4 IN. | \$3.50/50 | \$3.00/100 |

PLASTIC STORAGE BOX-WITH KEY FOR 100 DISKETTES... \$19.00

|                           |                           |
|---------------------------|---------------------------|
| TAPES AND CARTRIDGES (3M) |                           |
| DC100A                    | \$16.2/1-10 \$14.10/10+   |
| DC300XL                   | \$24.75/1-10 \$21.10/10+  |
| 2400 FT TAPE SEAL         | \$15.00/10-50 \$14.35/50+ |
| BLACK WATCH               |                           |
| 2400 FT TAPE SEAL         | \$16.25/10-50 \$15.60/50+ |

|                   |        |
|-------------------|--------|
| WINCHESTER DRIVES |        |
| 10MB (FORMATTED)  | \$535. |
| 15MB (FORMATTED)  | \$750  |
| 20MB (FORMATTED)  | \$980. |
| 32MB (FORMATTED)  | \$1155 |

|                         |         |          |
|-------------------------|---------|----------|
| DOT MATRIX PRINTERS     | 80 COL. | 132 COL. |
| MANNESMANN TALLY SPIRIT | \$325.  | —        |
| MANNESMANN TALLY 160CPS | \$585.  | \$820.   |
| FACIT 120-140CPS        | \$450.  | \$820.   |

|                      |         |         |         |
|----------------------|---------|---------|---------|
| HARD DISK SUBSYSTEMS | 10MB    | 15MB    | 21MB    |
| APPLE                | \$1150. | \$1350. | \$1750. |
| IBM                  | \$1150. | \$1350. | \$1750. |

**WE SELL WHAT YOU NEED... NOT JUST WHAT WE STOCK. PLUS... LOW PRICES. TECH SUPPORT AND RELIABILITY.**

**Met-Chem** MasterCard VISA  
Met-Chem International Corporation  
2911 Dixwell Avenue, Hamden, Conn. 06518  
Phone: (203) 248-3212 or 1-800-638-2436

Circle 250 on inquiry card.

**NEW! NOTHING LIKE IT!**

## THE PRINTER STAND™

Only! **\$44.95**  
Plus \$2 Postage

- Elevates & Tilts 80 Column Printer 45° Angle for easy readability
- Saves space!
- Paper feeds from underneath
- Solid Hardwoods

ORDER NOW  
SEND CHECK, MONEY ORDER OR CHARGE IT: VISA • MASTERCARD • AM. EX. SPECIFY FINISH: LT. OR DARK POPLAR OR WALNUT. UNCONDITIONALLY GUARANTEED 2 TO 4 WEEK DELIVERY.

(812) 897-5351

## SYNERGY PRODUCTS

P.O. Box 485, Boonville, IN 47601

Circle 360 on inquiry card.

## 3M Diskettes Lifetime Warranty

Think you're getting the best price on 3M Diskettes? You're right... BUT ONLY IF... You're buying from **NORTH HILLS CORP.** We will beat any nationally advertised price\* or give you a 15 disk library case FREE! Call us last—TOLL FREE—for our best shot every time.

1-800-328-3472

Formatted and hard sectored disks in stock.

Dealer inquiries invited. COD's and charge cards accepted. All orders shipped from stock within 24 hours. Why wait 10 days to be shipped?



**North Hills Corporation**  
3564 Rolling View Dr.  
White Bear Lake, MN 55110  
MN Call Collect 1 612-770 0485

\*verifiable; same product, same quantities

Circle 286 on inquiry card.

## New From APPLEWARE, INC.

Improved Programs • Lower Prices Expanded Selection

### One-Of-A-Kind Apple User's Group Disk Program Library Service

Featuring: 40 State-of-the-Art packaged disks (up to 40 programs per disk) not available from any other service, including, at no extra cost:

- Guaranteed fully operable
- Completely copyable & fixable
- 3 kinds of documentation
- No duplication
- Toll Free member hotline
- 5 year disk replacement guarantee
- Any single disk (30 or more programs) for \$18.95 each, less than 70¢ per program.

**BUY ONE-AT-A-TIME** OR  
The entire disk library \$50% off, for 15,000+ Program Files Plus a FREE bonus of 400 blank diskettes, if ordered direct from us.

**MEMBERSHIP-ADDITIONAL DISCOUNTS**  
Members are entitled to an additional 15% discount above and beyond other discounts. Simply send one time membership fee (\$10 HAND ANNUAL DUES) of \$15 Domestic, \$20 Foreign. (INSTITUTIONS FREE) Fees include perpetual updates, amortized catalog and eventual access to 15,000+ programs, guaranteed, used, and tested.

All categories included, for any age group or skill level. Recognized purchase orders gladly accepted.

Join **92,000** other Appleware enthusiasts spanning **31** countries!

For orders only call now 1-800-327-8668  
Or write: Appleware, Inc. 6400 Hayes Street Hollywood, FL 33024

Program disks operable on Apple II, II+, IIe, IIc, III Emul., Clones, Franklin and IBM Quad Link.

Circle 29 on inquiry card.

**MARYMAC INDUSTRIES INC.**

800-231-3680

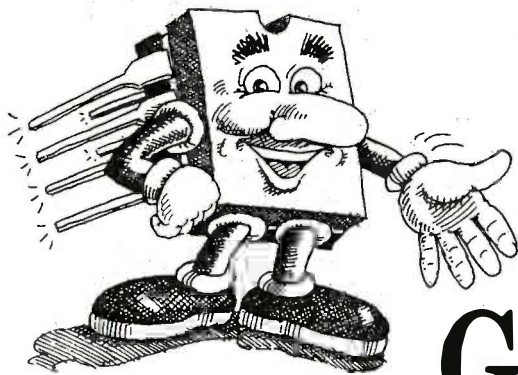
## Radio Shack TRS-80's Epson Printers

People you Trust to give you the very best!

- Lowest Price
- Reliable Service
- Quality Products

22511 Katy Fwy., Katy (Houston) Texas 77450  
(713) 392-0747 Telex 774132

Circle 242 on inquiry card.



# BUY ANY I.C. AND GET ONE FREE

**Special offer: Buy any I.C. and get a free certificate worth up to \$10.00 off your next order. Now that's a great way to get guaranteed I.C.'s at wholesale prices, *plus* a free part.**

**Guaranteed parts**—every part guaranteed for 60 days—and pre-tested before shipment.

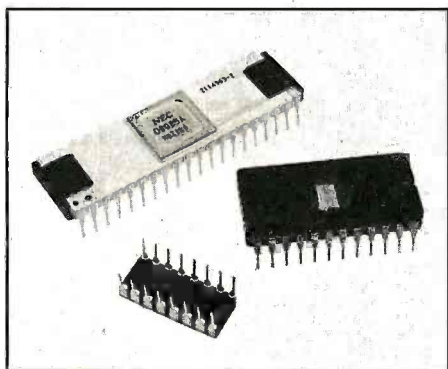
**Guaranteed fast**—same day—shipping.

**Guaranteed low prices.**

**Guaranteed satisfaction** or purchase price cheerfully refunded.

## How to order.

Call toll free. We accept Visa, Mastercard or American Express. Or we can ship UPS C.O.D. National 800-235-4900 California 800-238-4900 Local Orange County (714) 474-1033.



**Visit our retail store:**

The Computer Parts Merchant, Inc.  
17777 Main Street, Suite D  
Irvine, CA 92714

Terms: minimum order \$10. For shipping and handling, include \$2.50 UPS Ground, or \$3.50 for UPS Air. California residents must include 6% sales tax. All prices are subject to change without notice. We are not responsible for typographical errors. All merchandise subject to prior sale.

Search service. If we don't have the I.C. you need in stock, we can find it for you. (There is a \$25 minimum charge for I.C.'s found through a search.)

A few samples from our million part inventory:

A few samples from our million part inventory:

### 74LSXX

|        |      |         |      |         |        |
|--------|------|---------|------|---------|--------|
| 74LS00 | S 38 | 74LS83  | S 87 | 74LS170 | \$1.49 |
| 74LS02 | 38   | 74LS86  | 46   | 74LS191 | 99     |
| 74LS04 | 40   | 74LS91  | 75   | 74LS221 | 1.30   |
| 74LS08 | 40   | 74LS93  | 66   | 74LS240 | 1.60   |
| 74LS10 | 40   | 74LS107 | 46   | 74LS241 | 1.30   |
| 74LS11 | 40   | 74LS109 | 46   | 74LS242 | 1.30   |
| 74LS12 | 36   | 74LS112 | 50   | 74LS243 | 1.30   |
| 74LS14 | 76   | 74LS122 | 53   | 74LS244 | 1.49   |
| 74LS20 | 38   | 74LS124 | 2.90 | 74LS245 | 1.49   |
| 74LS21 | 38   | 74LS132 | 91   | 74LS251 | .75    |
| 74LS30 | 38   | 74LS137 | 99   | 74LS257 | .75    |
| 74LS32 | 50   | 74LS138 | 87   | 74LS258 | .75    |
| 74LS37 | 40   | 74LS147 | 2.75 | 74LS266 | .79    |
| 74LS38 | 40   | 74LS151 | 66   | 74LS273 | 1.69   |
| 74LS40 | 38   | 74LS153 | 69   | 74LS373 | 1.49   |
| 74LS42 | 66   | 74LS157 | 65   | 74LS374 | 1.49   |
| 74LS51 | 36   | 74LS158 | 65   | 74LS377 | 1.49   |
| 74LS54 | 38   | 74LS161 | 75   | 74LS640 | 3.49   |
| 74LS63 | 1.50 | 74LS166 | 1.95 | 74LS669 | 1.99   |
| 74LS74 | 55   | 74LS169 | 1.75 | 74LS670 | 2.99   |

Partial List

### 5, 8, 12 AND 15 VOLT VOLTAGE REGULATORS

Call for Prices

### 74SXX

|        |      |        |      |
|--------|------|--------|------|
| 74S00  | S 45 | 74S151 | S 97 |
| 74S02  | 49   | 74S153 | .97  |
| 74S04  | 49   | 74S157 | .97  |
| 74S08  | 49   | 74S161 | 1.87 |
| 74S10  | 45   | 74S169 | 3.99 |
| 74S11  | 49   | 74S174 | .99  |
| 74S20  | 49   | 74S181 | 4.39 |
| 74S22  | 45   | 74S194 | 1.99 |
| 74S30  | 35   | 74S197 | 1.79 |
| 74S32  | 59   | 74S240 | 2.20 |
| 74S37  | 89   | 74S241 | 2.40 |
| 74S38  | 99   | 74S244 | 2.20 |
| 74S74  | 89   | 74S251 | .95  |
| 74S86  | 95   | 74S253 | .95  |
| 74S112 | 1.19 | 74S257 | .95  |
| 74S113 | 1.19 | 74S260 | .79  |
| 74S124 | 2.99 | 74S273 | 2.45 |
| 74S132 | 1.59 | 74S287 | 2.29 |
| 74S138 | 97   | 74S373 | 3.39 |
| 74S139 | 97   | 74S374 | 3.39 |
| 74S140 | .77  | 74S570 | 3.50 |

Call for others

### DYNAMIC RAMS

|         |        |         |        |
|---------|--------|---------|--------|
| TMS4027 | S 1.99 | 4116    | \$1.49 |
| MMS280  | 1.95   | 2118    | 4.95   |
| TMS4060 | 1.95   | 4164    | 5.95   |
| UPD411  | 1.95   | TMS4416 | 9.95   |
| MK4108  | 1.95   | 41256   | Call   |

Call for more

### LINEAR DEVICES

|        |      |        |      |
|--------|------|--------|------|
| LM301  | S 47 | NE570  | S395 |
| LM307  | .57  | LM709  | .59  |
| LM309H | 1.95 | LM723  | .59  |
| LM312  | 1.75 | LM741  | 49   |
| LM318  | 1.49 | LM747  | 69   |
| LM324  | .79  | LM748  | .59  |
| LM350  | 4.95 | LM1458 | .59  |
| LM380  | .89  | LM2900 | 85   |
| LM393  | 1.29 | LM3900 | 79   |
| NE555  | .57  | MC4024 | 3.95 |
| NE556  | .77  | MC4044 | 4.50 |

Call for others

### 74XX

|       |      |       |      |
|-------|------|-------|------|
| 7400  | S 35 | 7451  | S 39 |
| 7401  | .35  | 7473  | 54   |
| 7402  | 39   | 7474  | 69   |
| 7404  | 39   | 7489  | 3.40 |
| 7406  | .89  | 7492  | 69   |
| 7407  | .41  | 74107 | .39  |
| 7408  | .35  | 74109 | .59  |
| 7411  | .39  | 74123 | .69  |
| 74120 | .35  | 74125 | .69  |
| 7421  | .49  | 74132 | .59  |
| 7427  | .45  | 74147 | 1.75 |
| 7430  | .35  | 74151 | .79  |
| 7432  | .35  | 74153 | .79  |
| 7438  | .49  | 74154 | 1.25 |
| 7442  | .59  | 74157 | .79  |

Others on shelf

### STATIC RAMS

|         |        |
|---------|--------|
| 2101    | \$1.95 |
| 2114    | 1.50   |
| 2147    | 4.95   |
| TMS4044 | 4.59   |
| TMM2016 | 4.59   |
| HM6116  | 4.75   |
| TMS4016 | 6.95   |
| HM6264  | 39.95  |

Others on shelf

### CMOS

|      |      |        |       |
|------|------|--------|-------|
| 4001 | S 35 | 74C00  | S 49  |
| 4002 | 35   | 74C02  | 47    |
| 4008 | 95   | 74C04  | 47    |
| 4010 | .57  | 74C08  | 47    |
| 4011 | .37  | 74C10  | 47    |
| 4012 | .37  | 74C20  | 49    |
| 4020 | 87   | 74C30  | 49    |
| 4021 | 95   | 74C73  | 87    |
| 4022 | 87   | 74C74  | 79    |
| 4030 | 57   | 74C86  | 59    |
| 4034 | 1.95 | 74C90  | 1.19  |
| 4040 | 97   | 74C93  | 1.75  |
| 4041 | 97   | 74C151 | 2.25  |
| 4050 | 47   | 74C157 | 1.75  |
| 4069 | 35   | 74C161 | 1.79  |
| 4071 | 35   | 74C173 | .79   |
| 4082 | 35   | 74C174 | 1.19  |
| 4093 | 67   | 74C192 | 1.49  |
| 4502 | 95   | 74C193 | 1.49  |
| 4512 | 97   | 74C373 | 2.45  |
| 4522 | 1.25 | 74C374 | 2.45  |
| 4532 | 1.95 | 74C906 | 95    |
| 4556 | 99   | 74C912 | 8.95  |
| 4585 | 99   | 74C921 | 15.95 |

Many more. Call.

### MEMORY EPROMS

|      |       |       |        |
|------|-------|-------|--------|
| 2708 | S3.95 | 2764  | \$6.95 |
| 2716 | 3.95  | 27128 | 34.95  |
| 2732 | 4.95  |       |        |

More available.

# FREE Comm.64 Book

GET ONE BASIC BOOK FREE WITH EVERY ORDER

**MACROFIRE Editor/Assembler for C64**  
This powerful tool for the machine language programmer consists of three parts: full screen editor/translator for the Commodore 64, very fast assembler with macro capability, machine language monitor. The assembler translates in three passes: physical and logical address macros expanded, net expanded, include function. For large source codes, source code can be saved/loaded on disk or cassette from the editor; object code can be saved/loaded from the monitor. Assembler gives list of used and unused labels, physical addresses. Disk or cassette. Comes with book No. 184.  
Order No. 4962 \$89.00

**SIXTY FORTH**  
This FORTH is an extended 160 FORTH adapted to the Commodore 64. Available on disk only.  
Order No. 4960 \$39.00

**SUPERMAILING for C64**  
This mailing list program allows you to handle up to 1000 addresses on a disk. Each address consists of 9 parameters: name, company, street, city, state, zip code, code 1, code 2, phone number. You can print labels or search for any parameter, for example all addresses from California. Available on disk only.  
Order No. 4962 \$49.00

Dealer and distributor inquiries are invited.  
ELCOMP PUBLISHING, INC.  
274 West Foothill Blvd., Unit E, Dept. 36  
Upland, CA 91786  
Phone: (714) 6238314, Fax: 29 81 91

# GILTRONIX SWITCHES ARE THE BEST CHOICE.

... and here are 10 good reasons why:

## IBM PC

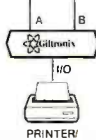


1. Serial (RS232) or Parallel (Centronics)
2. Prompt Deliveries
3. Nationally Advertised Products
4. Broad Product Line
5. Over 30,000 Units Sold to Date
6. Sales and Technical Support

## APPLE



7. F.C.C. Approved Units
8. Manual and Automatic Units
9. Highest Quality PC Board Switch Technology
10. Buy Direct From Giltronix, or From Any Authorized Distributor



Manual Units—2 to 5 Ports  
Automatic Units—3 to 15 Ports



ORDER HOT-LINE: 1-800-531-1300 (Outside of California)

# maxell DISKS

LIFETIME WARRANTY

Think you're getting the best price on Maxell Diskettes? You're right . . . BUT ONLY IF . . . You're buying from **NORTH HILLS CORP.**

We will beat any nationally advertised price\* or give you a 15 disk library case FREE!

Call us last—TOLL FREE—for our best shot every time.

1-800-328-3472

Formatted and hard sector disks in stock.

Dealer inquiries invited. COD's and charge cards accepted. All orders shipped from stock within 24 hours. Why wait 10 days to be shipped?



**North Hills Corporation**  
3564 Rolling View Dr.  
White Bear Lake, MN 55110  
MN Call Collect 1-612-770-0485

\*verifiable; same product, same quantities

Circle 145 on inquiry card.

Circle 167 on inquiry card.

Circle 287 on inquiry card.

# THE HANDICAPPED'S SOURCE

Division Of Computability Corporation

**FREE**  
Catalog of Computer Products for the Handicapped

Software & Hardware for COMMUNICATION • EDUCATION • ENVIRONMENTAL CONTROL • VOCATIONAL • ENTERTAINMENT



**Computability Corporation**  
101 Route 46 East  
Pine Brook, New Jersey 07058  
201-882-0171

Circle 73 on inquiry card.

# APPLE AND IBM COMPATIBLE PERIPHERALS

- **PRINTER—PANASONIC 1091** \$310
- **NASHUA DISKS** —soft sectored— SSDD \$ 15
- 10 to a box DSDD \$ 20

- IBM**
- **COLOR GRAPHICS CARD** \$185
  - **MULTIFUNCTION CARD** \$170
  - **DISK CONTROLLER CARD** \$125
  - **DISK DRIVE** —TEAC 55B— 320KB, DSDD \$160

- APPLE**
- **Z80 CARD** (Microsoft comp.) \$ 60
  - **80 COLUMN CARD** (Videx comp.) \$ 80
  - **GRAPHICS PRINTER CARD** (Grappler+comp.) \$ 70
  - **128K RAM CARD** (Titan, Saturn comp.) \$180
  - **DISK DRIVE** (sim to TEAC 55A) \$150
  - **TAITRON MODEM II** (sim. to Micro Modem IIE) \$160

• 6 MONTH WARRANTY •  
All cards are highest quality and fully socketed. Call or write for complete price list and data sheets.

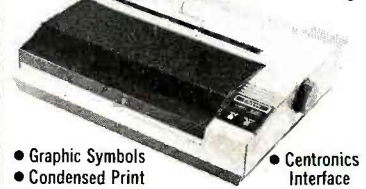
**LANTON COMPUTER SYSTEMS**  
Box B • 37 Juneau Boulevard  
Woodbury, NY 11797  
**24 HOUR ORDER LINE**  
(NYS) 800-632-4441 • (outside NYS) 800-645-4441

Shipping and handling charge \$5.00 per order. 2nd day air \$300 additional. (\$100 for printer) C.O.D. charge \$3.00 per order. Allow up to 3 weeks for personal checks to clear. Money orders, certified checks and C.O.D. orders shipped immediately. Please include phone number. Prices and availability subject to change without notice. NYS residents add sales tax.

Circle 223 on inquiry card.

# NOW! from Esprit direct to You

**100 CPS Dot Matrix Printer \$275** with a 90 day warranty



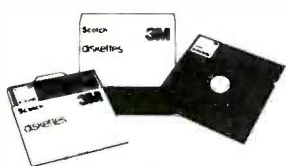
• Graphic Symbols • Condensed Print • Centronics Interface

**For Immediate Delivery CALL 800-645-5300**  
Or In N.Y. State Call (516) 293-5775

Circle 149 on inquiry card.

# Scotch Diskettes

Rely on Scotch® diskettes to keep your valuable data safe. Dependable Scotch diskettes are tested and guaranteed error-free. The low abrasivity saves your read/write heads. They're compatible with most diskette drives.



(800)235-4137



Dealer Inquiries Invited

**PACIFIC EXCHANGES**  
1001 Franklin Blvd.  
San Luis Obispo, CA 93401  
In Cal call (805)562-5915 or (805)564-1117

Circle 300 on inquiry card.

# WOW!

- IBM-PC WITH DRIVE \$1399**
- APPLE 2e WITH DRIVE \$859**
- SANYO 555 DSDD \$969**
- COMMODORE 64 \$189**

- JUKI 6100 \$378**
- OKIDATA 92 \$345**
- EPSON RX 80 FT \$284**
- BROTHER 15 \$345**
- GEMINI 10X \$237**

**HARMONY VIDEO & COMPUTERS**  
2357 Coney Island Ave., B'klyn., NY 11223  
Call Toll Free  
800-VIDEO84 or 800-441-1144  
or in NY 718-627-1000

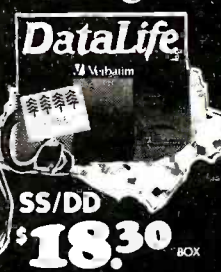
Circle 174 on inquiry card.

# Here's the one gift that gives you a free gift in return.

Now when you buy a DataLife® Holiday Pack, you'll get a \$9.60 Head Cleaning Kit FREE.

**SS/DD \$18.30** BOX

**DS/DD \$24.40** TWO BOX MINIMUM



**TOLL FREE #1-800-524-8130**

**Disk Jockey**  
P.O. BOX 31126  
CHICAGO, IL 60631-1126  
IL-524-8160 MASTERCARD/VISA/C.O.D.

Circle 96 on inquiry card.





# FORTRON CORPORATION Power Supply Professional

3797 YALE WAY, FREMONT, CA 94538

ORDER TOLL FREE: [800] 821-9771

INFORMATION & CALIF. RES. [415] 490-8171

## FC 135-40 Features:

- Full Replacement to your regular IBM® PC 65 W. Power Supply
- 4 Disk Drives Connectors
- Building "ROTRON" or equal High Performance Cooling Fan
- (U) File #E82453
- Schematics available
- One year Warranty
- +5V/15A, +12V/4.2-8.5A (peak)  
+12V/1A, -5V/1A. (max. outputs)

## 140 W.(max) Power Switcher

#FC 135-40



only  
**175.00**  
[Fully Tested in USA]

### IDEAL FOR:

- Upgrade IBM® PC
- OEM Manufacturer
- Do it yourself an IBM® PCXT Compatible

Please do not confuse this high quality product with the cheap imported units sold by others because of same outlooking.

## Dealers/OEMs are Invited

For "Build Your Own Computer" and OEM's Convenience, we also carry:

### FC 427 Keyboard

- For IBM® PC or its compatible products
- High Performance
- High Reliability

**109.00**



### FC 630A-2 Cabinet

- IBM identical
- Use FORTRON FC 135-40 power supply
- 7 & 8 slots rear panels, good for 0.75" or 1" apart slot connectors.

**99.00**



### HSC 130-40 130 Watt Power Switcher

- For building an IBM PCXT Compatible
- Backside Power Switch
- Use Cabinet FC-630

**169.00**



### FC-630 Cabinet

- On-off switch to be on back side
- Use FORTRON HSC-130-40 power supply
- Good for Faraday
- 6400 or DTC mega-board

**99.00**



## SP COMPUTERS, INC.

### COMPARE AND SAVE!

851 BURLWAY RD., SUITE 303  
BURLINGAME, CA 94010  
TEL: (415) 340-1006  
TELEX: 4070477 MONS

#### SOFTWARE

##### SPREAD SHEETS

|                               |     |
|-------------------------------|-----|
| Calcstar . . . . .            | 87  |
| Supercalc II . . . . .        | 165 |
| Supercalc III . . . . .       | 195 |
| Microsoft Multiplan . . . . . | 120 |
| Open Access . . . . .         | 367 |
| Visicalc IV . . . . .         | 157 |
| TK Solver . . . . .           | 265 |

##### WORD PROCESSING

|                               |     |
|-------------------------------|-----|
| Multimate . . . . .           | 275 |
| Benchmark . . . . .           | 265 |
| Volkswriter Deluxe . . . . .  | 160 |
| Word Perfect . . . . .        | 270 |
| Microsoft Word with           |     |
| Mouse . . . . .               | 284 |
| Wordstar w/starcard . . . . . | 299 |
| PFS File . . . . .            | 84  |
| PFS Report . . . . .          | 79  |
| Peachtext 5000 . . . . .      | 235 |
| Bank Street Writer . . . . .  | 55  |

##### DATA BASE MANAGEMENT

|                        |     |
|------------------------|-----|
| Quick Code . . . . .   | 154 |
| Dutil Pak . . . . .    | 54  |
| RBase 4000 . . . . .   | 289 |
| Friday . . . . .       | 185 |
| Knowledgeman . . . . . | 295 |
| DBase II . . . . .     | 297 |
| DBase III . . . . .    | 370 |
| Infostar . . . . .     | 239 |

#### LANGUAGES

|                                |     |
|--------------------------------|-----|
| Microsoft C Compiler . . . . . | 325 |
| Pascal Compiler . . . . .      | 205 |
| Lattice Compiler . . . . .     | 325 |
| Digital C Compiler . . . . .   | 375 |

#### UTILITY

|                            |    |
|----------------------------|----|
| Norton Utilities . . . . . | 51 |
| Prokey . . . . .           | 87 |
| Microsoft Flight           |    |
| Simulator . . . . .        | 32 |
| Sideways . . . . .         | 44 |

#### TRANSFER PROGRAMS

|                               |     |
|-------------------------------|-----|
| Microstuf Crosstalk . . . . . | 115 |
| Hayes Smartcom . . . . .      | 105 |
| Move-it . . . . .             | 105 |

#### ACCOUNTING

|                                                 |     |
|-------------------------------------------------|-----|
| BPI - GL/AP/AR . . . . .                        | 365 |
| State of the Art GL AP/<br>AR/PR Each . . . . . | 350 |
| Peach SI/IP/GL/AP/AR                            |     |
| 8 series . . . . .                              | 350 |
| Think Tank Apple . . . . .                      | 125 |
| Home Accountant Apple . . . . .                 | 49  |
| Personal Investor Apple . . . . .               | 135 |

#### HARDWARE

##### MODEMS

|                                   |     |
|-----------------------------------|-----|
| Smart Mod 300w/Smartcom . . . . . | 199 |
| Smart Mod 1200 . . . . .          | 485 |
| Smart Mod 1200B . . . . .         | 429 |
| J-Cat . . . . .                   | 99  |

|                                     |     |
|-------------------------------------|-----|
| Smart Cat 103 . . . . .             | 175 |
| Smart Cat 212 . . . . .             | 399 |
| <b>MONITORS</b>                     |     |
| Amdek 12" 310A . . . . .            | 169 |
| Amdek Color II RGB Hi-Res . . . . . | 399 |
| Princeton RGB HX 12 . . . . .       | 480 |
| Taxan 12" Green 121 . . . . .       | 155 |
| Taxan 12" 122 Amber . . . . .       | 165 |

##### PRINTERS

|                        |      |
|------------------------|------|
| Juki 6100 . . . . .    | 410  |
| Epson Fx 100 . . . . . | 690  |
| Okidata 92 . . . . .   | 399  |
| NEC 3550 . . . . .     | 1625 |
| Qume Pro 20 . . . . .  | 599  |

##### HARDWARE & PERIPHERALS

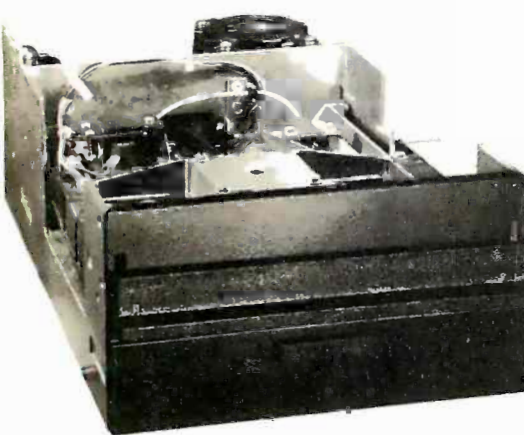
|                                      |      |
|--------------------------------------|------|
| 64K Ram Chips . . . . .              | 44   |
| Six Pac PLUS 64K . . . . .           | 265  |
| Quadboard II . . . . .               | 285  |
| Quadcolor I . . . . .                | 206  |
| Orchid Blossom . . . . .             | 255  |
| Hercules Graphics . . . . .          | 335  |
| STB . . . . .                        | 335  |
| Plantronics . . . . .                | 395  |
| Kraft Joysticks . . . . .            | 35   |
| TG Joysticks . . . . .               | 35   |
| Tall Grass Hard Disk 20MGB . . . . . | 2296 |
| Teac Half/Hgt 48 DPI . . . . .       | 169  |
| Rodine Half/Hgt 27M . . . . .        | 889  |
| Lotus 1-2-3 . . . . .                | 299  |
| Symphony . . . . .                   | 425  |

**TERMS:** Prices reflect 3% Cash Prepaid Discount on Cashier's Check, MO, Bank Transfer. Allow time for company or personal checks to clear. California residents add sales tax. All prices subject to change. Shipping UPS surface minimum \$4.00 within USA continent. Monday thru Saturday 9 a.m. to 5:30 p.m.

**WE SHIP OVERSEAS**

# California Digital

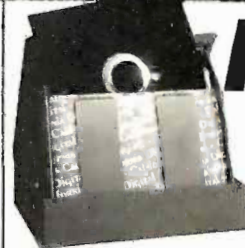
17700 Figueroa Street • Carson, California 90248



## Shugart

# \$159

The Shugart 801R has long been the standard by which all other eight inch disk drives have been judged. The 801R has historically been used by thousands of quality conscious equipment manufacturers because of their extremely high degree of reliability. These units are current production, rack mountable LSI technology. The drives are identical to drives currently sold by distributors at \$600. California Digital has acquired these NEW units as a result of a change of marketing strategy of the A. M. Jaquard Corporation. This is the best value that has ever been offered on any Shugart eight inch disk drive. SHU-801R



# FREE

Plastic library case supplied with all diskettes purchased from California Digital.

## DISKETTES AS LOW AS \$16.50

FIVE INCH SINGLE SIDED DOUBLE DENSITY

|                    | Soft Sector<br>Ten Sector              | Sixteen | Each box | 10 Boxes | 100 Boxes |
|--------------------|----------------------------------------|---------|----------|----------|-----------|
| <b>CAL DIGITAL</b> | CAL-501<br>CAL-510<br>CAL-516          |         | 18.95    | 17.50    | 16.50     |
| <b>SCOTCH</b>      | MMM-744/0<br>MMM-744/10<br>MMM-744/16  |         | 24.95    | 22.75    | 21.75     |
| <b>VERBATIM</b>    | VRB-525/01<br>VRB-525/10<br>VRB-525/16 |         | 24.95    | 22.75    | 21.75     |
| <b>MEMOREX</b>     | MRX-3481<br>MRX-3483<br>MRX-3485       |         | 24.95    | 21.75    | 17.75     |
| <b>MAXELL</b>      | MXL-MD1<br>MXL-MM1/10<br>MXL-MM1/16    |         | 24.95    | 22.75    | 21.25     |
| <b>DYSAN</b>       | DYS-104/1D<br>DYS-107/1D<br>DYS-105/1D |         | 35.00    | 33.00    | 30.50     |

FIVE INCH DOUBLE SIDED DOUBLE DENSITY

|                    |                                        |  |       |       |       |
|--------------------|----------------------------------------|--|-------|-------|-------|
| <b>CAL DIGITAL</b> | CAL-551<br>CAL-561<br>N/A              |  | 24.95 | 22.75 | 20.50 |
| <b>SCOTCH</b>      | MMM-745/0<br>MMM-745/10<br>MMM-745/16  |  | 37.95 | 35.95 | 31.25 |
| <b>VERBATIM</b>    | VRB-550/01<br>VRB-550/10<br>VRB-550/16 |  | 37.95 | 35.95 | 32.75 |
| <b>MEMOREX</b>     | MRX-3481<br>MRX-3483<br>MRX-3485       |  | 32.95 | 31.25 | 26.25 |
| <b>MAXELL</b>      | MXL-MD2<br>MXL-MD2/10<br>MXL-MD2/16    |  | 37.95 | 35.95 | 33.75 |
| <b>MAXELL / 96</b> | MXL-MD2/96<br>N/A                      |  | 45.00 | 43.00 | 41.25 |
| <b>DYSAN</b>       | DYS-104/2D<br>DYS-107/2D<br>DYS-204/2D |  | 42.50 | 40.50 | 35.50 |
| <b>DYSAN / 96</b>  | N/A                                    |  | 49.95 | 47.95 | 45.75 |

EIGHT INCH SINGLE SIDED SINGLE DENSITY

|                 |             |  |       |       |       |
|-----------------|-------------|--|-------|-------|-------|
| <b>SCOTCH</b>   | MMM-740/0   |  | 28.50 | 27.50 | 23.80 |
| <b>MEMOREX</b>  | MRX-3062    |  | 27.75 | 26.60 | 22.25 |
| <b>VERBATIM</b> | VRB-34/9000 |  | 31.50 | 29.50 | 25.60 |
| <b>DYSAN</b>    | DYS-3740/1  |  | 35.75 | 32.75 | 29.75 |

EIGHT INCH SINGLE SIDED DOUBLE DENSITY

|                 |             |  |       |       |       |
|-----------------|-------------|--|-------|-------|-------|
| <b>SCOTCH</b>   | MMM-741/0   |  | 33.95 | 31.75 | 29.15 |
| <b>MEMOREX</b>  | MRX-3090    |  | 31.95 | 27.75 | 26.15 |
| <b>VERBATIM</b> | VRB-34/8000 |  | 35.25 | 33.25 | 28.75 |
| <b>DYSAN</b>    | DYS-3740/1D |  | 40.75 | 38.75 | 32.25 |
| <b>MAXELL</b>   | MXL-FD1     |  | 45.50 | 39.75 | 35.15 |

EIGHT INCH DOUBLE SIDED DOUBLE DENSITY

|                 |             |  |       |       |       |
|-----------------|-------------|--|-------|-------|-------|
| <b>SCOTCH</b>   | MMM-743/0   |  | 45.95 | 43.25 | 37.50 |
| <b>MEMOREX</b>  | MRX-3102    |  | 37.95 | 36.75 | 31.50 |
| <b>VERBATIM</b> | VRB-34/4001 |  | 41.75 | 37.50 | 32.25 |
| <b>DYSAN</b>    | DYS-3740/2D |  | 54.65 | 49.75 | 40.50 |
| <b>MAXELL</b>   | MXL-FD2     |  | 52.50 | 48.75 | 40.45 |

## \$49 Apple Macintosh Diskettes



## QUME DT8



# \$319

These Qume DT8/842 disk drives are NEW double sided units acquired from the excess inventory of a major computer manufacturer.

Five Inch Winchester Hard Disk Drives

|                                   | One  | Two  |
|-----------------------------------|------|------|
| <b>FUJITSU M2235AS</b> 27 Meg.    | 999  | 959  |
| <b>RODINE RO-208</b> 53 Meg.      | 1589 | 1493 |
| <b>MAXTOR XT1065</b> 65 Meg.      | 1995 | 1965 |
| <b>SHUGART 712</b> 13 Meg. 1/2 Ht | 795  | 765  |
| <b>TANDON 503</b> 19 Meg.         | 795  | 775  |

Three Inch Disk Drives

|                      |     |     |
|----------------------|-----|-----|
| <b>SHUGART SA300</b> | 229 | 219 |
|----------------------|-----|-----|

Upon request, all drives are supplied with power connectors and manual

## MEMORY

# 4164 DYNAMIC MEMORY 150ns \$5.95

DYNAMIC MEMORY

|                             | 1-31  | 32+   | 100+  |
|-----------------------------|-------|-------|-------|
| 4116 150ns. 16K             | 1.75  | 1.65  | 1.45  |
| 4116 200ns. 16K             | 1.75  | 1.65  | 1.45  |
| 4164 150ns. 64K 128 refresh | 5.95  | 5.25  | 4.95  |
| 4125 150ns. 256K            | 39.95 | 34.65 | 27.70 |
| D78409 dynamic controller   | 39.00 | 35.00 | 29.00 |

| STATIC MEMORY          |      |      |      |
|------------------------|------|------|------|
| 21L02 200ns. 1K static | 1.49 | 1.29 | 1.15 |
| 21L02 450ns. 1K static | 1.29 | 1.15 | .99  |
| 2112 450ns. 2K static  | 2.99 | 2.85 | 2.75 |
| 2114 300ns. 1K x 4     | 1.95 | 1.85 | 1.75 |
| 4044TMS 450ns. 4 K x 1 | 3.49 | 3.25 | 2.99 |
| 5257 300ns. 4K x 1     | 2.50 | 2.25 | 1.99 |
| 6116 P4 200ns. 2K x 8  | 4.95 | 4.65 | 4.50 |
| 6116 P3 150ns. 2K x 8  | 5.25 | 4.05 | 4.85 |

| EPROMS                     |       |       |       |
|----------------------------|-------|-------|-------|
| 2708 450ns. 1K x 8         | 4.95  | 4.75  | 4.55  |
| 2716 450ns. 2K x 8         | 4.50  | 4.25  | 3.97  |
| 2716TMS 450ns. Tri-voltage | 7.95  | 7.55  | 7.25  |
| 2732 450ns. 4K x 8         | 4.80  | 3.75  | 3.55  |
| 2764 350ns. 8K x 8         | 6.95  | 6.95  | 6.95  |
| 27128 350ns. 16K x 8       | 24.95 | 23.75 | 22.50 |



# \$139

Your Choice

## TEAC 55B 55F 48TPI-96TPI

Five Inch Single Sided Drives

|                                   | One | Two | Ten |
|-----------------------------------|-----|-----|-----|
| <b>TEAC FD-54A</b> half height    | 99  | 95  | 89  |
| <b>SHUGART SA400L</b> full height | 189 | 179 | 175 |
| <b>TANDON TM100-1</b> full height | 169 | 165 | 179 |

Five Inch Double Sided Drives

|                                       |     |     |     |
|---------------------------------------|-----|-----|-----|
| <b>TEAC FD55B</b> half height         | 139 | 135 | 129 |
| <b>TEAC FD55F</b> 96 TPI, half ht.    | 139 | 135 | 129 |
| <b>CONTROL DATA 9409 PC</b>           | 219 | 199 | 195 |
| <b>CONTROL DATA 9428</b> 1/2 ht.      | 219 | 199 | 195 |
| <b>SHUGART SA455</b> Half Height      | 189 | 179 | 175 |
| <b>PANASONIC JA551/2N (455)</b>       | 139 | 135 | 129 |
| <b>SHUGART SA465</b> 1/2 Ht. 96TPI    | 269 | 259 | 249 |
| <b>TANDON 100-2</b> full height       | 179 | 175 | 169 |
| <b>TANDON 101-4</b> 96TPI full ht.    | 329 | 319 | 305 |
| <b>MITSUBISHI 4851</b> half height    | 169 | 159 | 155 |
| <b>MITSUBISHI 4853</b> 96/TPI 1/2 ht. | 179 | 169 | 165 |
| <b>MITSUBISHI 4854</b> 8" elec.       | 395 | 385 | 375 |
| <b>QUME 142</b> half height           | 219 | 205 | 199 |

## REMEX

# DOUBLE SIDED \$219



Eight Inch Single Sided Drives

|                                  |     |     |     |
|----------------------------------|-----|-----|-----|
| <b>SHUGART 801R</b>              |     |     |     |
| <b>SIEMENS FDD 100-8</b>         | 129 | 125 | 119 |
| <b>TANDON 848E-1</b> Half Height | 369 | 359 | 349 |

Eight Inch Double Sided Drives

|                                    |     |     |     |
|------------------------------------|-----|-----|-----|
| <b>SHUGART SA851R</b>              | 495 | 485 | 475 |
| <b>QUME 842 "QUME TRACK 8"</b>     | 459 | 459 | 449 |
| <b>TANDON 848E-2</b> Half Height   | 459 | 447 | 435 |
| <b>REMEX RFD-4000</b>              | 219 | 219 | 209 |
| <b>MITSUBISHI M2894-63</b>         | 447 | 439 | 433 |
| <b>MITSUBISHI M2896-63</b> 1/2 Ht. | 459 | 449 | 409 |

Shipping: First five pounds \$3.00, each additional pound \$.50. Foreign orders: 10% shipping, excess will be refunded. California residents add 6 1/2% sales tax. • COD's discouraged. Open accounts extended to state supported educational institutions and companies with a strong "Dun & Bradstreet" rating.



# California Digital

17700 Figueroa Street • Carson, California 90248

## NEC RGB COLOR MONITOR \$259



The NEC JC-1401D is a 13" medium/high resolution RGB monitor suitable for use with the Sanyo MBC-550/555 or the IBM/PC. The monitor features a resolution of 400 dots by 240 lines. Colors available are Red, Green, Blue, Yellow, Cyan, Magenta, Black and White. These monitors are currently being used in applications far more critical than microcomputers.

The NEC monitor carries the Litton-Monros label and was originally scheduled for use in their "Office of the Future" equipment. A change in Monros's marketing strategy has made these units excess inventory which were sold to California Digital. We are offering these prime new RGB monitors at a fraction of their original cost. Sanyo compatible NEC-1401/S, IBM/PC Computer compatible NEC-1401/PC

## MONITORS

|                                                     |            |        |
|-----------------------------------------------------|------------|--------|
| BMC 12A green phosphor 15 MHz composite video       | BMC-12A    | 7895   |
| BLIC 12 high resolution 20 MHz                      | BMC-12EN   | 119.00 |
| Amdek 300S 12 green phosphor                        | AMK-300S   | 12895  |
| Amdek 300A 12 amber phosphor hi-resolution          | AMK-300A   | 13895  |
| Amdek 300A designed for IBM/PC amber                | AMK-300A   | 15895  |
| Zenith ZVM122 Amber Phosphor 12 40/80 column switch | ZTH-122    | 91.95  |
| Zenith ZVM23 green phosphor 12 40/80 column switch  | ZTH-23     | 91.95  |
| NEC JB1201 green phosphor 18 MHz composite video    | NEC-JB1201 | 15900  |
| NEC JB1260 commercial grade composite               | NEC-JB1260 | 119.00 |
| Motolora 23 open frame black white composite video  | MOT-18W23  | 15900  |
| Conrac 9 open frame requires horz sync & 12v supply | CON-BW9    | 5900   |

|                                                   |            |        |
|---------------------------------------------------|------------|--------|
| NEC JC-1401D Medium/High 13" RGB                  | NEC-1401-X | 25900  |
| BMC A191910 Color composite video with sound      | BMC-9191M  | 23895  |
| Zenith ZVM122 RGB designed for the IBM computer   | NEC-1203   | 37900  |
| NEC JC1203 color composite                        | NEC-JC1203 | 339.00 |
| Zenith ZVM135 RGB & composite suitable for IBM/PC | ZTH-2135   | 475.00 |
| Amdek Color 13 composite video                    | AMK-100    | 25900  |
| Amdek Color II 13 RGB resolution                  | AMK-200    | 119.95 |
| Amdek Color III 13 RGB medium resolution          | AMK-300    | 359.95 |
| Princeton HX-12 RGB IBM/PC compatible             | PRN-HX12   | 37895  |



## TeleVideo \$795

The TeleVideo TPC/1 portable micro is a full featured computer with the advantage of portability. The 9 inch amber phosphor offers easy readability and a non-glare surface for easy on the eyes screen display. TPC 1 has an IBM style, low profile keyboard, detachable for comfortable data input which folds up to make a compact carrying case. The alpha numeric displayed character set includes 96 ASCII characters, 32 control codes, along with 10 programmable function keys. This unit features two double sided 320 K/byte disk drives, Z80 microprocessor and provides 64K of user RAM along with 32K of screen memory. The standard software package includes Telewrite exclusive word processor, Teletalk spreadsheet, Teletchart business graphics and CPM operating system which makes the portable compatible with the largest library of microcomputer software available.

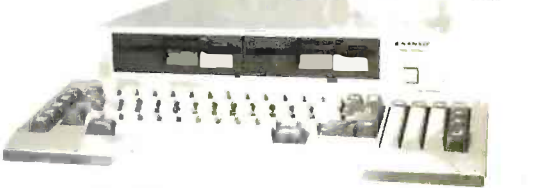


## Return of a Smash Hit Sellout \$139 DRAGON

Compatible with most Radio Shack Color Computer software. The world famous Dragon computer is now available in the United States. Manufactured by the Tano Corp. under license of the British Broadcasting Company. The Dragon comes complete with 64K Byte of memory, serial modem port along with a Centronics printer interface. This unique microcomputer features Motorola's advanced 6809E microprocessor and comes standard with Microsoft Color Basic, data base manager, and a complete word processing package. The computer outputs color composite video along with R.F. video that allows the unit to be used in conjunction with any color television. This is the ideal low cost computer to be used with any dial up information system such as the Source, Western Union's Easylink or any other time share service.

California Digital has agreed to act as exclusive agent for North America in an effort to assist The Tano Corporation in reducing their overstock. For a limited time California Digital can offer the Dragon computer for only \$139.

## SANYO IBM Compatible \$759



The Sanyo MBC-550 Microcomputer includes 128K byte of memory, a 5 1/4" disk drive along with a parallel printer port. The computer outputs both RGB color and monochrome composite video. Extensive software such as Sanyo Basic, Wordstar, Calcstar and Easy Writer I is included with the MBC-550.

|                         |                                     |                |
|-------------------------|-------------------------------------|----------------|
| <b>Sanyo 550</b>        | <b>reduced SALE price</b>           | <b>759.00</b>  |
| <b>Sanyo 550 Plus</b>   | <b>two single sided drives</b>      | <b>829.00</b>  |
| <b>Sanyo 550-2</b>      | <b>one double sided drive</b>       | <b>949.00</b>  |
| <b>Sanyo 550-2 Plus</b> | <b>two double sided drives</b>      | <b>1095.00</b> |
| <b>Sanyo 555</b>        | <b>two sgl. drives, bonus soft.</b> | <b>1095.00</b> |
| <b>Sanyo 555-2</b>      | <b>two dbl. drives, bonus soft.</b> | <b>1249.00</b> |
| <b>Memory Upgrade</b>   | <b>256K total memory</b>            | <b>99.00</b>   |
| <b>Serial Card</b>      | <b>modem interface</b>              | <b>85.00</b>   |

## PRINTERS

### MATRIX PRINTERS

|                                                         |           |         |
|---------------------------------------------------------|-----------|---------|
| Star Gemini-10X 120 char/sec                            | STR-G10X  | 25900   |
| Star Gemini-15X 100 char/sec 15 paper                   | STR-G15X  | 36500   |
| Star Gemini Delta 10, 160 Char/sec                      | STR-D10   | 399.00  |
| Star Coax 80FT tractor & tractor                        | VST-C80FT | 179.00  |
| Proprinter II parallel 15 paper letter quality          | TDS-1151  | 1495.00 |
| Okidata 82A serial & parallel 9" paper                  | OKI-82A   | 329.00  |
| Okidata 92A parallel interface, 160 char/sec            | OKI-92A   | 399.00  |
| Okidata 83A & parallel 15 paper                         | OKI-83A   | 559.00  |
| Okidata 84A & parallel 15 paper                         | OKI-84A   | 929.00  |
| Epson RX-800 120 Char/sec                               | EPS-RX800 | 259.00  |
| Epson FX80 10, 160 Char/sec with graphitax              | EPS-FX80  | 1399.00 |
| Epson FX100 15, 160 Char/sec with graphitax             | EPS-FX100 | 629.00  |
| Epson LX100 15, correspondence quality                  | EPS-LX100 | 1179.00 |
| Epson JX80 Color printer                                | EPS-JX80  | 579.00  |
| Andover 950 18 high speed with graphics                 | ADX-9501B | 1029.00 |
| Andover 9620 200 char/sec, par & serial                 | ADK-9620B | 1129.00 |
| Proprinter 8510 parallel 9" paper                       | PRO-8510P | 359.00  |
| Proprinter II parallel 15 paper graphics                | PRO-2P    | 689.00  |
| Dalproducts 8-600-3, band printer 600 LPM               | DPS-B600  | 6985.00 |
| Printronix P300 high speed printer 300 lines per minute | PTX-P300  | 3995.00 |
| Printronix P600 ultra high speed 600 lines per minute   | PTX-P600  | 5795.00 |

### WORD PROCESSING PRINTERS

|                                                          |            |         |
|----------------------------------------------------------|------------|---------|
| NEC7710 55 char/second, serial interface                 | NEC-7710   | 1795.00 |
| NEC7730 55 char/sec, par interface                       | NEC-7730   | 1795.00 |
| NEC3550 popular printer designed for the IBM/PC          | NEC-3550   | 1599.00 |
| NEC2650 designed for IBM/PC 20 char/sec, par i           | NEC-2650   | 995.00  |
| Silver Reed EXP550 11 char/sec, par interface            | SRD-EXP550 | 459.00  |
| Silver Reed EXP550 17 Char/sec par interface             | SRD-EXP550 | 659.00  |
| Diablo 630 40 char/sec serial                            | DLB-630    | 1765.00 |
| Diablo 620, proportional spacing, horz & vert tab 20 cps | DLB-620    | 775.00  |
| Juki G100, 18 char/sec SPECIAL                           | JUK-G100   | 429.00  |
| Brother HR1A serial interface                            | BTH-HR1S   | 695.00  |
| Starwriter F10 serial, 40 char/sec                       | PRO-F10S   | 1125.00 |
| Starwriter F10 parallel, 40 char/sec                     | PRO-F10P   | 1125.00 |
| Comrex CR2, 5k buffer, proportional spacing, par i       | CRX-CR2P   | 495.00  |

## TERMINALS

|                                                          |           |         |
|----------------------------------------------------------|-----------|---------|
| Freedom 100, split screen, detachable keyboard           | LIB-F100  | 495.00  |
| Qume 102 green phosphor terminal                         | QUM-102   | 539.00  |
| Ampex Dialogue 125 green screen                          | APX-D125G | 675.00  |
| Ampex Dialogue 175 amber screen, two page, func. keys    | APX-D175A | 719.00  |
| Wyse 50, 14 green phosphor                               | WYS-50    | 595.00  |
| Wyse 300, eight color display, split screen              | WYS-300   | 1159.00 |
| Zenith 29 terminal, VT52 compatible, detach ble keyboard | ZTH-229   | 705.00  |
| Televideo 910 Plus, block mode                           | TVI-910P  | 575.00  |
| Televideo 925, detachable keyboard, 22 function keys     | TVI-925   | 759.00  |
| Televideo 950, graphic char, split screen 22 func.       | TVI-950   | 950.00  |
| Televideo 970, 14 green, 132 column, European            | TVI-970   | 1095.00 |

## MODEMS \$319



The CTS212AH Modem is 300/1200 Auto Answer/Auto Dial, Hayes Compatible, Microsoft Labs Companion communications software \$35.00 additional

|                                                        |            |        |
|--------------------------------------------------------|------------|--------|
| CTS 212AH 1200 baud auto dial                          | CTS-212AH  | 319.00 |
| Signalman Mark 12, 1200 baud, Hayes compatible         | SQL-MK12   | 259.00 |
| Signalman Mark 1, direct connect with terminal cable   | SQL-MK1    | 75.00  |
| Hayes Smart Modem 1200 baud, auto answer, auto dial    | HVS-120AD  | 479.00 |
| Hayes 1200B for use with the IBM/PC 1200 baud          | HVS-1200B  | 429.00 |
| Hayes Smartmodem 300 baud only, auto answer, auto dial | HVS-103AD  | 229.00 |
| Hayes Micromodem II, 103 Apple direct connect          | HVS-M42    | 279.00 |
| Hayes Chronograph, time & date                         | HVS-CHR232 | 199.00 |
| U.S. Robotics 212A 300/1200 baud, auto dial/answer     | USR-212A   | 439.00 |
| U.S. Robotics 212B 300/1200 baud                       | USR-212B   | 439.00 |
| Perini 300/1200 terminal quality                       | PER-12AD   | 599.00 |
| Universal Data 102, line cover, answer & originate     | UDS-102LP  | 169.00 |
| Universal Data 212, 1200 baud, half duplex only        | UDS-212LP  | 319.00 |
| Universal Data 212E, full 1200 baud duplex, line power | UDS-212LP  | 319.00 |
| Novation J-Cal, direct connect, auto answer            | NOV-JCAL   | 115.00 |
| Novation SmartCat 103/212, 1200 baud auto dial         | NOV-SC212  | 529.00 |

## Advanced Logic Systems CP/M 3.0 CARD \$179



We have just purchased from Digital Research over eight hundred of the Advanced Logic Systems CP/M 3.0 cards. This unique product offers performance up to 300% faster than existing Apple CP/M cards. Featuring a 6 MHz, Z80B micro-processor, 64K/Byte of on board memory, with CP/M 3.0 along with GSX 80 graphics and CBasic. The ALS card supports larger programs with enhanced CP/M editing features.

Manufacturers suggested price on the CP/M board is \$399, while supplies last California Digital is offering this card at only \$179. ALS-Z80

TOLL FREE ORDER LINE (800) 421-5041 TECHNICAL & CALIFORNIA (213) 217-0500



Circle 170 on inquiry card.



# GSL



**Customer Service (801) 972-2739**  
**Sales (Utah) (801) 972-2717**  
**Sales (Outside Utah) (800) 545-2633**

# COMPUTER

**Retail and Mail Orders**  
**1780 West 2300 South**  
**Salt Lake City, Utah 84119**  
Prices subject to change without notice.

## III INTERNATIONAL INSTRUMENTATION, INC.

### 10, 15, 22 and 30 MG Hard Disk Subsystems

- Plug in controller and have instant Mass Storage!
  - 3 times faster than XT
  - Fully PC or XT compatible
  - Boot from hard disk
- Note - All hard disk add-on drives above 10 MG require additional power.

| Size  | Internal | External |
|-------|----------|----------|
| 10 MB | \$789    | \$889    |
| 15 MB | \$989    | \$1089   |
| 22 MB | \$1349   | \$1529   |
| 33 MB | \$1689   | \$1889   |

## STANLEY STREAMER

- 10 MG Streamer Tape back-up
  - Backs up 10 MG in 8 minutes
  - Uses inexpensive tape cartridges
- Internal Stream 1/2 HGT. . . . . \$899  
External Stream (w/Power Supply and case) (1/2 HGT) . . . . . \$999  
10.38 MG Tape Cartridge . . . . . \$29

## DISK DRIVE CABINETS

### 8" CABINETS

- III DTL-002 Holds 2 ea. 8" Thinline W/P.S. . . . . \$169
- III FDE-002 2 ea 8" Std Size Horizontally w/P.S. . . . . \$189
- OTC DDC88V28 Holds 2 ea. 8" Std Size/Vert. w/P.S. . . . . \$289

### 5 1/4" CABINETS

\*Note - All P.C. Products Units Available w/Extender Connector for \$15 ea.

- III HD 5-001 w/P.S. got 2 Thinline Hard Disk . . . \$189
- III HD 5-002 w/P.S. for 2 Full Size Hard Disk or Tape Back-up . . . . . \$209
- JMR DDC5H w/P.S. Horiz. for 1 ea. Std. Size . . . . . \$55
- P.C. DDC5V P.S. Vert. for 1 ea. Std. Size . . . . . \$55
- P.C. DDC55V w/P.S. Vert. for 2 ea. Std. Size . . . . . \$85

### SLIMLINE 5 1/4" CABINET

- JMR DDC55H 1/2 w/P.S. Horiz. for 2 ea. 1/2 HGT. . . . . \$75
- P.C. DDC55V 1/2 w/P.S. Vert. for 2 ea. Drives . . . . . \$75

## PRINTERS

- Daisywriter 2000-48K Buffer, 20 to 40 CPS Ltr Qual. . . . . \$999
- Diablo 620 API (25CPS) . . . . . \$749
- Diablo 630 API (40CPS) . . . . . \$1549
- Diablo 630 ECS/IBM or API . . . . . \$1649
- Epson FX-80 (160 CPS - 10" - Graphtrax/Tractor) . . . . . \$399
- Epson FX-100 (160 CPS - 15" - Graphtrax/Tractor) . . . . . \$649
- Juki 6100 (18 CPS - Diablo Compatible Daisywheel) . . . . . \$419
- Juki 6300 (40 CPS - 16" - 3K Buffer Upgrade to 15K) . . . . . \$799
- Okidata 82a (120CPS - 10") . . . . . \$319
- Okidata 83a (120CPS - 15") . . . . . \$569
- Okidata 92a (160CPS - 10") . . . . . \$399
- Okidata 93a (160CPS - 15") . . . . . \$649
- Okidata 84p (200CPS - 15") . . . . . \$729
- Okidata 84S (200CPS - 15") . . . . . \$849
- Okidata 2350P . . . . . \$1895
- Okidata 2410P . . . . . \$1895
- Panasonic 1091 (120 CPS - Logic Seeking Head - Runs Faster than FX-80-Par Port - Double Strike Switch - with Tractor) . . . . . \$299
- Star Gemini 10X (120CPS - 10") . . . . . \$268
- Star Gemini 15X . . . . . \$399
- Star Gemini Powertype (18 CPS Ser or Par) . . . . . \$399
- Toshiba P-1351 (192CPS/120CPS Ltr) . . . . . \$1299

## PRINTER ACCESSORIES

- Daisywriter 2000 B1-D1 Tractor . . . . . \$210
- Diablo 620 Tractor . . . . . \$189
- Diablo 630 Tractor . . . . . \$210
- Juki 6100 Tractor . . . . . \$138
- Juki 6100 Serial Interface . . . . . \$65
- Okidata 82/92 Tractor . . . . . \$60
- Okidata Serial Interface w/2K Buffer (92 & 93) . . . . . \$129
- Okidata Okigraph I . . . . . \$55
- Okidata Okigraph II . . . . . \$60
- Star Gemini 10X or 15X Serial Board w/4K Buffer . . . . . \$129
- Toshiba 1351 Tractor Feed . . . . . \$195

## PRINTER SWITCHER

Allows you to switch from letter quality to Dot Matrix by flip of switch

- SCN-2/Two Position Centronics Par to Centronics Par . . . . . \$99
- SCN-4/Four Position Cen Par to Cen Par . . . . . \$139
- SRS-2/Two Position Serial to Serial . . . . . \$89
- SRS-4/Four Position Serial to Serial . . . . . \$129

## CABLES

- IBM to Par Cable . . . . . \$22
- Centronics to Centronics . . . . . \$24
- RS232 Serial (Specify) . . . . . \$16
- Columbia to Par . . . . . \$28
- IBM Add-on Drive (DC37 Conn) . . . . . \$34
- Disk Drive Cable 5" or 8" . . . . . \$26
- Y-Splitter Cable . . . . . \$7.95

## SANYO PRODUCTS

- MBC 555-2 - 128K RAM (Expands to 256K) 2 ea. DS/DD 1/2 HGT Drive, Par port, Speaker and joystick port, Display, Keyboard & Following Software: Wordstar Mailmerge Easywriter Spellstar Calcstar Intostar MS-DOS 2.11 . . . . . \$1,149
- SANYO DRIVE UPGRADE Double Your Storage by Adding 2 ea Teac FD55B with software for only . . . . . \$339
- Sanyo Serial Port . . . . . \$65
- 128K Memory Expansion for Sanyo . . . . . \$69
- RGB Cable . . . . . \$19.95
- Copylink Software (US Digital for Modem) . . . . . \$89

## QT PRODUCTS

### QT 8" MAINFRAME



- Provision for any 2-8" drives (hard or floppy) Desk Top Version
- QTC-MF + DD6 (6 Slot MB) . . . . . \$575
- QTC-MF + DD8 (8 Slot MB) . . . . . \$625
- QTC-MF + DD12 (12 Slot MB) . . . . . \$675

All mainframes have EMI filter, 2 AC outlets, 15 ea. DB25, 2ea. 50 pin, 2 ea. 34 pin, 1 ea. Centronic cutouts, power supply for 8" MF (-5V1A/+5V5A/+8V14A/+16V3A/+24V5A)

### QT STANDARD MAINFRAME



- Provisions for any 2-5 1/4" drives\*15 ea DB 25 cutout \*2 ea 50 pin\*2 ea 34 pin\*1 ea Centronic\*EMI filter (fused)\*2 AC outlets\*Avbi with 6-8-12-18 or 22 slot MB\*Power supply (+8V16A-16V3A)
- Desk Top Version
- QTC-MF + 12 . . . . . \$499
- QTC-MF + 18 . . . . . \$525
- QTC-MF + 22 . . . . . \$550

## CARD CAGES/MOTHERBOARDS

\*IEEE-696-No termination required

| Slots | Bare Bd | A + T  | w/card cage | bare card cage |
|-------|---------|--------|-------------|----------------|
| 4     | \$20    | 51.75  | 74.75       | \$20           |
| 6     | \$25    | 60.95  | 86.25       | \$22           |
| 8     | \$30    | 85.10  | 120.75      | \$31           |
| 12    | \$35    | 119.60 | 166.75      | \$41           |
| 18    | \$50    | 178.25 | 235.75      | \$50           |
| 22    | \$65    | 218.50 | —           | \$75           |

All card cages will accommodate a 4" fan Add \$20.00 for 1 fan - Add \$30.00 for 2 fans

## CLOCK/CALENDAR

- S-100\*Time in hrs, min, sec\*AM/PM or Military Format\*Date in Mo., Day, Yr., Day of Week & Leap Year recognition\*4 hard interrupts (1024 Hz, 1 Hz 1 min, 1 hr)\*On board battery (will last 14 mos. w/no power on)
- QTC-CCS-BB (S-100) . . . . . \$45
- QTC-CCS-A (A+T) for S-100 . . . . . \$105

## QT/COMPUTIME BOARD SET

- Best Bare Board Set Available
- QTC-SBC 2/4 CPU (SBC 880)
- QTC-EXP + III 256K (CT256) Memory bd./ Expandable to 1 MG
- QTC-FDC 5/8 Floppy disk controller
- Bare Board Set . . . . . \$165
- 1) Includes manuals & assembly instructions
- 2) Parts available 3) Monitor & B10S available

## DISK DRIVES

|                                       | 1   | 2   | 10  |
|---------------------------------------|-----|-----|-----|
| <b>CDC</b>                            |     |     |     |
| CDC 9409 DS/DD 360K                   | 199 | 190 | 180 |
| CDC 9409T Quad 720K                   | 239 | 199 | 190 |
| <b>MPI</b>                            |     |     |     |
| B-52 DS/DD 360K                       | 100 | 95  | 90  |
| <b>MITSUBISHI</b>                     |     |     |     |
| M-2894-63 8" Stds 123/DS/DD/ 1.2 MG   | 419 | 390 | 380 |
| M-2894-63 8" Thin-line/DS/DD/ 1.2 MG  | 419 | 390 | 380 |
| M-4853 1/2 HGT                        | 169 | 159 | 140 |
| <b>QUME</b>                           |     |     |     |
| 142 DS/DD 360K 5" 1/2 HGT             | 169 | 165 | 160 |
| 842 or DT-8 DS/DD 1.2 MG 8" Full Size | 449 | 440 | 430 |

|                                  | 179 | 169 | 160 |
|----------------------------------|-----|-----|-----|
| <b>SHUGART</b>                   |     |     |     |
| SA400 SS/DD 160K 5" Full Size    | 179 | 169 | 160 |
| SA455L DS/DD 360K 5" 1/2 HGT     | 155 | 145 | 140 |
| SA801R SS/DD 600K 8" Full Size   | 349 | 330 | 320 |
| <b>TANDON</b>                    |     |     |     |
| TM100-1A SS/DD 160K 5" Full Size | 150 | 140 | 130 |
| TM100-2A DS/DD 360K 5" Full Size | 155 | 145 | 140 |
| TM-101-4 Quad 720K 5" Full Size  | 280 | 270 | 260 |
| <b>TEAC</b>                      |     |     |     |
| FD55B DS/DD 360K 1/2 H           | 135 | 129 | 119 |
| FD55F Quad 720K 1/2 H            | 169 | 159 | 149 |



# TOLL FREE 1-800-545-2633



# IBM HOLIDAY GIFTS from GSL COMPUTER

## TOLL FREE 1-800-545-2633

All prices for MC, VISA, AMEX or Pre-pay customers only. Call for P.O. Prices.

**Terms:**

We accept MC, Visa, American Express (3% handling charge), Wire transfer, and Purchase Orders from qualified firms. All returns without RMA are subject to 20% restocking charge. Utah residents pay 5.75% sales tax. Call for freight charges. Prices subject to change and are in U.S. Currency only. MINIMUM ORDER \$15.00

- UPS Red Label 1 day delivery
- UPS Blue Label 3 day delivery
- UPS Surface Min. 3 to 10 day delivery



### IBM SYSTEMS

- IBM PC-0 No Drive System with 64K & KYBD ..... \$1099
- IBM PC-1 Includes 64K RAM, 1 ea 360K FD ..... \$1329
- IBM PC-2 64K RAM, 2 ea 360K FD ..... \$1499
- IBM PC-22 256K RAM, 2 ea 360K FD ..... \$1699
- IBM PC-3 256K RAM, 2ea 360K FD, IBM Mono Display, IBM Mono Card ..... \$1999
- IBM PC-33 256K RAM, 2 ea 360K FD, Color Bd. Monitor ..... \$1899
- IBM PC-4 256K RAM, 2ea 360K FD, STB Graphics+ Princeton HX-12 ..... \$2429

### FLOPPY CONTROLLERS

- FDC (5" Only) ..... \$140
- FDC-P (5" w/Par Port) ..... \$190
- FDC-S (5" w/Serial Port) ..... \$210
- Sandstar FDC (5" & 8" w/ability to add following modules) ..... \$200
- Modules - Parallel Mod ..... \$55
- Serial Port Mod ..... \$75
- Clock-Cal Mod ..... \$65
- Game Mod ..... \$45
- Hard Disk Module ..... \$299

### KEYBOARDS

- KB-5150 ..... \$179
- KB-5151 ..... \$199

### MEMORY BOARDS

#### AST RESEARCH

- 6 Pak+ w/64K (Expands to 384K) has Par. Serial, Clk, RAM Disk, Spooler ..... \$289
- 6 Pak+ w/384K Plus all above features ..... \$469

#### P.C. WARE

- "256K RAM" w/0 RAM ..... \$119
- "256K RAM" w/64K RAM ..... \$159

#### QUADRAM

- "Quadboard 384" w/64K (Expands to 384K) has Par, Serial, Clk, RAM Disk, Spooler, Game Port ..... \$299
- "Quadboard 384" w/384K and all above features ..... \$479

### MONITORS

- IBM Color Display ..... \$549
- IBM Monochrome Monitor ..... \$249
- AMDEK 300A ..... \$149
- AMDEK 310A (for IBM) ..... \$169
- AMDEK 600 RGB Hi-Res ..... \$499
- AMDEK 700 RGB Ultra Hi-Res ..... \$595
- Princeton HX-12 Hi-Res ..... \$489

### OUR BEST BUY

#### IBM UP-GRADE KIT

INCLUDES 9 EA. 4164-200NS FOR EXPANSION ON ALL PRODUCTS WITH PARITY

**\$34.00 PER SET**

### IBM PC JR SYSTEMS

- PCjr-1 Enhanced Model ..... \$799
- Includes 128K RAM (expands to 512K) 1 ea 360K Floppy, 2 ea Cart. Slots, New Kybd
- PCjr-2 Entry Model ..... \$499
- Includes 64K RAM (expands to 512K) 2 ea Cart. Slots, New Kybd
- PCjr-3 All features of "Enhanced Model" Plus ..... \$1239
- IBM Color Monitor
- Free Software includes Basic Cartridge, Word Processor and DOS 2.1
- PCjr-4 All features of "Enhanced Model" Plus ..... \$1499
- IBM Color Monitor and Internal Modem Free Carrying Case and Software.

### PCjr ACCESSORIES

|                             | list    | our price |
|-----------------------------|---------|-----------|
| Color Display               | \$429   | \$365     |
| Printer Adapter             | \$99    | \$87      |
| Compact Printer (Thermal)   | \$175   | \$160     |
| Half Height 360K Disk Drive | \$480   | \$399     |
| Serial Adapter Cable        | \$25    | \$23      |
| Color Display Cable         | \$20    | \$18      |
| Keyboard Cord               | \$20    | \$18      |
| TV Connector                | \$30    | \$28      |
| Carrying Case               | \$60    | \$55      |
| Game Control Adapter        | \$45    | \$41      |
| Joystick                    | \$40    | \$36      |
| Hands on Basic              | \$17.50 | \$16      |
| Basic Cartridge             | \$75    | \$70      |
| Internal Modem              | \$199   | \$175     |
| Mouse                       | \$195   | \$175     |
| Additional Memory           | \$295   | \$250     |

### PC POWER SUPPLIES

- HDPC-X Pwr - External Power Supply (130w) for Hard Disk Add-ons w/fan ..... \$169
- HDPC-I Pwr - Internal Power Supply (130w to Replace 63w) ..... \$189

NOTE! "All hard disks above 10MB require 130w power supply"

### IBM HARD DISK SYSTEMS

- IBM XT 128K RAM, 10 MB Hard Disk, & Keybd ..... \$3495
- PC-10 256K RAM, 10MG H.D., 1 ea 360K FD and Keybd ..... \$2499
- PC-10/2 256K RAM, 10MG HD, 2 ea 1/2 Hgt 360K FD and Keybd ..... \$2699
- PC-10/2M 256K RAM, 10 MG HD, 2 ea 360K FD, Amdek 310a, IBM Monocard, Keybd ..... \$2995

### IBM-AT SYSTEMS

#### 3 TIMES SPEED OF XT

- IBM-AT (Base Model) includes 256K RAM, 1.2 MB F.D., Clk/Cal, 8 Slots, Keylock ..... \$3900
- IBM-AT (Enhanced) includes 512K RAM, 1.2 MB FD, 20 MB Fixed Drive, Ser/Par Port, 8 Slots, Keylock ..... \$5700

### MODEMS

- Anchor Mark XII - External-Direct Connect-Hayes Commands Includes Serial Cable-Auto Answer & Dial ..... \$239
- Hayes 300 - External-Direct Connect ..... \$199
- Hayes 1200 - External-Direct Connect ..... \$499
- Hayes 1200B - Internal for IBM with Software ..... \$399
- Pro-Modem 1200 - External-Direct Connect-w/Clock - Hayes Commands - Auto Answer and Dial ..... \$339
- Quadmodem 1000 - External - Direct Connect - 1200 Baud - with Software ..... \$329
- Quadmodem 1100 - Internal - 1200 Baud - with Software ..... \$289

### VIDEO CARDS

#### Mono Cards

- IBM Monochrome Card ..... \$229
- Hercules Graphics Card ..... \$349

#### Color Cards

- Paradise Mono & RGB w/Par Port ..... \$319
- 640X200 B&W 320X200 (4 Color) Flicker Free - Mono to Color Switch
- Quadcolor 1 - Composite and RGB ..... \$209
- Quadcolor 2 - Piggyback Upgrade for Quadbd 1 ..... \$209
- STB Graphics Plus - Composite, Mono 50% Faster Scroll, Lite Pen Intfce, Flicker Free, Par Port Runs all Software ..... \$349
- Tecmar Graphics master - 128K Display RAM ..... \$549
- On Low Scan (640X400V) (16 color) (720X480V) (4 Color)
- Everex - "The Graphics Edge" ..... \$399
- (80X25 or 132X44) Runs Mono and Color Simultaneously - (640X200V) 16 Color Par Port

### IBM MISCELLANEOUS

#### PRODUCTS

- IBM Memory Upgrade Kit (64K) ..... \$34
- P.C. Ware Serial Board ..... \$79
- P.C. Ware Par Board ..... \$75
- P.C. Ware Clock/Calendar ..... \$59
- Math Co-Processor - 8087 ..... \$159
- IBM DOS 2.1 ..... \$57
- IBM DOS 3.0 ..... \$60



Customer Service (801) 972-2739  
Sales (Utah) (801) 972-2717  
Sales (Outside Utah) (800) 545-2633

The Great Salt Lake  
Computer Company, Inc.

Retail and Mail Orders  
1780 West 2300 South  
Salt Lake City, Utah 84119

Circle 170 on inquiry card.

Prices subject to change without notice.

**NEW!!**

# MEGA-CASE™

**NEW!!**

**IDEAL FOR OEM MANUFACTURERS, UNIVERSITIES,  
RESEARCH LABS ETC.**

**THE ULTIMATE PC COMPATIBLE ENCLOSURE**

**IDEAL FOR MEGA-BOARD™ XT OR ANY IBM-PC PC-XT  
COMPATIBLE BOARDS**

**OEM AND DEALER  
QUANTITY DISCOUNTS AVAILABLE**

**EASY ACCESS!!**  
FLIP-TOP-CASE™  
OPENS FOR EASY  
ACCESS TO INSIDE!!

**EXCLUSIVE  
FLIP-TOP-CASE™**  
Overcomes Problems  
With PC Case

**Bus Expansion Slot**  
Allows External  
Access To PC Bus

MOUNTS STANDARD  
POWER SUPPLY

Blank Label Inset  
For Your Company Or  
University Name Here

Mounts Standard  
Half or Full Height  
Floppy Disk  
or Hard Disk Drives

Rugged Heavy Gauge Steel Construction

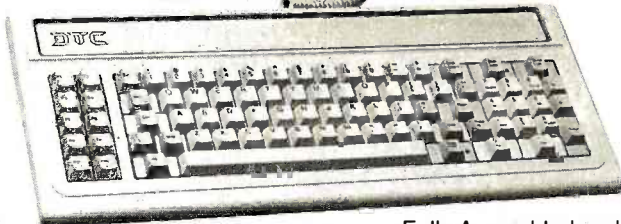
**ONLY  
\$99<sup>95</sup>**  
COMPLETE

## ADVANCED KEYBOARD

- FEATURES:**
- Horizontal Return Key
  - Caps Lock and Num. Lock Indicators
  - Enter Key for Numeric Keypad



Full PC Compatibility



Fully Assembled and Tested with One Year  
Limited Warranty

**ONLY  
\$149<sup>95</sup>**

**DTC™** DISPLAY  
TELECOMMUNICATIONS  
CORPORATION

4100 SPRING VALLEY ROAD  
SUITE 400  
DALLAS, TX 75234  
(214) 991-1644

**TERMS:** We accept cash, checks, money orders, or purchase orders from qualified firms and institutions. Prices and availability subject to change without notice. Shipping and handling charges via UPS ground 50¢/lb UPS air \$1.00/lb. Minimum charge \$3.00

\*IBM and IBM PC are trademarks of International Business Machines

©1984 Display Telecommunications Corporation

# MEGA-BOARD™-XT

**#1 CHOICE OF MAJOR OEM MANUFACTURERS, UNIVERSITIES, RESEARCH LABS ETC. A THOROUGHLY FIELD PROVEN DESIGN. HIGH VOLUME PRODUCTION ENGINEERED.**

- **FULL IBM PC-XT\* COMPATIBILITY!**
- **FULL MEGA-BYTE RAM CAPACITY ON MOTHERBOARD!**

**THOUSANDS SOLD WORLD WIDE!**

**DEALERS AND OEM MANUFACTURERS QUANTITY DISCOUNTS AVAILABLE**

**Eight Compatible I/O Interface Connectors**  
(Full PC compatible)  
(compatible with all IBM-PC\* plug-in cards)

**Special J1 Interface**  
(Allows horizontal mounting of compatible expansion cards for easy bus expansion and custom configuring) (Board has 62 pin gold plated compatible connector)

**Extended ROM Capability**  
(Runs all compatible PC ROMS) (Jumper programmable to accommodate all popular 8K, 16K, 32K and 64K ROM chips and NEW EE ROMS! VPP power pin available for EP ROM burning!) (External VPP voltage required)

**Full Mega-Byte Ram Capacity! On board!**  
(With parity)  
 256K Bytes using 64K chips  
 1 Mega Bytes using 256K chips

**Standard Keyboard Interface**  
(Full PC compatible)

**Hardware Reset**  
(Overcomes reset flaw in PC)

**Power Connector**  
(Full IBM\* pinout compatible)

**8088 Processor**  
(Same as PC)

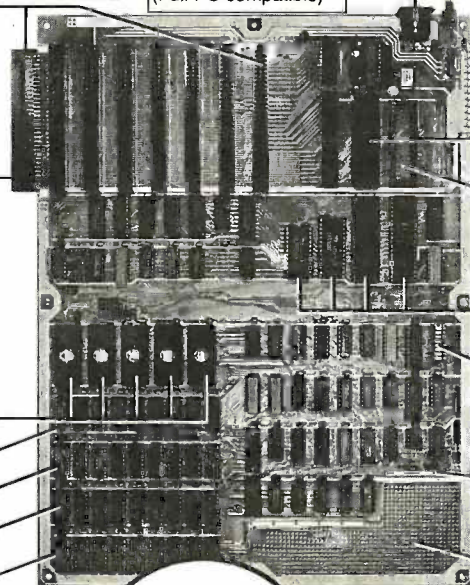
**8087 Numeric Processor**  
(Same as PC)

**Peripheral Support Circuits**  
(Same as PC)

**Configuration Switches**  
(Same as PC)

**Speaker/Audio Port**  
(Same as PC)

**Wire Wrap Area**  
To facilitate special custom applications!



**ONLY!**  
**\$999<sup>95</sup>**  
**Evaluation Board Kit**

**Mega-Board™ Evaluation Board Kit!**  
(Blank board with full assembly instructions and parts list.)

Includes highest quality PC board with gold plating, silk screen, solder mask

**Board Size** 10.5 inch X 13.5 inch

- MEGA-BOARD™ — XT
  - BARE BOARD KIT ..... \$ 99.95
  - ASSEMBLED AND TESTED SOCKET KIT (LESS ICS) (FULLY SOCKETED) ..... \$199.95
  - ASSEMBLED AND TESTED — COMPLETE (INCLUDES USERS MANUAL AND MEGA-BIOS ROM) ..... \$499.95
  - USERS MANUAL WITH THEORY OF OPERATION, SCHEMATICS, BLOCK DIAGRAM, APPLICATION NOTES ..... \$ 19.95
  - MEGA-BIOS™ ROM (2764) FULLY XT COMPATIBLE, MS-DOS, PC DOS ..... \$ 29.95
  - HARD TO GET PARTS ..... CALL

**FREE OFFER**

**FREE! Displaytel™ Exclusive.**  
Our Commitment to Microcomputer Education!

**FREE Intel 8088 Data Book** with each Mega-Board™ Order!

**ORDER NOW!!!** Fast, friendly service



**CALL 214-991-1644**



**100% SATISFACTION GUARANTEE**

**Immediate shipment!**  
Most instock items shipped same or next day!

10 Day money back guarantee if not completely satisfied!

**DTC™ DISPLAY TELECOMMUNICATIONS CORPORATION**

4100 SPRING VALLEY ROAD  
SUITE 400  
DALLAS, TX 75234  
(214) 991-1644

**TERMS:** We accept cash, checks, money orders, or purchase orders from qualified firms and institutions. Prices and availability subject to change without notice. Shipping and handling charges via UPS ground 50¢/lb. UPS air \$1.00/lb. Minimum charge \$3.00

\*IBM and IBM PC are trademarks of International Business Machines

## Logic Simulation System

Type: 4 state unit delay  
(1,0,unknown,hi-z)

Input: ASCII files or keyboard entry  
User defined macros  
Circuit description  
Named nodes  
Signal sources, patterns  
Full editing

Output: Timing diagram (screen/printer)  
Loading report (fanout)  
Circuit listings

For MS-DOS, CP/M  
Price \$175

Tatum Labs  
P.O. Box 698  
Sandy Hook, CT 06482  
(203) 426-2184

## MODEM & A/D + D/A FOR IBM PC

MODEM CARD:  
Bell 103 and/or 212A Compatible.

AD/DA CARD:  
12 Bit, A/D 30  $\mu$ sec, 16 Channel.

Dealer and/or Customer Design are Welcomed



P.O. Box 58144, TPE, TWN 100 R.O.C.  
Tlx: 20370 COMPOWER  
Tel: (886) (2) 321-3060  
Fax: (886) (2) 752-5040

## C SOFTWARE DEVELOPMENT PCDOS/MSDOS

- FULL C COMPILER PER K&R
- Inline BOB7 or Assembler Floating Point
- Full 1MB Addressing for Code or Data
- Transcendental Functions
- MSDOS 1.1/2.0 LIBRARY SUPPORT
- Program Chaining using Exec
- Environment Available to Main
- c-window™ C SOURCE CODE DEBUGGER
- Variable Display & Alteration Using C Expression
- FAST BOBB/BOB6 ASSEMBLER

Combined Package — \$199

Call or write:

c-systems Fullerton, CA 92634  
P.O. Box 3253 714-637-5362  
TM c-systems

Circle 364 on inquiry card.

Circle 70 on inquiry card.

Circle 49 on inquiry card.

## MULTI-CHANNEL current carrier transceiver 2-WAY COMMUNICATION with any BSR type device

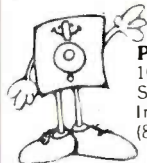
- Switch selectable for 8 channels transmit & 3 channels receive OR 3 channels transmit & 8 channels receive + 1 channel for on/off cmd.
- Switch selectable for any of the 16 BSR 'house codes' A thru P.
- To transmit a BSR signal, take the assigned TTL input port high momentarily.
- Upon receiving a BSR 'on' signal, the TTL output port goes high and stays high until reset by BSR 'off' signal.
- An interrupt driven Z-8 micro, complete with power supply (requires 24 vac ct @ 200 ma) on a 4.5" card with 44 pin connector, \$187.00.
- Optional RS-232 interface capable of sending and receiving all 256 channels, \$49.00.

HYDRUS CORPORATION (214) 350-8766  
6218 Cedar Springs Rd Dallas, Texas 75235

## Maxell Floppy Disks The Mini-Disks with maximum quality.



Dealer inquiries invited. C.O.D's accepted. Call FREE (800) 235-4137.



PACIFIC EXCHANGES  
100 Foothill Blvd., San Luis  
San Luis Obispo, CA 93401.  
In Cal. call (800) 592-5935 or  
(805)543-1037.

Circle 183 on inquiry card.

Circle 300 on inquiry card.

Circle 273 on inquiry card.

## Subscription Problems?

*If you have a problem with your BYTE subscription, write us with the details. We'll do our best to set it right. But we must have the name, address, and zip of the subscription (new and old address, if it's a change of address). If the problem involves a payment, be sure to include copies of the credit card statement, or front and back of cancelled checks. Include a "business hours" phone number.*

BYTE  
Subscriber Service  
P.O. Box 328  
Hancock, NH 03458

## CONVERSE WITH YOUR COMPUTER

AT LAST! A FULL IMPLEMENTATION of the original ELIZA program is now available to run on your microcomputer!

Created at MIT in 1966, ELIZA has become the world's most celebrated artificial intelligence demonstration program. ELIZA is a non-directive psychotherapist who analyzes each statement as you type it in and then responds with her own comment or question—and her remarks are often amazingly appropriate!

Designed to run on a large mainframe, ELIZA has never before been available to personal computer users except in greatly stripped down versions lacking the sophistication which made the original program so fascinating.

Now, our new microcomputer version possessing the FULL power and range of expression of the original is being offered at the introductory price of only \$25. And if you want to find out how she does it for herself to do more, we will include the complete SOURCE PROGRAM for only \$20 additional!

Order your copy of ELIZA today and you'll never again wonder how to respond when you hear someone say, "Okay, let's see what this computer of yours can actually do!"

ELIZA IS AVAILABLE IN THE FOLLOWING FORMATS:

1. 5 1/4 inch disk for the 48K Apple II, II Plus, IIe or IIc \$25 for Protected Version—\$45 for Applesoft Source Version
2. 5 1/4 inch disk for the 64K IBM Personal Computer \$25 for Protected Version—\$45 for IBM Disk BASIC Source Version
3. 5 1/4 inch disk or tape cassette for the Commodore 64 (specify which) \$25 for Protected Version—\$45 for C-64 BASIC Source Version
4. Standard 8 inch single density disk for all CP/M based computers \$25 for ELIZACOM—\$45 with Microsoft BASIC-80 Source
5. 5 1/4 inch disk for most CP/M based computers (specify computer) \$25 for ELIZA.COM—\$45 with Microsoft BASIC-80 Source

Please add \$2.00 shipping and handling to all orders (California residents please add 6% sales tax)

ARTIFICIAL INTELLIGENCE RESEARCH GROUP

921 North La Jolla Avenue, Dept. B  
Los Angeles, CA 90046  
(213) 656-7368 (213) 654-2214  
MC, VISA and checks accepted

Circle 419 on inquiry card.

## CALCULATOR

4 FUNCTION w/MEMORY  
\$39 REGISTER TAPE \$39  
PRINT FUNCTIONS

## INDEXER

PRINT FUNCTIONS SORTS  
NOTEBOOKS \$69 NAME  
ROLODEX CARDS ADDRESS  
MAILING LABELS CATEGORY

## CALENDAR

BY DAY \$59 YOU'VE GOT  
BY WEEK TO SEE IT  
BY MONTH TO BELIEVE IT  
EXPENSES AND NOTES

IBM & COMPATIBLES

MicroTime

ALL 3 FOR \$139 SEE OUR AD ON PAGE 4

800-642-7684

Circle 268 on inquiry card.



## NEW! EPSON LQ-1500 200 CPS & letter quality!

24 pin head, 200 CPS draft mode, 67 CPS letter quality mode

LQ-1500 \_\_\_\_\_ **SAVE 200.00**

|              |      |        |
|--------------|------|--------|
|              | LIST | JADE   |
| TRACTOR      | 89   | 54.95  |
| SHEET FEEDER | 499  | 439.95 |

## NEW! EPSON JX-80 COLOR PRINTER

160 CPS black and white printing (identical to FX-80). Plus seven color printing compatible with popular software such as LOTUS Symphony. Full color graphics—plus 144 different typefaces!

NEW! EPSON JX-80 \_\_\_\_\_ 799 599.95

## NEW! 420 CPS PRINTER From EPSON/COMREX

New Comwriter 420 prints at 420 CPS draft mode, 100 CPS correspondence mode, parallel and serial ports, very quiet, tractor and friction feed  
List 2495.00 \_\_\_\_\_ **SALE 1995.00**

# Printers

### EPSON

Call us for our best price!

EPSON RX-80 100 CPS w/tractor, graphics  
CALL FOR BEST PRICE

EPSON RX-80FT 80 CPS w/FREE graphics  
Friction & tractor feed \_\_\_\_\_ **SAVE 150.00**

EPSON FX-80 160 CPS w/FREE graphics  
Friction & tractor feed \_\_\_\_\_ **SAVE 150.00**

EPSON FX-100 160 CPS 15 inch platten  
Friction & tractor feed \_\_\_\_\_ **SAVE 150.00**

Apple IIc or Macintosh Universal serial interface  
4K buffer, x-on, x-off \_\_\_\_\_ 119.95

### OKIDATA

Prices slashed!

**FREE\*  
IBM  
ROMS**

160 CPS, Correspondence Quality LIST JADE

|                              |     |         |
|------------------------------|-----|---------|
| OKI 92 parallel              | 599 | 389.95* |
| OKI 93 parallel FREE tractor | 995 | 599.95* |
| 2K serial board              | 120 | 99.95   |
| IBM PC ROMS for 92           | 59  | 49.95   |
| IBM PC ROMS for 93           | 69  | 59.95   |
| Extra 92/93 ribbons          | 19  | 4.95    |
| 82/92 tractor                | 89  | 54.95   |

120 CPS & 200 CPS OKIDATAS

|                         |      |         |
|-------------------------|------|---------|
| OKI 82 120 CPS          | 499  | 299.95  |
| OKI 83 120 CPS          | 775  | 569.95* |
| OKI 84 parallel 200 CPS | 1395 | 799.95* |
| OKI 84 serial 200 CPS   | 1495 | 949.95  |
| 2K serial board         | 150  | 119.95  |
| IBM PC ROMS for 82/83   | 49   | 39.95   |
| IBM PC ROMS for 84      | 99   | 89.95   |

350 CPS, Near Letter Quality,  
High-Resolution Graphics

|                   |      |         |
|-------------------|------|---------|
| OKI 2350 parallel | 2695 | 1899.95 |
| OKI 2350 serial   | 2775 | 1999.95 |

\* FREE Plug-n-Play option with  
purchase of 92, 93, or 84

### A-B PRINTER SWITCH

Allows your computer to run either of two printers. Standard parallel switch box

|                |      |       |
|----------------|------|-------|
|                | LIST | JADE  |
| Printer Switch | 149  | 89.95 |
| Extra Cable    | 40   | 29.95 |

### LETTER QUALITY PRINTERS ON SALE!

|                          |      |         |
|--------------------------|------|---------|
|                          | LIST | JADE    |
| Diablo 630 40 CPS        | 2340 | 1699.95 |
| Tractor for 630          | 250  | 219.95  |
| Starwriter F-10 40 CPS   | 1895 | 999.95  |
| Starwriter F-10 55 CPS   | 1995 | 1299.95 |
| Tractor for F-10         | 250  | 219.95  |
| Comrex CR-II 5K parallel | 599  | 399.95  |
| Comrex CR-II 5K serial   | 644  | 499.95  |
| Tractor for CR-II        | 120  | 99.95   |
| Keyboard for CR-II       | 199  | 179.95  |
| Sheet feeder for CR-II   | 259  | 199.95  |
| Silver Reed 500 14 CPS   | 599  | 499.95  |
| Tractor for 500          | 149  | 124.95  |
| Silver Reed 550 18 CPS   | 699  | 599.95  |
| Tractor for 500          | 159  | 129.95  |
| Silver Reed 770          | 1295 | 999.95  |
| Tractor for 770          | 159  | 139.95  |
| Juki 6100 18 CPS         | 599  | 449.95  |
| Tractor for 6100         | 149  | 124.95  |
| NEC 3550 33 CPS          | 2250 | 1699.95 |
| Tractor for 3550         | 265  | 229.95  |

### TOSHIBA P1351

High speed & letter quality!

High quality 24 pin head, 192 CPS draft mode,  
96 CPS letter quality

|              |      |         |
|--------------|------|---------|
|              | LIST | JADE    |
| P1351        | 1895 | 1299.95 |
| TRACTOR      | 195  | 174.95  |
| SHEET FEEDER | 1095 | 899.95  |

### PRINTER ACCESSORIES

|                         |           |       |
|-------------------------|-----------|-------|
|                         | LIST      | JADE  |
| IBM PC style cable      | 54        | 28.95 |
| STANDARD parallel cable | 40        | 28.95 |
| APPLE Card & Cable      | 109       | 49.95 |
| TRS-80 MDL-3 cable      | 109       | 49.95 |
| COLUMBIA MPC cable      | 50        | 39.95 |
| RS-232 serial cable     | 30        | 24.95 |
| PRINTER stands          | AS LOW AS | 19.95 |
| RIBBONS                 | AS LOW AS | 4.99  |
| APPLE IIC cable         | 39        | 27.95 |

### STAR MICRONICS Lowest prices!

GEMINI 10X \_\_\_\_\_ 269.95

Call for prices on Gemini 15X, Delta 10 &  
15, Radix 10 & 15, Power Type LQ

### SUPER DISKETTE SPECIAL

Ultra-high quality diskettes from a premium U.S. manufacturer, certified to be error free for one year! SS/DD  
Box of 10 w/FREE! case \_\_\_\_\_ 34 16.95

### MICROFAZER BUFFERS Quadram

Expandable to 64K (parallel model expands to 512K)

|                                 |      |        |
|---------------------------------|------|--------|
| <u>Parallel in/Parallel out</u> | LIST | JADE   |
| 8K                              | 169  | 139.95 |
| 32K                             | 225  | 164.95 |
| 128K                            | 445  | 269.95 |

Serial in/Parallel out

|     |     |        |
|-----|-----|--------|
| 8K  | 199 | 169.95 |
| 32K | 260 | 199.95 |

Parallel in/Serial out

|     |     |        |
|-----|-----|--------|
| 8K  | 199 | 169.95 |
| 32K | 260 | 199.95 |

Serial in/Serial out

|     |     |        |
|-----|-----|--------|
| 8K  | 199 | 169.95 |
| 32K | 260 | 199.95 |

### MICROBUFFER Practical Peripherals

|                                 |      |        |
|---------------------------------|------|--------|
| <u>Stand alone Microbuffers</u> | LIST | JADE   |
| Parallel, 32K                   | 299  | 229.95 |
| Parallel, 64K                   | 349  | 269.95 |
| Serial, 32K                     | 299  | 229.95 |
| Serial, 64K                     | 349  | 269.95 |
| 64K add-on board                | 179  | 149.00 |

Microbuffers for Apple II

|               |     |        |
|---------------|-----|--------|
| Parallel, 16K | 259 | 189.95 |
| Parallel, 32K | 299 | 229.95 |
| Serial, 16K   | 259 | 189.95 |
| Serial, 32K   | 299 | 229.95 |

Microbuffers for Epson Printers

|               |     |        |
|---------------|-----|--------|
| Parallel, 16K | 159 | 129.95 |
| Serial, 8K    | 159 | 129.95 |

We have showrooms in—  
Los Angeles, Woodland Hills,  
Santa Ana, San Diego,  
Sunnyvale, and Dallas

(Prices will be slightly higher in our retail stores—  
But we're still the best deal in town!)

# JADE

## Computer Products

Circle 204 on inquiry card.

# Accessories for your IBM PC

## NEW! FROM JADE IBM Multifuntion Card

Up to 384K, parallel printer port, RS-232 serial port, FREE serial cable, clock/calendar, RAM Disk/spooler and diagnostic software package

|      | LIST | JADE        |
|------|------|-------------|
| OK   | 349  | SALE 198.95 |
| 64K  | 449  | 243.90      |
| 256K | 549  | 372.90      |
| 384K | 649  | 458.90      |



### 10 MEGABYTE HARD DISK For IBM PC

Plug-n-run, ready to go, complete with controller card, data cable, and mounting hardware, totally PC/XT compatible, faster than XT, handles 4 different operating systems, streamer tape back-up available. External model includes cabinet & power supply

|                   | LIST | JADE    |
|-------------------|------|---------|
| 10 mbyte internal | 1795 | 799.95  |
| 10 mbyte external | 2095 | 999.95  |
| 15 mbyte internal | 1995 | 1299.95 |
| 15 mbyte external | 2295 | 1399.95 |
| 22 mbyte internal | 2495 | 1699.95 |
| 22 mbyte external | 2795 | 1799.95 |

### 64K RAM UPGRADE For IBM PC

High speed RAM upgrade kit with FREE parity (error detection) and one year warranty

|                     | LIST | JADE   | PRICE PER 64K |
|---------------------|------|--------|---------------|
| 64K kit for IBM PC  | 90   | 39.95  | 39.95         |
| 128K kit for IBM PC | 180  | 77.90  | 38.95         |
| 192K kit for IBM PC | 270  | 115.85 | 37.95         |
| 256K kit for IBM PC | 360  | 147.80 | 36.95         |
| 384K kit for IBM PC | 540  | 209.70 | 34.95         |

### KEYTRONICS KEYBOARDS

|      | LIST | JADE   |
|------|------|--------|
| 5150 | 209  | 159.95 |
| 5151 | 299  | 199.95 |
| 5152 | 329  | 229.95 |

### HIGH SPEED 8087 APU

List Price 293 SALE PRICE 179.95

### PERSYST BOARDS

|                              | LIST | JADE   |
|------------------------------|------|--------|
| Mono display adapter         | 225  | 189.95 |
| Mono display adp. w/parallel | 250  | 199.95 |
| BoB Hi-res display adp.      | 595  | 469.95 |
| Time Spectrum SB 384 64K     | 395  | 299.95 |

### 320K DISK DRIVES For IBM PC

Double-sided, double-density

|              |        |      |
|--------------|--------|------|
| TANDON 100-2 | 169.00 | each |
| TEAC 55B     | 129.00 | each |

### MICROSOFT For IBM PC

|                  | LIST | JADE   |
|------------------|------|--------|
| MOUSE w/WORD     | 495  | 339.95 |
| MOUSE            | 199  | 129.95 |
| SYSTEM CARD 64K  | 395  | 279.95 |
| SYSTEM CARD 256K | 625  | 429.95 |

### EVEREX For IBM PC

GRAPHICS EDGE with simultaneous RGB color graphics and TTL monochrome video outputs

|                      |             |
|----------------------|-------------|
| List 599.00          | Jade 389.95 |
| 384K Magic card w/OK | 299 199.95  |

### DISKETTES For IBM PC

High quality double-sided, double-density diskettes, certified to be absolutely error free. Box of 10, warranted for one year

|                               | LIST | JADE  |
|-------------------------------|------|-------|
| Box of 10 w/FREE plastic case | 39   | 19.95 |

### QUADRAM For IBM PC

|                    | LIST | JADE   |
|--------------------|------|--------|
| QUADBOARD No RAM   | 269  | 234.95 |
| QUADBOARD 64K      | 395  | 275.95 |
| QUADBOARD 128K     | 495  | 339.95 |
| QUADBOARD 256K     | 595  | 399.95 |
| QUADBOARD 384K     | 795  | 595.95 |
| QUADLINK           | 680  | 449.95 |
| QUAD 512 PLUS 64K  | 325  | 239.95 |
| QUAD 512 PLUS 256K | 550  | 389.95 |
| QUAD 512 PLUS 512K | 895  | 549.95 |
| QUADCOLOR I        | 295  | 209.95 |
| QUADCOLOR II       | 275  | 199.95 |

### AST For IBM PC

|                    | LIST | JADE   |
|--------------------|------|--------|
| SIX PAK PLUS 0K    | N/A  | 249.95 |
| SIX PAK PLUS 64K   | 395  | 269.95 |
| SIX PAK PLUS 256K  | 695  | 489.95 |
| SIX PAK PLUS 384K  | 945  | 589.95 |
| MEGA PLUS 64K      | 395  | 269.95 |
| MEGA PLUS 256K     | 665  | 429.95 |
| MEGA PLUS 512K     | 1095 | 799.95 |
| I/O PLUS           | 165  | 129.95 |
| MP PLUS 64K        | 295  | 199.95 |
| MP PLUS 128K       | 395  | 249.95 |
| MP PLUS 192K       | 495  | 299.95 |
| MP PLUS 256K       | 595  | 349.95 |
| GRAPHPAK           | 790  | 574.95 |
| AST MONOGRAPH PLUS | 595  | 449.95 |

### VIDEO BOARDS IBM

|                        | LIST | JADE   |
|------------------------|------|--------|
| HERCULES COLOR         | 245  | 189.95 |
| HERCULES GRAPHIC       | 499  | 339.95 |
| PLANTRONICS COLOR PLUS | 549  | 379.95 |
| QUADCOLOR I            | 295  | 209.95 |
| QUADCOLOR II           | 275  | 209.95 |
| AMDEK MAI              | 649  | 449.95 |
| AST MONOGRAPH PLUS     | 595  | 449.95 |
| PC PEACOCK             | 299  | 239.95 |
| PC 384K GENIE 0K       | 395  | 249.95 |
| PARADISE GRAPHICS card | 395  | 319.95 |
| PARADISE MODULE A      | 95   | 87.95  |
| PARADISE MODULE B      | 275  | 239.95 |
| VUTEK COLOR PLUS       | 399  | 239.95 |
| EVEREX GRAPHICS EDGE   | 599  | 389.95 |

Continental USA  
800/421-5500

Inside California  
800/262-1710

Los Angeles  
213/973-7707

We accept cash, checks, credit cards, or purchase orders from qualified firms and institutions. Minimum prepaid order \$15.00 California residents and 6 1/2% tax. Export customers outside the U.S. or Canada please add 10% to all prices. Prices and availability subject to change without notice. Shipping and handling charges via UPS Ground 50¢/lb. UPS Air \$1.00/lb. minimum charge \$3.00 Prices quoted are for pre-paid orders only.

## HA YES Smartmodem

Sophisticated direct-connect auto-answer/auto dial modem, touch tone or pulse dialing RS232C interface programmable LIST JADE

|                             |     |        |
|-----------------------------|-----|--------|
| Smartmodem 1200 _____       | 699 | 475.00 |
| 1200B w/o Smartcom II _____ | 539 | 359.95 |
| 1200B for IBM PC _____      | 599 | 399.95 |
| Smartmodem 300 _____        | 289 | 199.00 |
| Hayes Cronograph _____      | 249 | 199.95 |
| Micromodem 100 _____        | 399 | 299.95 |
| Micromodem lie _____        | 299 | 239.95 |
| Smartmodem lic _____        | 339 | 249.95 |
| PLEASE Software _____       | 395 | 299.95 |
| Smartcom II _____           | 149 | 99.95  |

## 1200b PRO MODEMS From Prometheus

|                                  |     |        |
|----------------------------------|-----|--------|
| 1200B for IBM PC _____           | 399 | 299.95 |
| 1200 RS-232 _____                | 495 | 389.95 |
| 1200A for Apple _____            | 449 | 329.95 |
| 1200 Mac Pac for Macintosh _____ | 495 | 389.95 |

## ISOBAR

The ISOBAR looks like a standard multioutlet power strip but contains surge suppression circuitry and built-in noise filters, plus 15amp circuit breaker LIST JADE

|                    |    |       |
|--------------------|----|-------|
| 4 receptacle _____ | 89 | 59.95 |
| 8 receptacle _____ | 99 | 69.95 |

## HI-RES MONITORS

|                             | LIST | JADE   |
|-----------------------------|------|--------|
| AMDEK 300G _____            | 179  | 139.95 |
| AMDEK 300A _____            | 199  | 149.95 |
| AMDEK 310A _____            | 230  | 179.95 |
| AMDEK COLOR 300 _____       | 349  | 249.95 |
| AMDEK COLOR 500 _____       | 525  | 399.95 |
| AMDEK COLOR 600 _____       | 650  | 469.95 |
| AMDEK COLOR 700 _____       | 799  | 589.95 |
| PGS MAX-12 _____            | 269  | 199.95 |
| PGS HX-12 640x240 _____     | 699  | 469.95 |
| PGS SR-12 720x480 _____     | 799  | 649.95 |
| PGS DOUBLER board _____     |      | 229.95 |
| QUADCHROME _____            | 795  | 499.95 |
| COMREX CR6800 750x400 _____ | 649  | 499.95 |
| GORILLA GREEN _____         | 99   | 89.95  |
| GORILLA AMBER _____         | 119  | 99.95  |
| CGS HI-RES AMBER _____      | 199  | 139.95 |
| CGS HI-RES GREEN _____      | 199  | 129.95 |
| CGS COLOR RGB 640x240 _____ | 699  | 349.95 |
| CGS COLOR RGB 720x480 _____ | 799  | 469.95 |

## THE LITTLE BOARD with FREE! CP/M 2.2

Miniature single board CP/M computer designed to mount directly on top of a 5 1/4" floppy disk drive (7.75" x 5.75"). Contains Z 80A, CPU, 64K RAM, Boot Eprom, terminal port, modem port, parallel printer port, floppy disk controller, and CP/M 2.2 included FREE! LIST JADE

|                              |     |        |
|------------------------------|-----|--------|
| Little Board with CP/M _____ | 400 | 329.95 |
| Support package _____        | 50  | 48.95  |
| Serial cable _____           | 13  | 11.95  |
| Diskless monitor Eprom _____ | 30  | 24.95  |
| 190K Disk drive _____        | 249 | 99.95  |
| 350K Disk drive _____        | 399 | 149.95 |

## ULTRA-VIOLET EPROM ERASERS

|                              | LIST | JADE  |
|------------------------------|------|-------|
| Spectronics w/o timer _____  | 99   | 69.95 |
| Spectronics with timer _____ | 139  | 94.95 |
| Logical Devices _____        | 89   | 49.95 |

\*Limited to quantity on hand

# IBM PC \$1595.

256K, dual disk drives, and disk controller

### OPTION #1

256K, two disk drives, disk controller, video card and monitor printer port

**\$1895.**

### OPTION #2

256K, two disk drives, disk controller, PGS color monitor, color graphics card, parallel port, serial port

**\$2395.**

### OPTION #3

256K expandable to 640K, 10 megabyte hard disk, parallel port, serial port, clock/calendar, RAM disk/spooler color card Amdek 300G monitor

**\$2995.**

NEC 8201

## LAP COMPUTER \$389<sup>95</sup>

16K RAM expandable to 64K, built-in BASIC and telecommunications, plus 14 additional programs, parallel and serial ports included, was \$799.00—you save over \$400.00!

|                               |     |         |
|-------------------------------|-----|---------|
| Additional 8K RAM PACKS _____ | 99  | 67.95   |
| 300 Baud Modem _____          | 99  | \$67.95 |
| Color Monitor Adapter _____   | 199 | 167.95  |

## DISK DRIVES

|                                        |             |               |
|----------------------------------------|-------------|---------------|
| <b>SIEMENS FDD 100-8 SS/DD</b>         |             |               |
| List 399 _____                         | 149.00 ea 2 | for 139.00 ea |
| <b>SHUGART SA 801R SS/DD</b>           |             |               |
| List 502 _____                         | 155.00 ea 2 | for 149.00 ea |
| <b>SHUGART SA-851R DS/DD</b>           |             |               |
| List 605 _____                         | 459.00 ea 2 | for 455.00 ea |
| <b>TANDON TM 848-2 DS/DD thin-line</b> |             |               |
| List 599 _____                         | 439.00 ea 2 | for 435.00 ea |
| <b>NEC FD1165 DS/DD thin-line</b>      |             |               |
| List 599 _____                         | 450.00 ea 2 | for 440.00 ea |

Handsome metal cabinet with proportionally balanced air flow system, rugged dual drive power supply, cable kit, power switch, line cord, fuse holder, cooling fan, nevarner rubber feet. All necessary hardware to mount two 8 inch disk drives, power supply, and fan. Does not include signal cable

|                                     |      |        |
|-------------------------------------|------|--------|
| <b>Dual 8" Sub-Assembly Cabinet</b> | LIST | JADE   |
| Bare cabinet _____                  | 75   | 49.95  |
| Cabinet Kit _____                   | 299  | 199.95 |
| A & T _____                         | 349  | 249.95 |

### 8" Sub-System—Single sided, double density

|                                   |      |        |
|-----------------------------------|------|--------|
| Kit w/2 Siemens FD100-8Ds _____   | 950  | 479.00 |
| A & T w/2 Siemens FD100-8Ds _____ | 995  | 529.00 |
| Kit w/2 Shugart SA-801Rs _____    | 1195 | 599.00 |
| A & T w/2 Shugart SA-801Rs _____  | 1295 | 699.00 |

### 8" Sub-Systems—Double sided, double density

|                                  |      |         |
|----------------------------------|------|---------|
| Kit w/2 Shugart SA-851Rs _____   | 1495 | 1199.00 |
| A & T w/2 Shugart SA-851Rs _____ | 1595 | 1219.00 |

### Dual 8" Slimline Cabinet

|                              |      |         |
|------------------------------|------|---------|
| Bare Cabinet _____           | 75   | 59.95   |
| A & T w/o drives _____       | 249  | 164.95  |
| A & T w/2 DS/DD drives _____ | 1495 | 1099.00 |

*System*

**SHUGART SA 801R\***  
Single sided, double density 8"  
as low as **\$149.**

**A P P L E**

## APPLE ACCESSORIES ON SALE!

|                                | LIST | JADE    |
|--------------------------------|------|---------|
| Full Height Disk Drive _____   | 299  | 179.95  |
| Half Height Disk Drive _____   | 249  | 169.95  |
| Controller _____               | 100  | 79.95   |
| 8 inch 2 Mbyte system _____    | 2495 | 1395.00 |
| CP/M 3.0 Card _____            | 399  | 199.95  |
| ALS Z Engine _____             | 199  | 149.95  |
| 16K RAM Card _____             | 99   | 39.95   |
| Best 80 Column Card _____      | 219  | 139.95  |
| Printer card & Cable _____     | 109  | 49.95   |
| Fan w/surge protect _____      | 99   | 59.95   |
| Koala Pad _____                | 125  | 89.95   |
| Grappler Plus _____            | 175  | 119.95  |
| Buffered Grappler/16K _____    | 245  | 175.95  |
| Buffered Grappler/64K _____    | 345  | 239.95  |
| Disk Drive for Apple IIc _____ |      | 199.95  |

## S-100 MAINFRAME

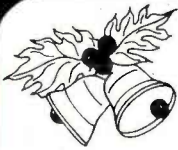
|                              |     |        |
|------------------------------|-----|--------|
| 2 8 inch cut-outs _____      |     |        |
| 6 SLOT w/power supply _____  | 699 | 439.95 |
| 12 SLOT w/power supply _____ | 799 | 499.95 |

**JADE**  
Computer Products

4901 West Rosecrans Ave, Hawthorne, California 90250

## Christmas Specials

SEND \$2.00 FOR OUR NEW 116 PAGE CATALOG & RECEIVE A COUPON WORTH 5% OFF YOUR 1st ORDER BY DEC. 31, 1984



### CompuPro®

|                             |         |
|-----------------------------|---------|
| SYSTEM 816/A SINGLE-USER    | \$4,199 |
| SYSTEM 816/B TWO-USER       | \$4,899 |
| SYSTEM 816/C MULTI-USER     | \$6,299 |
| SYSTEM 816/D 8086-10MHz     | \$9,299 |
| SYSTEM 816/Dd W/O M-DRIVE/H | \$5,699 |
| SYSTEM 816/E 68000-10MHz    | \$7,099 |
| SYSTEM 816/Ee W/O M-DRIVE/H | \$5,099 |

FOR 40Mb H.D. OPTION ADD \$1,900

TO HAVE 2ND 8" FLPY W/ H.D. \$500

**STAND ALONE 40Mb HARD DISK SUBSYSTEM: \$2,275**

**WITH CP/M 80&86 \$2,325**

|                             |         |
|-----------------------------|---------|
| SYSTEM 816/10 4-USERS       | \$3,495 |
| SYSTEM 816/10 H20 20Mb H.D. | \$5,295 |
| SYSTEM 816/10 H40 40Mb H.D. | \$5,595 |

SEE ALLOY FOR TAPE BACK-UP

|                                   |         |
|-----------------------------------|---------|
| CPU 286 RUNS CPM 86 5X FASTER     |         |
| CPU 286 A&T W/ 287 MATH CHIP      | \$1,513 |
| CPU 286 6MHz CSC W/ 287 MATH CHIP | \$1,649 |
| CPU Z 6MHz A&T                    | \$229   |
| CPU 8085/88 A&T                   | \$349   |
| HUDSON 8087 PIGGY BACK FOR ABOVE  | \$446   |

|                          |       |
|--------------------------|-------|
| CPU 8086 10MHz A&T       | \$569 |
| CPU 86/87 5MHz A&T       | \$739 |
| CPU 68K W/MMU OPTION CSC | \$795 |
| CPU 68K 10MHz CSC        | \$600 |

|                                  |         |
|----------------------------------|---------|
| RAM 22 256K STATIC 8&16 A&T      | \$1,075 |
| RAM 23 - 64K                     | \$329   |
| RAM 23 - 128K                    | \$595   |
| M-DRIVE/H 512K RAM-DISK          | \$895   |
| INTERFACER 1 - 2 SERIAL PORTS    | \$189   |
| INTERFACER 3-8 SERIAL A&T        | \$489   |
| INTERFACER 4-3 SERIAL/2 PARALLEL | \$319   |
| SYSTEM SUPPORT 1 A&T             | \$319   |
| DISK 1A 5 1/4" & 8" FLPY CTRL    | \$489   |
| DISK 2 A&T 8" H.D. CNTRL SET     | \$559   |

|                               |         |
|-------------------------------|---------|
| FUJITSU 2302B ADD-ON SYS.     | \$2,695 |
| DISK 3 A&T 5 1/4" H.D. CNTRL. |         |
| W/ CP/M 80&86                 | \$559   |

|                                        |       |
|----------------------------------------|-------|
| <b>KONAN</b>                           |       |
| SMC-200 DUAL DRV. SMD VF CTRL 8D.      | \$500 |
| DGC-100 CTRL 8D/5 1/4" H.D.. ST-506 VF | \$325 |

### COLUMBIA

1600-VP PORTABLE  
W/CURRENT S.W. PKG AND  
DUAL DS DD DRVS. \$1,695

*Atrix* \$1,495

DUAL SSDD 5 1/4 FLPY, 2S, 1P, IEEE488, MX80 PRT, REAL TIME CLOCK, 2 MODEMS, 8" FLPY INTERFACE, CP/M80, M8ASIC, C8ASIC, COMMUN. PERFECT WRITER, SPELLER, CALC, FILER & FANCY FONT IN 33LB. PORTABLE

### MORROW

**PIVOT** 9 LBS. DUAL DRVS. MSDOS, MODEM & MORE CALL

**MD3 SYSTEM W/ TERMINAL & EPSON RX80FT PRT.** \$1,999

**MD-1E PLUS** W/2 DSDD DRVS. AND ONLY CP/M 2.2, NEW WORD, & CO-PILOT MENU SYSTEM \$1,059

**MDP-3 PORT.** SAME AS MD3 EXCEPT WITH 5X7" SCREEN & EPSON RX80FT PRT. \$1,329

**MD5-E** W/ 1 FLPY & 5Mb H.D. \$1,825

**MD11 SYSTEM** W/11Mb H.D., 128K, 1DSDD DRV., TERMINAL, CP/M 3.0, ALL MD3 SOFTWARE EPSON FX80 160 CPS DOT MATRIX OR BROTHER HR-15 13 CPS DAISY PRINTER \$2,995



PROMBLASTER 2 W/EXTEND MODULE PROGRAMS 27256 EPROMS @ 45 SEC. \$398

KLUGE CARD KIT INCLUDES ALL START-UP HARDWARE \$129

OCTAFLOPPY W/CP/M OBJECT & SOURCE \$379

California Computer Systems

|                                      |       |
|--------------------------------------|-------|
| Z80 CPU W/SERIAL PORT #2010          | \$199 |
| 5 1/4" & 8" FLPY. CTRL. W/CP/M #2422 | \$329 |
| 64K DRAM #2065                       | \$195 |

### Electralogics

QUASI-DISK 512K RAM-DISK W/ON-BD. DRV.

STATUS LED'S WRITE PROTECT, DMA

E-Z INSTALL W/SAMPLE CP/M BIOS \$795

512K PIGGY-BACK EXPANSION \$595

BATTERY BACK-UP W/PWR. SUPPLY \$169

### SEATTLE COMPUTER

|                        |       |
|------------------------|-------|
| 8086 CPU 10MHz         | \$345 |
| 8086 CPU 8MHz          | \$185 |
| CPU SUPPORT BOARD      | \$280 |
| 2 PORT SERIAL BOARD    | \$159 |
| 64K STATIC RAM-85m SEC | \$369 |



**DUPLEX 816** 8MHz 80186 AND Z80H, 2 SERIAL, 16Mb MMU, 5 & 8 FLPY, DMA CTRL., WITH CONCURRENT CP/M86 SINGLE-USER \$1,400

W/ CONCURRENT CP/M86 MULTI-USER \$1,675



SBC8/16 DUAL CPU EXECUTES Z80 & 8088 CODE, 5 1/4" & 8" FLPY CTRL, 2S, 8 VECTORED & REAL TIME INTERRUPTS \$689  
EXPANDORAM V 256K \$652

### SOFTWARE

SOFTWARE IS NOT RETURNABLE

|                                               |       |
|-----------------------------------------------|-------|
| BDS "C" COMPILER                              | \$99  |
| C86 C COMPILER                                | \$299 |
| COMPUVIEW TRANSYS MS-DOS CP/M86 FILE TRANSFER | \$159 |
| COMPUVIEW VEDIT-86-\$156 MS-DOS-\$120         |       |
| KNOWLEDGEMAN-86 8" DBMS                       | \$345 |
| K-PAINT                                       | \$75  |

|                            |       |
|----------------------------|-------|
| SORCIM SUPER CALC-3 18M-PC | \$245 |
| PERSONAL PEARL DBMS (PC)   | \$215 |
| ACCOUNTING PEARL (PC)      | \$635 |

**DATAFlex MULTI-USER**  
FILE & RECORD LOCKING DBMS  
AVAIL. FOR MOST O/S FORMATS CALL

**NEW WORD WORD PROCESSOR**  
WORDSTAR COMPATIBLE BUT  
EASIER W/ MERGE PRINT IN  
SINGLE OR MULTI-USER CP/M 80  
OR 86 & MS-DOS FORMATS \$169

|                         |       |
|-------------------------|-------|
| ASHTON-TATE dBASE-II    | \$375 |
| FOX & GELLER dGRAPH     | \$195 |
| FOX & GELLER QUICK CODE | \$195 |

**LATTICE C (CP/M86 & MS/PC-DOS) CP/M86 8"** \$315  
**C FOOD SMORGASBORD** OF ROUTINES \$99

|                              |       |
|------------------------------|-------|
| HALO (1 LANGUAGE) GRAPHICS   |       |
| SUB ROUTINES FOR PC-DOS ONLY | \$99  |
| PLINK PC/86 LINKAGE EDITOR   |       |
| FOR OVERLAY SCHEMES          | \$275 |
| PANEL PC/86/80 CUSTOMIZED    |       |
| TERMINAL DISPLAYS            | \$239 |

|                  |       |
|------------------|-------|
| <b>MICROPRO:</b> |       |
| WORDSTAR PROPAK  | \$395 |
| REPORTSTAR       | \$195 |
| DATASTAR         | \$195 |
| CORRECTSTAR/PC   | \$125 |
| MAILMERGE        | \$175 |
| CALCSTAR         | \$125 |
| SUPERSOFT        | \$175 |

### DIGITAL RESEARCH

|                          |                       |
|--------------------------|-----------------------|
| "C" LANGUAGE COMPILER-86 | \$229                 |
| CP/M PLUS (3.0)          | \$245                 |
| ACCESS MNGR.             | 80 = \$195 86 = \$260 |
| DISPLAY MNGR.            | 80 = \$260 86 = \$325 |
| SPEED PROG. PKG.         | 80 = \$130 86 = \$163 |
| GSX                      | 80 = \$55 86 = \$65   |
| C BASIC COMPILER         | 80 = \$325 86 = \$390 |
| PASCAL MT+               | 80 = \$225 86 = \$390 |
| PL/1 W/ UTILITIES        | 80 = \$359 86 = \$488 |
| ASMBLR + TOOLS           | 80 = \$130 86 = \$130 |

**FLUKE** FLUKE 77 DVO METER \$119  
0.3% DC ACCURACY

*Vobrax* PERSONAL SPEECH SYSTEM \$285

**Giltronix 500 SERIES**  
2-WAY RS232 24 WIRE \$89  
2-WAY CENTRONICS \$127  
2-WAY IBM-PC PARALLEL \$102



S-100 DIV./696 CORP.  
14455 NORTH 79TH ST.  
SCOTTSDALE, AZ 85260

**FULL DEALER SUPPORT  
VISIT OUR SHOWROOM**

# WORLD'S LARGEST SELECTION OF S-100 PRODUCTS

# S-100™



HAYES COMMAND COMPATIBLE WITH HELP MENU WITH MACPAC \$349 \$389



PASSWORD 1200 AUTO ANS./DIAL \$295  
 AUTO DIAL 212A (HAYES COMPAT.) \$395  
 IBM PERSONAL MODEM W/SOFTWARE \$289  
 IBM PERSONAL MODEM W/ 64K, PRT PORT, CLOCK, S.W. \$469  
 IBM PERSONAL MODEM W/ 256K, ETC. \$759  
 TELPAC MSDOS/ CP/M 80 \$79  
**HAYES 1200 MODEM \$489**

## TERMINALS

LIBERTY FREEDOM 100 \$396  
 LIBERTY FREEDOM 110 \$476  
 LIBERTY FREEDOM 200 \$639  
 LIBERTY FREEDOM 220 \$619  
**QUME QVT 102G \$449**  
**WYSE-50 14" 132 COLUMN \$519**

## MONITORS

AMDEK 300 GREEN MONITOR \$129  
 AMDEK 300A AMBER MONITOR \$145  
 AMDEK 310 IBM AMBER \$159  
 PRINCETON GRAPHICS HX-12 \$469  
 TAXAN RGB VISION 420 \$469  
 USI 12" HI-RES AMBER \$89  
 ZENITH ZVM 122A AMBER NON-GLARE \$85  
 ZENITH ZVM 123A GREEN NON-GLARE \$85

## PRINTERS

**BROTHER DAISYWHEEL**  
 HR-15 SER. OR PAR. 13 CPS \$375  
 HR-25 SER. OR PAR. 23 CPS \$649  
 HR-35 SER. OR PAR. 36 CPS \$849  
**BROTHER DOT MATRIX**  
 2024L 24 PIN HEAD, GRAPHICS, 80 CPS L.Q. & 160 CPS DRAFT \$925  
**DAISYWRITER 2000 40 CPS DAISY** \$795  
 CUT SHEET FEEDER \$495  
**DIABLO 620API 21 CPS DAISY** \$725  
**DIABLO 630 API 40 CPS DAISY** \$1,575  
**DIABLO 630 ECS-API**  
 EXT. CHARACT. \$1,695  
**DIABLO 630 ECS-IBM** \$1,695  
**EPSON ALL MODELS/ACCESS.** CALL  
**OKIDATA ALL MODELS/ACCESS.** CALL  
**TALLY 'SPIRIT' 80 CPS N.L.Q.** \$275  
**TALLY 'SPIRIT' 2K SERIAL I/F** \$70  
**TALLY MT160L 160 CPS S-OR-P** \$595  
**TEXAS INST. T1855 W/TRACTOR** \$798

## INDUSTRIAL QUALITY CABINETS

DUAL 1/2 HI HORIZ. 5 1/4" FLPY \$75  
 SINGLE STD. HI HORIZ. 5 1/4" FLPY \$59  
 5 1/4" H.D. CABINET W/ P.S. & FAN \$225  
 DUAL 8" 1/2 HI FLPY HORIZONTAL OR SINGLE STD. 8" FLPY \$215

## PARA DYNAMICS

3820S PRONTO W/ SEQUENCER \$1,159  
**2810 MINI-PRONTO 10 SLOT 2X8 FLPY BAYS \$749**  
 3510D 10 SLOT W/ 2X6 1/2" FLPY BAYS \$669  
 2200D DUAL STD. 8" DRV. CAB. \$295

## DISK DRIVES

CALL FOR LOW, LOW PRICES ON SUBSYSTEMS

**Tandon 100-2 5 1/4" DSDD \$159**

**Qume 1 YEAR WARRANTY**

142 DSDD 5 1/4" HI \$149  
 242 DSDD 8" HI \$359  
 842 OSDD 8" STD HI \$449



**4851 1/2 HT 5 1/4" 48TPI \$159**  
**4853 1/2 HT 5 1/4" 96TPI \$179**  
**M2B94 STD 8" DSDD \$399**  
**M2B96 1/2 HI 8" OSDD \$399**

## SANYO

5 1/4" 1/2 HI FLPY. DIRECT DRV. 1 YR. WARR. \$116

## WE SERVICE FLOPPY DRIVES

5 1/4" + PARTS + SHIPPING \$35  
 8" + PARTS + SHIPPING \$50



**IDXCS-100T TAPE BACK-UP FOR S-100 BUS COMPUTERS W/HARD DISK 17.6Mb on 555' CARTRIDGE TAPE INCLO'S ALL SOFTWARE, CTRL. BD., CABINET, DRIVE, AND CABLES \$1,949**

**IDS-412 SCSI/SASI 17.6Mb CARTRIDGE TAPE BACK-UP EXCELLENT FOR COMPUPRO 816/10 \$1,949**

**ITS-100 + 42Mb 9-TRACK TAPE SUBSYSTEM \$5,795**

**PCQI TAPE IBM-PC BACK-UP TO 60Mb IN 10 MIN. OR LESS \$1,995**

**PC-9 TRACK SUBSYSTEM FOR BACK-UP & MAINFRAME DATA TRANSFER \$5,795**



**ARAPAHOE 7110 25Mb FIXED & REMOVABLE 8" H.D. W/35 mSEC. AVG. ACC. FULL CDC LARK COMPATIBLE \$3,995**  
 OPTIONAL P/S \$285  
 25Mb 8" DYSAN CARTRIDGE \$140

## ST506 5 1/4 INCH BARE HARD DRIVES



SA712 1/2 HT. 10Mb \$498



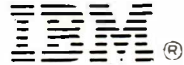
RO203 20Mb \$739  
 RO204 27Mb \$888  
 RO203E 40Mb \$1,250  
 RO204E 53Mb \$1,395



Q540 42.66Mb 45m SEC ACCESS \$1,475



XT-1065 66.99Mb 30m SEC ACCESS \$1,995  
 XT-1106 106.27Mb 30m SEC ACCESS \$2,996  
 XT-1140 143.65Mb 30m SEC ACCESS \$3,749



**ADAPTEC AC8 2002 5 1/4" H.D. CTRL. 64K RAM 4164-150 NS 9 CHIPS/SET \$239 \$35**

## HARD DISK SUBSYSTEMS:

10Mb "PC-INSIDER" \$769  
 21Mb "PC-OUTSIDER" \$1,375  
 33.3Mb "PC-OUTSIDER" \$1,775  
 44Mb "PC-OUTSIDER" \$1,995  
 56Mb "PC-OUTSIDER" \$2,695  
 90Mb "PC-OUTSIDER" \$3,695  
 120Mb "PC-OUTSIDER" \$4,495



**RIO PLUS: RS232 S, P I/O, G, CLK/ CAL. 64K & PC ACCEL. STB-RIO+64 \$267**  
**GRAPHIX PLUS II: RGB & MONOCHROME PRINTER & LT. PEN PORTS \$326**

**SUPER RIO: RAM-IO MULTI-FUNC. W/ 64K (UPGRO TO 768K), 2S, 1P (IBM COMPAT.) 1G, CLK/ CAL. \$275**  
**STB-SRIO-64 \$275**  
**STB-PB-64 PIGGYBK (EXPAND. TO 612K) \$165**  
**MEMORY EXPAN. BD: 64K (EXPAND TO 384K) STB-1-64 \$195**

## IBM-AT COMPATIBLE BDS:

QUARTER BYTE 64K \$165  
**RIO PLUS II 64K TO 384K, 1S (2ND S OPTIONAL), 1P, CLOCK, GAME, PC ACCELERATOR \$259**



**CAPTAIN 64K, IS, IP, CLK/CAL \$269**  
**CAPTAIN 128K \$289**  
**CAPTAIN 256K \$389**  
**CAPTAIN 384K, IS, IP, CLK/CAL \$469**  
**WAVE 'XT' MEMORY 80 64K \$210**  
**DYNAMIC MEMORY-128K \$219**  
**DYNAMIC MEMORY-256K \$289**  
**GRAPHICS MASTER - HIGH RES. COL. (640X400), MONO (720X700), RGB, NTSC COMPOSITE & IBM MONO. MON., 128K, LT. PEN INTERFACE \$439**  
**jrCAPTAIN 64K P. C. 1 YR BATT LIFE \$266**  
**jrWAVE 64K \$239**  
**jrCADET 64K ADD ON PIGGYBACK BO. FOR jr CAPTAIN/WAVE \$169**  
**jr 2ND MATE 64K, P. C. 1YR BATT LIFE \$119**

## Mac Drive

73010 5Mb REMOVABLE H.D. \$1,459  
 73020 2X 5Mb REMOVABLE H.D. \$2,429  
 73200 10Mb FIXED H.D. \$1,459  
 73210 10Mb FIXED W/ 5Mb REMOVABLE CARTRIDGE \$2,429



**MICROSOFT WORD W/MAIL LIST & MULTI-PLAN INCLUDED W/ALL ZENITH CPU'S UNTIL JAN. 85. Z-150 PC THE MOST COMPATIBLE PC \$2,095**  
**Z-150 PC (W/10.6Mb H.D.) \$3,369**  
**Z-160 PC PORTABLE \$2,249**

**STANDARD-NET FOR IBM & Z150 PC'S INCLD'S BD., SOFTWARE & INSTALL GUIDE \$599**

**TTX UNIVERSAL 64K BUFFER "IN" S OR P \$209**  
**"OUT" S OR P \$209**

Circle 329 for Dealer inquiries.  
 Circle 330 for End-User inquiries.

**SUBJECT TO AVAILABLE QUANTITIES**  
**HRS: 8:30AM - 5:00PM M-F**



**PRICES ARE CASH PREPAID & MAY CHANGE WITHOUT NOTICE. SHIPPING, INS., HANDLING EXTRA**

# APPLE & IBM ACCESSORIES

## VIEWMAX-80 149.95

80-Column card for Apple II series

- Video Soft Switch
- Inverse Video
- VIDEA's Videoterm compatible



## VIEWMAX-80e 119.95

80-Column extended video card for Apple IIe

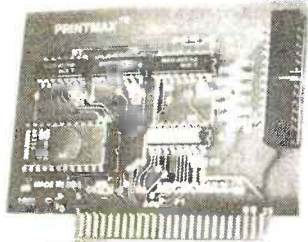
- 64K RAM, expandable to 128K
- Double High-resolution circuit
- Compatible with Pascal & CP/M



## PRINTMAX 59.95

Parallel printer card, Apple II series

- Centronics compatible
- Variable print widths
- Up to 5000 characters/second



## Z-MAX-80 89.00

Z-80 card for CP/M on Apple II series

- Softcard and Z-Card compatible
- Full Interrupt and DMA operation

## GRAPHMAX 99.95

Dual High-Res graphics printer card for Apple II series

- Grappler+ compatible
- Color and Zoom magnification
- Inverse graphics
- 90-degree Rotation
- Pascal and CP/M compatible

## MULTIVIEW 80/160 249.00

80-160 columns with any monitor!

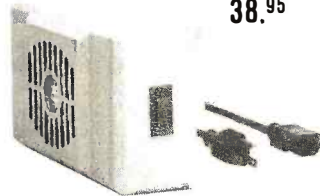
- Screens: 80x24, 80x32, 80x48, 96x24, 132x24, 132x30, 160x24
- On-screen BOLD and Underline
- Reverse scrolling
- Easy-to-read Wide-angle mode
- Apple II and IIe compatible
- Prompt lines
- Upper & lowercase letters



- 80 Column Apple II+ ... 149.95
- 80 Column Apple IIe ... 129.95
- Z80 Apple II+ ..... 89.00
- Z80 Apple IIe ..... 89.00
- 16K Card ..... 39.95
- Cooling Fan ..... 38.95
- Power Supply ..... 74.95
- Joystick ..... 29.95
- RF Modulator ..... 13.95
- Disk Drive ..... 199.00
- Controller Card ..... 59.95
- Paddles ..... 7.95

## COOLING FAN

38.95



## APPLE COMPATIBLE POWER SUPPLY

74.95



- Powers Apple type systems
- +5V @ 5A +12V @ 3A
- -5V @ .5A -12V @ .5A
- includes instructions

## 16K RAM Card - Apple II+

- 2-Year Warranty



Assembled & Tested .... 39.95

## APPLE COMPATIBLE DISK DRIVE



199.00

- Shugart mechanism, made in U.S.A.
- Directly replaces Apple Disk II
- Fully compatible with Apple Controller or other Apple compatible controllers.
- One Year Warranty

FULL or 1/2-Height

## APPLE or IBM JOYSTICK

\$29.95

Compatible for either:

APPLE II and APPLE IIe  
OR

IBM-PC, JR., & IBM-XT  
MULTIFUNCTION CARD



- 64K to 384K RAM
- Parallel Port
- Serial Port
- Clock Calendar
- Software Included
- 1-Year Warranty

\$249.95

## MEMORY CARD



- Expandable to 512K
- Fully compatible with IBM software
- Fully compatible w/IBM diagnostic utilities
- Serial Port Available
- 1-Year Warranty

\$199.95

—VUTEK—

Color • Parallel • Serial  
Card



- Full bit-mapped Color Graphics
- Printer Port (LPT1, LPT2, LPT3)
- Serial Port (Com1, Com2)
- IBM PC, XT and Portable compatible
- Full software compatibility
- Compatible with Lotus 1-2-3, Multi-Plan and Flight Simulator
- Full 2-Year Warranty Parts and Labor

\$299.00

## DISK DRIVES

- Tandon TR100-2 DS/DD 199.00
- Teac FD-55B DS/DD 159.00

## MEMORY EXPANSION KIT



4164 150ns  
9 for \$45.00

## DISKETTES

5 1/4"

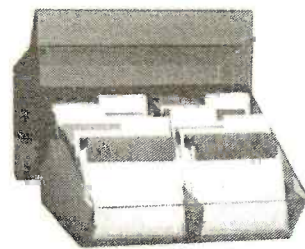
— ATHANA —

- SS/SD ..... 15.90
- SS/DD ..... 16.90
- DS/DD ..... 22.90

SOFT SECTOR with HUB RING

BULK 5 1/4" DISKETTES  
(NO LABEL)

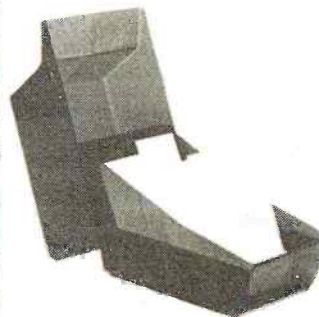
- SS/DD ... 10 for 14.90
- 100 up ..... 139.00  
(Lifetime Warranty)



## The Flip Sort PLUS™

The new Flip Sort PLUS™ adds new dimensions to storage. Its smoked acrylic elegance holds over 100 diskettes with all the features you expect from the Flip Sort Family—

\$24.95



## The FLIP SORT™

The new Flip Sort™ has all the fine qualities of the original with some added benefits: a new design and 50% greater capacity. Holds 75 diskettes and the price is now lower than ever—

\$16.95

ORDER TOLL FREE

(800) 538-8800

(CALIFORNIA RESIDENTS)

(800) 848-8008

**DoKay**

# EDUCATIONAL ELECTRONIC ROBOT KITS

## A Great Gift Idea . . .

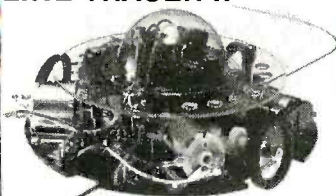
### PEPPY



PEPPY's 2-way sensor is susceptible to noise and solid objects in its path. When the front sensor contacts a wall or other obstacle or hears a loud noise, such as a hand-clap, it automatically turns to the left. Uses 2 AA and 1 9V battery (not included).

**MV-916 \$24.95**

### LINE TRACER II



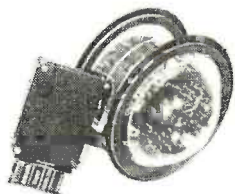
Uses an infra-red light sensor to automatically follow a black line (min. 10mm wide) drawn on white paperboard. (Minimum turn radius 15cm.) Uses 2 AA and 1 9V battery (not included).

**MV-913 \$39.95**

The **MOVIT** line is a series of computerized (and logic controlled) battery robot kits that can teach the basic principles of robotic sensing and locomotion. Each of the kits features pre-assembled pc boards, hardware and mechanical drive systems that can be handled by anyone. Only basic hand tools are required for assembly. You can experience and learn any one or all of the following features: remote control, sound sensor, infra-red sensor, wired control or programmable memory.

**You'll want to meet all of these entertaining, affordable, robots!**

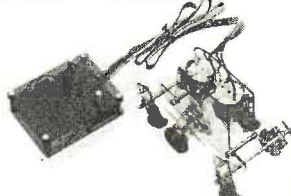
### CIRCULAR



Two large wheels roll this new robot left or right, forward or round & round; controlled by hand-held remote control box. Uses 3 AA and 2 9V batteries (not included).

**MV-935 \$69.95**

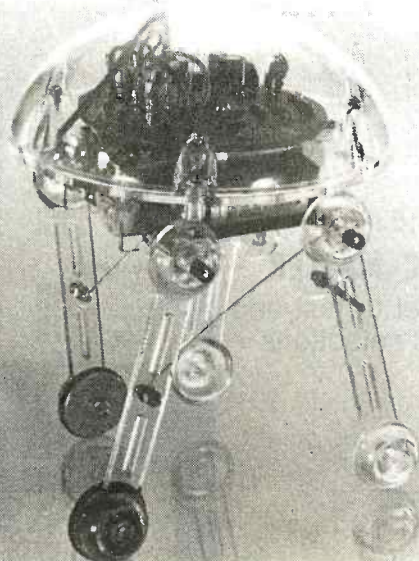
### MR. BOOTSMAN



Two speeds with six legs! Walks or runs forwards, backwards, left, right, even full circle turns. Wired control. Uses 2 AA batteries (not included).

**MV-931 \$32.95**

### MEDUSA Walking robot with Sound Sensor!



Medusa's electronic brain registers your command and starts to hobble on its 4 legs, stopping after a pre-set time. Sensor includes condenser microphone. Uses 2 N size 1.5 V (E90, MN9100) batteries (not incl.)

**MV-939 Sound Sensor ..... \$29.95**

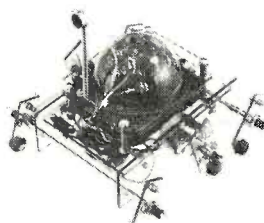
### PIPER-MOUSE



Controlled by a Supersonic sound sensor and a 1-channel electronic circuit. Use the whistle in this kit and Piper-Mouse will follow your commands, immediately turning left, stopping, turning right, advancing and stop. Uses 2 AA and 1 9V battery (not included).

**MV-915 \$44.95**

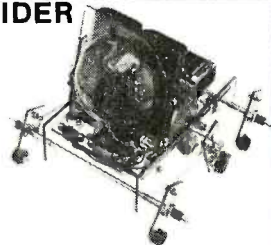
### TURN BACKER



When its about to hit a wall, just yell "Look Out!" and the robot automatically turns left. Requires 4 "AA" batteries (not included).

**MV-911 \$39.95**

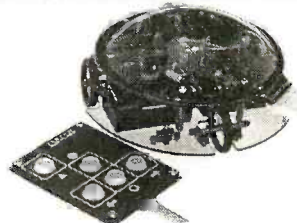
### AVOIDER



Emits an infra-red beam to detect obstacles in front. Knows how to avoid hitting walls! Uses 2 AA and 1 9V battery (not included).

**MV-912 \$44.95**

### MEMOCON CRAWLER



Runs through the program you input on the included keyboard: forward, turn right or left, pause, sound buzzer or turn light beam on. Uses 2 AA and 1 9V battery (not included).

**MV-918 \$74.95**

**TERMS:** Minimum order \$10.00. For shipping and handling, include \$2.50 for UPS ground; or \$3.50 for UPS Blue (air). For each additional air pound, add \$1 for UPS Blue shipping and handling. California residents must include 6% sales tax; Bay area and LA residents include 6 1/2% sales tax. Prices are subject to change without notice. We are not responsible for typographical errors. We reserve the right to limit quantities and to substitute manufacturers. All merchandise subject to prior sale.

**CALL for VOLUME Quotes**

**HOURS:** Mon. - Fri. 7:30 to 5:00  
Saturdays 10:00 to 3:00

VISIT OUR RETAIL STORE

2100 De La Cruz Blvd.  
Santa Clara, CA 95050  
(408) 988-0697

ALL MERCHANDISE IS  
100% GUARANTEED

Telex: 756440

**Do Kay**

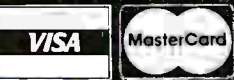
# DoKay

COMPUTER PRODUCTS, Inc.

ORDER TOLL FREE

(800) 538-8800

(CALIFORNIA RESIDENTS)  
(800) 848-8008



## STATIC RAMS

|              |                              |       |
|--------------|------------------------------|-------|
| 2101         | 266 x 4 (450ns)              | 1.90  |
| 5101         | 256 x 4 (450ns) (cmos)       | 3.90  |
| 2102-1       | 1024 x 1 (450ns)             | .88   |
| 2102L-4      | 1024 x 1 (450ns) (LP)        | .98   |
| 2102L-2      | 1024 x 1 (250ns) (LP)        | 1.45  |
| 2111         | 256 x 4 (450ns)              | 2.45  |
| 2112         | 256 x 4 (450ns)              | 2.95  |
| 2114         | 1024 x 4 (450ns)             | .99   |
| 2114-25      | 1024 x 4 (250ns)             | 1.10  |
| 2114L-4      | 1024 x 4 (450ns) (LP)        | 1.20  |
| 2114L-3      | 1024 x 4 (300ns) (LP)        | 1.30  |
| 2114L-2      | 1024 x 4 (200ns) (LP)        | 1.40  |
| 2125         | 1024 x 1                     | 2.49  |
| 2147         | 4096 x 1 (55ns)              | 4.90  |
| TM84044-4    | 4096 x 1 (450ns)             | 3.45  |
| TM84044-3    | 4096 x 1 (300ns)             | 3.95  |
| TM84044-2    | 4096 x 1 (200ns)             | 4.45  |
| MK4118       | 1024 x 8 (250ns)             | 9.90  |
| TM2M2016-200 | 2048 x 8 (200ns)             | 4.10  |
| TM2M2016-150 | 2048 x 8 (150ns)             | 4.90  |
| TM2M2016-100 | 2048 x 8 (100ns)             | 6.10  |
| HMB118-4     | 2048 x 8 (250ns) (cmos)      | 4.70  |
| HMB118-3     | 2048 x 8 (150ns) (cmos)      | 4.90  |
| HMB118-2     | 2048 x 8 (120ns) (cmos)      | 8.90  |
| HMB118L-4    | 2048 x 8 (250ns) (cmos)      | 8.90  |
| HMB118L-3    | 2048 x 8 (150ns) (cmos) (LP) | 8.90  |
| HMB118L-2    | 2048 x 8 (120ns) (cmos) (LP) | 9.95  |
| Z-6132       | 4096 x 8 (300ns) (Qcstr)     | 33.95 |
| HMB264P-15   | 8192 x 8 (150ns) (cmos)      | 38.95 |
| HMB264LP-15  | 8192 x 8 (150ns) (cmos)      | 48.95 |

LP = Low Power Qcstr = Qcstr-Static

## DYNAMIC RAMS

|          |                        |      |
|----------|------------------------|------|
| TM84027  | 4096 x 1 (250ns)       | 1.95 |
| UP0411   | 4096 x 1 (300ns)       | 1.95 |
| MM5280   | 4096 x 1 (300ns)       | 1.95 |
| MK4106   | 8192 x 1 (200ns)       | 1.90 |
| MM5296   | 8192 x 1 (250ns)       | 1.60 |
| 4116-200 | 18384 x 1 (200ns)      | .79  |
| 4116-150 | 18384 x 1 (150ns)      | 1.20 |
| 2118     | 18384 x 1 (150ns) (5v) | 4.90 |
| 4164-250 | 85536 x 1 (250ns)      | 4.45 |
| 4164-200 | 85536 x 1 (200ns) (5v) | 5.00 |
| 4164-150 | 85536 x 1 (150ns) (5v) | 5.00 |

5V = Single 5 Volt Supply

## EPROMS

|          |                                |       |
|----------|--------------------------------|-------|
| 1702     | 256 x 8 (1us)                  | 4.45  |
| 2708     | 1024 x 8 (450ns)               | 2.49  |
| 2758     | 1024 x 8 (450ns) (5v)          | 5.90  |
| 2718     | 2048 x 8 (450ns) (5v)          | 2.95  |
| 2716-1   | 2048 x 8 (350ns) (5v)          | 5.90  |
| TM82518  | 2048 x 8 (450ns) (5v)          | 5.45  |
| TM82716  | 2048 x 8 (450ns)               | 8.95  |
| TM82532  | 4096 x 8 (450ns) (5v)          | 5.90  |
| 2732     | 4096 x 8 (450ns) (5v)          | 4.45  |
| 2732-250 | 4096 x 8 (250ns) (5v)          | 8.90  |
| 2732-200 | 4096 x 8 (200ns) (5v)          | 10.95 |
| 2764     | 8192 x 8 (450ns) (5v)          | 8.45  |
| 2764-250 | 8192 x 8 (250ns) (5v)          | 7.45  |
| 2764-200 | 8192 x 1 (200ns) (5v)          | 18.45 |
| TM82564  | 8192 x 8 (450ns) (5v)          | 18.95 |
| MC88784  | 8192 x 8 (450ns) (5v) (24 pin) | 38.95 |
| 27128    | 18384 x 8 Cell                 | 24.95 |

5v = Single 5 Volt Supply

## 74LS00

|         |      |         |      |          |       |
|---------|------|---------|------|----------|-------|
| 74LS00  | .23  | 74LS125 | .48  | 74LS280  | .58   |
| 74LS01  | .24  | 74LS128 | .48  | 74LS266  | .54   |
| 74LS02  | .24  | 74LS132 | .58  | 74LS273  | 1.45  |
| 74LS03  | .24  | 74LS133 | .58  | 74LS275  | 3.30  |
| 74LS04  | .23  | 74LS136 | .38  | 74LS279  | .48   |
| 74LS05  | .24  | 74LS137 | .98  | 74LS280  | 1.95  |
| 74LS08  | .27  | 74LS138 | .54  | 74LS283  | .98   |
| 74LS09  | .28  | 74LS139 | .54  | 74LS290  | .88   |
| 74LS10  | .24  | 74LS145 | 1.15 | 74LS293  | .88   |
| 74LS11  | .34  | 74LS147 | 2.45 | 74LS295  | .98   |
| 74LS12  | .34  | 74LS148 | 1.30 | 74LS298  | .88   |
| 74LS13  | .44  | 74LS151 | .54  | 74LS299  | 1.70  |
| 74LS14  | .58  | 74LS153 | .54  | 74LS323  | 3.45  |
| 74LS15  | .34  | 74LS154 | 1.85 | 74LS324  | 1.70  |
| 74LS20  | .24  | 74LS155 | .88  | 74LS352  | 1.25  |
| 74LS21  | .28  | 74LS158 | .88  | 74LS353  | 1.25  |
| 74LS22  | .24  | 74LS157 | .84  | 74LS353  | 1.30  |
| 74LS28  | .28  | 74LS158 | .58  | 74LS364  | 1.90  |
| 74LS27  | .28  | 74LS160 | .88  | 74LS365  | .48   |
| 74LS28  | .34  | 74LS161 | .84  | 74LS368  | .48   |
| 74LS30  | .24  | 74LS162 | .88  | 74LS367  | .44   |
| 74LS32  | .28  | 74LS163 | .84  | 74LS368  | .44   |
| 74LS33  | .54  | 74LS164 | .88  | 74LS373  | 1.35  |
| 74LS37  | .34  | 74LS165 | .94  | 74LS374  | 1.35  |
| 74LS38  | .34  | 74LS168 | 1.90 | 74LS377  | 1.35  |
| 74LS40  | .24  | 74LS168 | 1.70 | 74LS378  | 1.13  |
| 74LS42  | .48  | 74LS169 | 1.70 | 74LS378  | 1.30  |
| 74LS47  | .74  | 74LS170 | 1.45 | 74LS375  | 1.85  |
| 74LS48  | .74  | 74LS173 | .88  | 74LS388  | .44   |
| 74LS49  | .74  | 74LS174 | .54  | 74LS390  | 1.15  |
| 74LS51  | .24  | 74LS175 | .54  | 74LS393  | 1.15  |
| 74LS54  | .28  | 74LS181 | 2.10 | 74LS395  | 1.15  |
| 74LS55  | .28  | 74LS189 | .88  | 74LS399  | 1.45  |
| 74LS63  | 1.20 | 74LS190 | .88  | 74LS424  | 2.90  |
| 74LS73  | .38  | 74LS191 | .88  | 74LS447  | .38   |
| 74LS74  | .34  | 74LS192 | .78  | 74LS490  | 1.90  |
| 74LS75  | .38  | 74LS193 | .78  | 74LS824  | 3.95  |
| 74LS78  | .38  | 74LS194 | .88  | 74LS840  | 2.15  |
| 74LS78  | .48  | 74LS195 | .88  | 74LS845  | 2.15  |
| 74LS83  | .58  | 74LS198 | .78  | 74LS888  | 1.85  |
| 74LS85  | .88  | 74LS197 | .78  | 74LS889  | 1.85  |
| 74LS88  | .38  | 74LS221 | .88  | 74LS870  | 1.45  |
| 74LS90  | .54  | 74LS240 | .94  | 74LS874  | 9.80  |
| 74LS91  | .88  | 74LS241 | .98  | 74LS882  | 3.15  |
| 74LS92  | .54  | 74LS242 | .98  | 74LS883  | 3.15  |
| 74LS93  | .54  | 74LS243 | .98  | 74LS884  | 3.15  |
| 74LS95  | .74  | 74LS244 | 1.25 | 74LS885  | 3.15  |
| 74LS98  | .88  | 74LS245 | 1.45 | 74LS888  | 2.35  |
| 74LS107 | .38  | 74LS247 | .74  | 74LS889  | 3.15  |
| 74LS109 | .38  | 74LS248 | .98  | 74LS873  | 23.95 |
| 74LS112 | .38  | 74LS249 | .98  | 81L895   | 1.45  |
| 74LS113 | .38  | 74LS251 | .58  | 81L898   | 1.45  |
| 74LS114 | .38  | 74LS253 | .58  | 81L897   | 1.45  |
| 74LS122 | .44  | 74LS257 | .58  | 81L898   | 1.45  |
| 74LS123 | .78  | 74LS258 | .58  | 25L82521 | 2.75  |
| 74LS124 | 2.85 | 74LS259 | 2.70 | 25L82569 | 4.20  |

## CRT CONTROLLERS

|      |       |        |       |
|------|-------|--------|-------|
| 1771 | 14.95 | 2797   | 84.85 |
| 1791 | 23.95 | 8843   | 33.95 |
| 1793 | 25.95 | 8272   | 38.95 |
| 1795 | 28.95 | UP0765 | 38.95 |
| 1797 | 48.95 | M88876 | 23.95 |
| 2791 | 79.95 | M88877 | 25.95 |
| 2793 | 79.95 | 1691   | 16.95 |
| 2795 | 84.95 | 2143   | 17.95 |

## DISC CONTROLLERS

|      |       |        |       |
|------|-------|--------|-------|
| 1771 | 14.95 | 2797   | 84.85 |
| 1791 | 23.95 | 8843   | 33.95 |
| 1793 | 25.95 | 8272   | 38.95 |
| 1795 | 28.95 | UP0765 | 38.95 |
| 1797 | 48.95 | M88876 | 23.95 |
| 2791 | 79.95 | M88877 | 25.95 |
| 2793 | 79.95 | 1691   | 16.95 |
| 2795 | 84.95 | 2143   | 17.95 |

1984

**- THE IC MASTER -**  
Your ticket to fast and easy IC selections



\$ 89.95

## 6500

| 1 MHZ |       | 2 MHZ |       |
|-------|-------|-------|-------|
| 6502  | 4.90  | 6502A | 8.90  |
| 6504  | 8.90  | 6522A | 9.90  |
| 6505  | 8.90  | 6532A | 10.95 |
| 6507  | 9.90  | 6545A | 28.95 |
| 6520  | 4.30  | 6551A | 10.95 |
| 6522  | 8.90  |       |       |
| 6532  | 9.90  |       |       |
| 6545  | 21.50 |       |       |
| 6551  | 10.85 |       |       |

## 6800

|       |       |       |       |
|-------|-------|-------|-------|
| 68000 | 66.96 | 6860  | 9.90  |
| 6800  | 3.90  | 6862  | 10.95 |
| 6802  | 7.90  | 6875  | 5.90  |
| 6808  | 12.90 | 6880  | 2.20  |
| 6809E | 16.95 | 6883  | 21.95 |
| 6809  | 10.95 | 68047 | 23.95 |
| 6810  | 2.90  | 68486 | 18.95 |
| 6820  | 4.30  |       |       |
| 6821  | 3.20  |       |       |
| 6826  | 13.95 |       |       |
| 6840  | 11.95 |       |       |
| 6843  | 33.95 |       |       |
| 6844  | 24.95 |       |       |
| 6845  | 13.95 |       |       |
| 6847  | 10.95 |       |       |
| 6860  | 3.20  |       |       |
| 6862  | 15.70 |       |       |

## 1 MHZ

|        |       |
|--------|-------|
| 68800  | 9.95  |
| 68802  | 21.25 |
| 68809E | 28.95 |
| 68809  | 26.95 |
| 68810  | 6.90  |
| 68821  | 6.90  |
| 68845  | 18.95 |
| 68850  | 5.90  |

## MICROPROCESSORS

### 8000

|          |        |        |       |
|----------|--------|--------|-------|
| 8035     | 5.90   | 8089   | 88.95 |
| 8039     | 8.90   | 8166   | 8.90  |
| IM8-8080 | 18.95  | 8166-2 | 7.90  |
| IM8-8073 | 49.95  | 8168   | 8.90  |
| 8080     | 3.90   | 8186   | 28.95 |
| 8086     | 5.90   | 8185-2 | 38.95 |
| 8086A-2  | 10.95  | 8741   | 38.95 |
| 8088     | 28.95  | 8748   | 49.95 |
| 8087     | 199.00 | 8765   | 23.95 |
| 8088     | 38.95  |        |       |

### 8200

|        |       |        |       |
|--------|-------|--------|-------|
| 8202   | 23.95 | 8255-5 | 5.20  |
| 8203   | 36.95 | 8257   | 7.90  |
| 8205   | 3.45  | 8257-5 | 8.90  |
| 8212   | 1.75  | 8259   | 6.85  |
| 8214   | 3.80  | 8259-5 | 7.45  |
| 8216   | 1.70  | 8271   | 75.00 |
| 8224   | 2.20  | 8272   | 38.95 |
| 8226   | 1.75  | 8275   | 28.95 |
| 8228   | 3.45  | 8279   | 8.90  |
| 8237   | 18.95 | 8279-5 | 9.00  |
| 8237-5 | 20.95 | 8282   | 6.45  |
| 8238   | 4.45  | 8283   | 8.45  |
| 8243   | 10.95 | 8284   | 14.95 |
| 8250   | 16.95 | 8286   | 8.45  |
| 8251   | 4.45  | 8287   | 6.45  |
| 8253   | 6.90  | 8288   | 24.00 |
| 8253-5 | 7.90  | 8289   | 48.95 |
| 8255   | 4.45  | 8292   | 16.95 |

### Z-80

| 2.5 MHZ   |       | 4.0 MHZ    |       |
|-----------|-------|------------|-------|
| Z80-CPU   | 3.90  | Z80A-CPU   | 4.29  |
| Z80-CTC   | 3.96  | Z80A-CTC   | 4.90  |
| Z80-OART  | 10.96 | Z80A-OART  | 9.95  |
| Z80-OMA   | 13.96 | Z80A-OMA   | 12.96 |
| Z80-PIO   | 3.95  | Z80A-PIO   | 4.29  |
| Z80-810/0 | 11.95 | Z80A-810/0 | 12.96 |
| Z80-810/1 | 11.96 | Z80A-810/1 | 12.96 |
| Z80-810/2 | 11.95 | Z80A-810/2 | 12.95 |
| Z80-810/9 | 11.96 | Z80A-810/9 | 12.95 |

| 8.0 MHZ   |       | ZILOG |       |
|-----------|-------|-------|-------|
| Z808-CPU  | 9.96  | Z6132 | 33.96 |
| Z808-CTC  | 12.96 | Z8671 | 38.95 |
| Z808-PIO  | 12.96 |       |       |
| Z808-OART | 12.96 |       |       |

## MEMORY EXPANSION KIT



4164 150ns  
9 for \$45.00

## Low Cost EPROM - PROGRAMMER -



The "Shooter" \$395.00

- 32K bits upgradable to 128K memory
- Built-in Serial RS-232 Port
- Program & verify 2718 thru 27256
- Intelligent, fast programming
- Up/download Hex, Binary, ASCII etc.
- Serial RS-232 Interface compatible

## UV ERASERS

QUV-T8/1 \$49.95  
ECONOMY Model



- Erases 8 EPROMs in 20 minutes
- Plastic Enclosure

QUV-T8/2T \$97.50  
INDUSTRIAL Model

- Tray Action, • UV Indicator
- 80-minute adjustable timer
- Steel enclosure • Safety switch
- Erase 15 EPROMs in 20 minutes

QUV-T8/2N \$68.95  
(No Timer)

LUV-1 \$149.95  
PRODUCTION Model

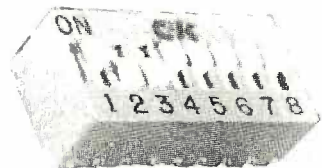
QUV-T8/2 \$124.95  
FAST Industrial Model

ST-8 \$195.00  
8-Tray Storage Cabinet

## GANG PROGRAMMER



### DIP SWITCHES



|            |     |
|------------|-----|
| 4 POSITION | .84 |
| 5 POSITION | .89 |
| 6 POSITION | .89 |
| 7 POSITION | .94 |
| 8 POSITION | .94 |

### IC SOCKETS

(1 to 99)

|           |     |           |      |
|-----------|-----|-----------|------|
| 8 pin ST  | .12 | 8 pin WW  | .58  |
| 14 pin ST | .14 | 14 pin WW | .58  |
| 18 pin ST | .18 | 16 pin WW | .58  |
| 18 pin ST | .19 | 18 pin WW | .98  |
| 20 pin ST | .28 | 20 pin WW | 1.04 |
| 22 pin ST | .29 | 22 pin WW | 1.34 |
| 24 pin ST | .29 | 24 pin WW | 1.44 |
| 28 pin ST | .39 | 28 pin WW | 1.64 |
| 40 pin ST | .48 | 40 pin WW | 1.94 |

ST = Solder-tell WW = Wirewrap

### ZIF SOCKETS



|            |      |
|------------|------|
| 16 pin ZIF | 5.90 |
| 24 pin ZIF | 7.90 |
| 28 pin ZIF | 8.90 |

ZIF = TEXTTOOL (Zero Insertion Force)

### VOLTAGE REGULATORS

|        |      |         |      |
|--------|------|---------|------|
| 7805T  | .74  | 7905T   | .84  |
| 78M05C | .34  | 7908T   | .84  |
| 7808T  | .74  | 7912T   | .84  |
| 7812T  | .74  | 7915T   | .84  |
| 7815T  | .74  | 7924T   | .84  |
| 7824T  | .74  | 7905K   | 1.44 |
| 7805K  | 1.34 | 7912K   | 1.44 |
| 7812K  | 1.34 | 7915K   | 1.44 |
| 7815K  | 1.34 | 7924K   | 1.44 |
| 7824K  | 1.34 | 79L05   | .78  |
| 78L05  | .88  | 79L12   | .78  |
| 78L12  | .88  | 79L15   | .78  |
| 78L15  | .88  | LM323K  | 4.90 |
| 78M05K | 9.90 | UA78340 | 1.90 |
| 78H12K | 9.90 |         |      |

C,T=TO-220 K=TO-3  
L=TO-92

### CRYSTALS

|            |      |             |      |
|------------|------|-------------|------|
| 1.0000 MHz | 3.89 | 8.0000 MHz  | 2.89 |
| 1.8432 MHz | 3.89 | 10.0000 MHz | 2.89 |
| 2.0000 MHz | 2.89 | 10.7386 MHz | 2.89 |
| 2.0972 MHz | 2.69 | 12.0000 MHz | 2.69 |
| 2.4578 MHz | 2.89 | 14.3182 MHz | 2.69 |
| 3.2768 MHz | 2.89 | 15.0000 MHz | 2.89 |
| 3.5795 MHz | 2.89 | 16.0000 MHz | 2.89 |
| 4.0000 MHz | 2.89 | 17.4300 MHz | 2.89 |
| 4.1943 MHz | 2.89 | 18.0000 MHz | 2.89 |
| 4.9160 MHz | 2.89 | 18.4320 MHz | 2.69 |
| 5.0000 MHz | 2.89 | 19.8608 MHz | 2.89 |
| 5.0688 MHz | 2.89 | 20.0000 MHz | 2.89 |
| 5.1850 MHz | 2.89 | 22.1184 MHz | 2.89 |
| 5.2429 MHz | 2.89 | 32.0000 MHz | 2.89 |
| 5.7143 MHz | 2.69 | 38.0000 MHz | 2.89 |
| 6.0000 MHz | 2.89 | 48.0000 MHz | 2.89 |
| 6.1440 MHz | 2.69 | 48.4350 MHz | 2.89 |
| 6.4000 MHz | 2.69 | 49.8900 MHz | 2.89 |
| 6.5538 MHz | 2.89 |             |      |
|            |      | 32.768 KHz  | 1.69 |

### CRYSTAL CLOCK OSCILLATORS

| PART NO. | FREQUENCY   | PRICE |
|----------|-------------|-------|
| 1.000    | 1.0000 MHz  | 9.95  |
| 1.843    | 1.8432 MHz  | 9.95  |
| 2.000    | 2.0000 MHz  | 9.95  |
| 4.000    | 4.0000 MHz  | 9.95  |
| 8.000    | 8.0000 MHz  | 9.95  |
| 10.000   | 10.0000 MHz | 9.95  |
| 16.000   | 16.0000 MHz | 9.95  |
| 18.432   | 18.4320 MHz | 9.95  |
| 19.860   | 19.8608 MHz | 9.95  |
| 20.000   | 20.0000 MHz | 9.95  |
| 32.000   | 32.0000 MHz | 9.95  |

### EDGECARD CONNECTORS

|           |      |           |      |
|-----------|------|-----------|------|
| 8-100 ST  | 3.85 | 50-pin ST | 4.85 |
| 8-100WW   | 4.85 | 44-pin ST | 2.85 |
| 72-pin ST | 8.85 | 44-pinWW  | 4.85 |
| 72-pinWW  | 7.85 |           |      |

### RESISTORS

1/4 WATT 5% CARBON FILM  
ALL STANDARD VALUES  
FROM 1 OHM - 10 MEG OHM

|           |       |
|-----------|-------|
| 50 PCS    | 1.25  |
| 100 PCS   | 2.00  |
| 1,000 PCS | 15.00 |

### LED LAMPS

|              |     |     |
|--------------|-----|-----|
| Jumbo RED    | .09 | .08 |
| Jumbo GREEN  | .16 | .14 |
| Jumbo YELLOW | .16 | .14 |

### INTERFACE CHIPS

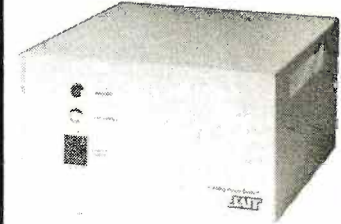
|       |      |        |      |
|-------|------|--------|------|
| 8T26  | 1.54 | 8T96   | .88  |
| 68T28 | 1.84 | DM6131 | 2.90 |
| 8T95  | .88  | DP8304 | 2.24 |
| 8T96  | .88  | 088835 | 1.94 |
| 8T97  | .88  | 088836 | 1.94 |

### TRANSISTORS

|         |      |         |      |         |      |
|---------|------|---------|------|---------|------|
| 2N918   | .49  | 2N3563  | .39  | 2N4402  | .24  |
| MP8918  | .24  | 2N3565  | .39  | 2N4403  | .24  |
| 2N2102  | .74  | PN3565  | .24  | 2N4857  | .99  |
| 2N2218  | .49  | MP83838 | .24  | PN4918  | .24  |
| 2N2218A | .49  | MP83840 | .24  | 2N5088  | .24  |
| 2N2219  | .49  | PN3843  | .24  | PN5129  | .24  |
| 2N2219A | .49  | PN3844  | .24  | PN5139  | .24  |
| 2N2222  | .24  | MP83704 | .14  | 2N5209  | .24  |
| PN2222  | .09  | MP83708 | .14  | 2N6028  | .34  |
| MP82389 | .24  | 2N3772  | 1.80 | 2N8043  | 1.70 |
| 2N2484  | .24  | 2N3903  | .24  | 2N8045  | 1.70 |
| 2N2905  | .49  | 2N3904  | .09  | MP8-A05 | .24  |
| 2N2907  | .24  | 2N3908  | .09  | MP8-A08 | .24  |
| PN2907  | 1.20 | 2N4122  | .24  | MP8-A55 | .24  |
| 2N3055  | .78  | 2N4123  | .24  | TIP29   | .84  |
| 3055T   | .88  | 2N4249  | .24  | TIP31   | .74  |
| 2N3393  | .29  | 2N4304  | .74  | TIP32   | .78  |
| 2N3414  | .24  | 2N4401  | .24  |         |      |

### SAFT Power Products:

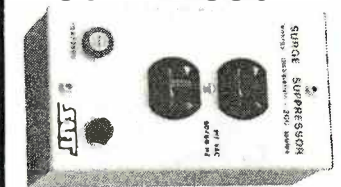
### STANDBY POWER SUPPLIES



Protect your computer and its precious data from black-outs or brownouts. Turns on if the power goes off at the wall outlet!

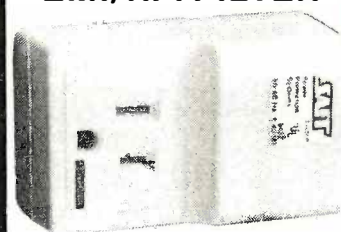
SPS0200VA/117V \$499.00  
SPS0400VA/117V \$699.00

### SURGE SUPPRESSOR



STOPS lightning bolts or other high energy line surges from damaging your computer's sensitive components.

SURGE SUPPRESSOR \$149.00  
EMI/RFI FILTER



Eliminates line noise caused by office equipment, printers, fluorescent lights, switches, etc.

INTERFERENCE FILTER \$49.95

### LINE CONDITIONER

Isolation transformer is harmonic compensating to hold line voltage steady, regulated; also suppresses pulses and line noise.

LINE CONDITIONER \$395.00

ORDER TOLL FREE

(800)

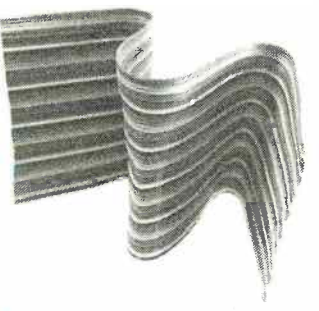
538-8800  
(CALIFORNIA RESIDENTS)

(800)

848-8008



### RIBBON CABLE



| CONTACTS | SINGLE COLOR |       | COLOR CODED |       |
|----------|--------------|-------|-------------|-------|
|          | 1'           | 10'   | 1'          | 10'   |
| 10       | .45          | 4.30  | .78         | 7.20  |
| 16       | .50          | 4.70  | .95         | 8.70  |
| 20       | .60          | 5.60  | 1.15        | 10.90 |
| 25       | .70          | 6.50  | 1.22        | 11.50 |
| 26       | .70          | 6.50  | 1.27        | 11.50 |
| 34       | .93          | 8.50  | 1.55        | 14.40 |
| 40       | 1.27         | 11.50 | 1.82        | 16.70 |
| 50       | 1.28         | 12.00 | 2.40        | 21.90 |

### DIP CONNECTORS

| DESCRIPTION                           | ORDER BY | NO. of CONTACTS |      |      |      |      |      |      |      |      |
|---------------------------------------|----------|-----------------|------|------|------|------|------|------|------|------|
|                                       |          | 8               | 14   | 16   | 18   | 20   | 22   | 24   | 28   | 40   |
| HIGH RELIABILITY TOOLED ST IC SOCKETS | HRTxxST  | .94             | .94  | .94  | 1.59 | 1.79 | 1.79 | 1.89 | 2.39 | 2.89 |
| COMPONENT CARRIERS (DIP HEADERS)      | ICCxx    | .60             | .70  | .80  | .95  | 1.15 | 1.15 | 1.25 | 1.40 | 2.00 |
| RIBBON CABLE DIP PLUGS (IDC)          | IDPxx    | —               | 1.35 | 1.55 | —    | —    | —    | 2.40 | —    | 4.05 |

ORDER EXAMPLE: A 14-pin High Rel. ST socket would be HRT 14 ST

### D-SUBMINIATURE

| DESCRIPTION                | ORDER BY | NO. of CONTACTS |      |      |      |      |
|----------------------------|----------|-----------------|------|------|------|------|
|                            |          | 9               | 15   | 25   | 37   | 50   |
| SOLDER MALE DPxxP          |          | 1.98            | 2.59 | 2.40 | 4.70 | 5.96 |
| CUP FEMALE DBxxS           |          | 2.56            | 3.53 | 3.15 | 7.01 | 9.14 |
| RT. ANGLE MALE DBxxPR      |          | 1.55            | 2.10 | 2.90 | 4.73 | —    |
| PC. SOLDER FEMALE DBxxSR   |          | 2.08            | 2.93 | 4.32 | 6.09 | —    |
| IDC MALE IDPxxP            |          | 3.27            | 4.60 | 6.13 | 9.12 | —    |
| RIBBON CABLE FEMALE IDBxxS |          | 3.59            | 5.03 | 6.74 | 9.98 | —    |
| HOODS BLACK HOOD-B         |          | —               | —    | 1.15 | —    | —    |
| HOODS GREY HOOD            |          | 1.50            | 1.50 | 1.15 | 2.85 | 3.40 |

ORDER EXAMPLE: A 5-pin Male Solder Cup would be MALE DP 25 P

### IDC CONNECTORS

| DESCRIPTION             | ORDER BY | NO. of CONTACTS |      |      |      |      |      |
|-------------------------|----------|-----------------|------|------|------|------|------|
|                         |          | 10              | 20   | 26   | 34   | 40   | 50   |
| SOLDER HEADER           | IDHxxS   | .77             | 1.19 | 1.58 | 2.10 | 2.48 | 3.14 |
| RT. ANGLE SOLDER HEADER | IDHxxSR  | .80             | 1.25 | 1.88 | 2.21 | 2.62 | 3.29 |
| WW HEADER               | IDHxxW   | 1.78            | 2.88 | 3.74 | 4.40 | 5.18 | 6.53 |
| RT. ANGLE WW HEADER     | IDHxxWR  | 1.95            | 3.18 | 4.12 | 4.35 | 4.70 | 7.20 |
| RIBBON HEADER SOCKET    | IDMxx    | 1.05            | 1.78 | 2.33 | 3.05 | 3.63 | 4.55 |
| RIBBON HEADER           | IDMxx    | —               | 5.40 | 6.15 | 6.90 | 7.40 | 8.40 |
| RIBBON EDGE CARD        | IDExx    | 2.15            | 2.26 | 2.55 | 3.15 | 3.70 | 4.84 |

ORDER EXAMPLE: A 20-pin WW Header would be IDH 20 W.

# Computer Components Unlimited

## Serving You in BYTE for Over 3 Years

(Quality Discount Specialists)

### STOCKING STUFFERS

#### 64K UPGRADE

★ 9 x 4164 ★ 1 Yr. War.

**\$33 a set**

#### Co-Processor

★ The Math Chip  
★ Intel Mfg.

**\$129**

#### Idea Multi-function Board

★ AST Sixpack Compatible  
★ OK-384K  
★ Par. & Ser. Ports w/Clock  
★ All Software ★ 6 Mo. War.

**\$199**

#### Blossom by Orchid

★ PC Network Board Opt.  
★ 64K Exp. to 384K  
★ Par., Ser. & Clock

**\$299**

#### Hard Disk

★ 10 Meg Internal  
★ Controller & Software

**\$769**

#### IBM System

★ 2 - 320K Drives  
★ 256K Memory  
★ Keybrd & Operation Guide

**\$1599**

#### Vutek

★ Par. & Ser. Ports  
★ RGB & Composite Video  
★ 2 Year Warranty

**\$199**

#### Paradise Modular Card

★ Monochrome, RGB  
★ Composite  
★ Light Pen  
★ RF Mod  
★ Software  
★ Ram Disk  
★ Print Buffer

**\$345**

### CCU YOUR LARGEST DISK DRIVE SUPPLIER

#### This Month Only PRICES SLASHED!

#### Apple Compatible Drives

QUANTITY  
1 2 10

|                          | 1     | 2     | 10    |
|--------------------------|-------|-------|-------|
| <b>Micro Sci</b>         |       |       |       |
| A-2, 35 Track Controller | \$175 | \$169 | \$159 |
|                          | 65    | 60    | 50    |

#### Rana Systems

|                              |       |       |       |
|------------------------------|-------|-------|-------|
| Elite I                      | \$210 | \$205 | \$200 |
| Elite II, Dbl. Head          | 335   | 330   | 325   |
| Elite III, Quad Density      | 395   | 445   | 435   |
| Controller Controls 4 Drives | 75    | 70    | 70    |

#### Half Height

|                        |       |       |       |
|------------------------|-------|-------|-------|
| FD525A Fully Applecom. | \$140 | \$130 | \$120 |
|------------------------|-------|-------|-------|

#### Sigma Technology

|               |       |       |       |
|---------------|-------|-------|-------|
| Full HT Apple | \$160 | \$150 | \$140 |
|---------------|-------|-------|-------|

#### 5 1/4" Disk Drives

QUANTITY  
1 2 10

#### Teac

|                     |       |       |       |
|---------------------|-------|-------|-------|
| FD55A, 160K         | \$160 | \$150 | \$140 |
| FD55B, 360K         | 135   | 129   | 119   |
| FD55F, Quad Density | 159   | 150   | 140   |

All Teac's are Half Heights

#### Tandon

|                         |       |       |       |
|-------------------------|-------|-------|-------|
| TM100-1, 160K           | \$150 | \$140 | \$130 |
| TM100-2, 360K           | 155   | 145   | 140   |
| TM101-4, Quad Density   | 280   | 270   | 260   |
| TM55-2, 360K 1/2 Height | 195   | 190   | 185   |

#### MPI

|                          |       |       |       |
|--------------------------|-------|-------|-------|
| B-52, 360K PC Compatible | \$100 | \$ 95 | \$ 90 |
|--------------------------|-------|-------|-------|

#### Shugart

|                             |       |       |       |
|-----------------------------|-------|-------|-------|
| 5A400, 160K                 | \$190 | \$180 | \$170 |
| 5A455, 360K 1/2 Height      | 150   | 140   | 130   |
| 5A465, Quad Den. 1/2 Height | 230   | 220   | 210   |

#### Mitsubishi

|                            |       |       |       |
|----------------------------|-------|-------|-------|
| 4851, 1/2 Height           | \$179 | \$169 | \$159 |
| 4853, Quad Den. 1/2 Height | 169   | 159   | 140   |

#### Control Data Corp.

|                         |       |       |       |
|-------------------------|-------|-------|-------|
| CDC 9409, 360K          | \$200 | \$190 | \$180 |
| CDC 9409T, Quad Density | 250   | 200   | 190   |

#### 8" Disk Drives

QUANTITY  
1 2 10

#### Siemens

|           |       |       |       |
|-----------|-------|-------|-------|
| FDD-100-8 | \$129 | \$120 | \$111 |
| FDD-200-8 | 180   | 170   | 160   |

#### Shugart

|                 |       |       |       |
|-----------------|-------|-------|-------|
| 801R, Sgl./Dbl. | \$290 | \$280 | \$270 |
| 851R, Dbl./Dbl. | 480   | 470   | 460   |

#### Tandon

|                             |       |       |       |
|-----------------------------|-------|-------|-------|
| TM848-1E, Sgl./Dbl. 1/2 Ht. | \$240 | \$230 | \$220 |
| TM848-2E, Dbl./Dbl. 1/2 Ht. | 370   | 360   | 350   |

#### Mitsubishi

|                             |       |       |       |
|-----------------------------|-------|-------|-------|
| M2894-63, Dbl./Dbl.         | \$400 | \$390 | \$380 |
| M2896-63, Dbl./Dbl. 1/2 Ht. | 400   | 390   | 380   |

### 5 1/4" & 8" Power Supply & Cabinets

QUANTITY  
1 2 10

#### PC Products 5 1/4"

|                         |       |       |       |
|-------------------------|-------|-------|-------|
| Single Cabinet w/pwr    | \$ 70 | \$ 60 | \$ 50 |
| Dual Thinline Cab w/pwr | 80    | 70    | 60    |
| Dual Cabinet & Power    | 80    | 70    | 60    |

All have 6 month Warranty

#### PC Products 8"

|                            |       |       |       |
|----------------------------|-------|-------|-------|
| Sgl. Cabinet w/pwr & fan   | \$220 | \$210 | \$200 |
| Dual w/pwr for 2 thinlines | 230   | 220   | 210   |
| Dual w/pwr & fan           | 270   | 260   | 250   |

#### Customer Service Hours:

10 a.m. - 4 p.m. Mon.-Fri.  
John Aurentz  
(213) 643-5191

#### Mail Order Hours:

7 a.m. - 7 p.m. Mon.-Fri.  
10 a.m. - 3 p.m. Sat.  
(800) 847-1718 (213) 643-5188  
(Outside California) (Inside California)

#### Retail Hours:

10 a.m. - 6 p.m. Mon.-Fri.  
10 a.m. - 3 p.m. Sat.  
(213) 643-5188

# CALL (800) 847-1718 To Open Your University or Corporate Account

## COMPUTER SYSTEMS

|              |        |
|--------------|--------|
| <b>Apple</b> |        |
| IIxcpu       | \$ 690 |
| Macintosh    | 1895   |
| Ic Portable  | 999    |

|                                                           |        |
|-----------------------------------------------------------|--------|
| <b>Compaq</b>                                             |        |
| Portable (PC Compatible) 2, 360K Drives<br>256K of Memory | \$2195 |
| Call for all new Compaq's                                 |        |

|               |        |
|---------------|--------|
| <b>Kaypro</b> |        |
| Kaypro II     | \$ 849 |
| Kaypro4       | Call   |
| Kaypro4 + 88  | Call   |
| Kaypro 10     | Call   |
| Kaypro IIX    | Call   |

|                       |        |
|-----------------------|--------|
| <b>IBM</b>            |        |
| PC 64K, No Drives     | \$1199 |
| PC 64K, 1 Drive       | 1349   |
| PC 64K, 2 Drives      | 1549   |
| XTw/10 Meg, 256K      | 3495   |
| Additional Memory 64K | 39     |
| AT Standard Config.   | 3495   |
| AT w/20 meg           | 5095   |

|                      |        |
|----------------------|--------|
| <b>Sanyo</b>         |        |
| MBC 550-2            | \$ 799 |
| MBC 555-2            | 1099   |
| Optional Serial Port | 79     |
| Optional 360K Drive  | 159    |

|                         |        |
|-------------------------|--------|
| <b>Tava</b>             |        |
| PC Compatible w/Monitor | \$1779 |

## IBM ADD ON'S

|                     |        |
|---------------------|--------|
| <b>Ast Research</b> |        |
| Six Pack +          | \$ 259 |
| Mega +              | 265    |

|                 |        |
|-----------------|--------|
| <b>Hercules</b> |        |
| ColorCard       | \$ 190 |
| GraphicsCard    | 340    |

|                         |        |
|-------------------------|--------|
| <b>Hard Disk</b>        |        |
| 10 Meg. External w/pwr. | \$1195 |

|                    |        |
|--------------------|--------|
| <b>IBM</b>         |        |
| Monochrome Adapter | \$ 229 |
| ColorCard          | 239    |

|                         |        |
|-------------------------|--------|
| <b>Paradise Systems</b> |        |
| Multi-displayCard       | \$ 329 |
| New Modular Card        | 345    |
| Module A                | 88     |
| Module B                | 240    |

|                    |        |
|--------------------|--------|
| <b>Plantronics</b> |        |
| PC + w/Software    | \$ 389 |

|                 |        |
|-----------------|--------|
| <b>Quadram</b>  |        |
| Quad Color Card | \$ 219 |

|                    |       |
|--------------------|-------|
| <b>64K Upgrade</b> |       |
| 64K of Memory      | \$ 33 |

|                  |        |
|------------------|--------|
| <b>STB</b>       |        |
| Graphics Plus II | \$ 369 |

|                    |        |
|--------------------|--------|
| <b>PC Products</b> |        |
| PC Peacock         | \$ 219 |

|              |       |
|--------------|-------|
| <b>Ports</b> |       |
| Parallel     | \$ 79 |
| Serial       | 79    |

## APPLE ADD ON'S

|              |        |
|--------------|--------|
| <b>ALS</b>   |        |
| Z Card       | \$ 119 |
| CPM 3.0 Card | 179    |

|              |       |
|--------------|-------|
| <b>Astar</b> |       |
| RF Modulator | \$ 15 |
| Fan w/Surge  | 34    |

|                        |       |
|------------------------|-------|
| <b>CCU</b>             |       |
| 16K Mem. Card 1 yr war | \$ 49 |

|              |       |
|--------------|-------|
| <b>Hayes</b> |       |
| Joystick     | \$ 44 |

|              |       |
|--------------|-------|
| <b>Kraft</b> |       |
| Joystick     | \$ 44 |

|              |       |
|--------------|-------|
| <b>Macro</b> |       |
| Joystick     | \$ 29 |

|                             |        |
|-----------------------------|--------|
| <b>Micro Max</b>            |        |
| Viewmax 80, 80 col. card    | \$ 139 |
| Viewmax 80E (F for IIe) 64K | 129    |

|                       |       |
|-----------------------|-------|
| <b>Micro Soft</b>     |       |
| 16K Card              | \$ 69 |
| Premium Soft Card IIe | 369   |
| Multiplan             | 189   |
| SoftCard (Z80)        | 239   |

|                  |       |
|------------------|-------|
| <b>Micro Tek</b> |       |
| Serial Interface | \$ 89 |

|               |       |
|---------------|-------|
| <b>TC</b>     |       |
| Joystick      | \$ 39 |
| Select-A-Port | 31    |
| Paddles       | 34    |

## MONITORS

|                           |        |
|---------------------------|--------|
| <b>Amdek</b>              |        |
| Color I + Composite Video | \$ 249 |
| Color II + RGB Video      | 419    |
| 300G, 12" Green           | 139    |
| 300A, 12" Amber           | 149    |
| 310A, Monochrome Amber    | 179    |

|                         |        |
|-------------------------|--------|
| <b>IBM</b>              |        |
| Monochrome Hi-Res Green | \$ 239 |

|                           |        |
|---------------------------|--------|
| <b>Princeton Graphics</b> |        |
| PGS HX12, IBM Copy        | \$ 469 |
| PGSSR-12, Hi-Res Color    | 849    |
| PGSMAX-12, 12" Monochrome | 199    |

|                  |        |
|------------------|--------|
| <b>Taxan</b>     |        |
| 121 Green Hi-Res | \$ 139 |
| 122 Amber Hi-Res | 149    |
| 440 720X 400     | Call   |

|                      |       |
|----------------------|-------|
| <b>Zenith</b>        |       |
| ZVM122, Hi-Res Green | \$ 99 |
| ZVM123, Hi-Res Amber | 99    |

## PRINTER INTERFACES

|                         |       |
|-------------------------|-------|
| <b>Fourth Dimension</b> |       |
| Card & Cable            | \$ 49 |

|                                   |       |
|-----------------------------------|-------|
| <b>Microtek</b>                   |       |
| Dumpling GX (Grappler Compatible) | \$ 89 |
| Dumpling GX exp to 64K            | 149   |
| Dumpling GX 16K w/16K exp to 64K  | 169   |
| for each additional 16K           | 15    |

|                        |       |
|------------------------|-------|
| <b>Okidata Options</b> |       |
| Tractor for 82 & 92    | \$ 59 |
| Serial Interface       | 99    |

|                     |        |
|---------------------|--------|
| <b>Orange Micro</b> |        |
| Grappler +          | \$ 109 |
| Grappler + w/16K    | 179    |

|                        |        |
|------------------------|--------|
| <b>Star or Epson</b>   |        |
| Epson Serial Interface | \$ 119 |
| Star Serial Interface  | 59     |

## PRINTERS

|                      |        |
|----------------------|--------|
| <b>Brother</b>       |        |
| HR15, Letter Quality | \$ 379 |
| HR25 (23 cps)        | 719    |
| HR35 (36 cps)        | 979    |

|                                      |              |
|--------------------------------------|--------------|
| <b>Epson</b>                         |              |
| RX-80 (120 cps)                      | Call         |
| RX-80FT (120 cps) Friction & Tractor | For          |
| FX-80 (160 cps)                      | Unbelievable |
| FX-100 (160 cps) 15" Carriage        | Prices       |
| JX-80                                | Call         |

|                                  |        |
|----------------------------------|--------|
| <b>Okidata</b>                   |        |
| 82A (120 cps) Par & Ser inter.   | \$ 299 |
| 83A (15" Carriage)               | 569    |
| 84P (200 cps) Friction & Tractor | 799    |

|                          |        |
|--------------------------|--------|
| <b>Okidata 90 Series</b> |        |
| 92P (160 cps) w/Rom      | \$ 379 |
| 93P (15" Carriage) w/Rom | 599    |

|                  |        |
|------------------|--------|
| <b>Panasonic</b> |        |
| 1091 (OKI Copy)  | \$ 319 |

|                   |        |
|-------------------|--------|
| <b>Switch Box</b> |        |
| Par. Box          | \$ 319 |

## 5 1/4" DISKETTES

|                        |                  |
|------------------------|------------------|
| <b>CCU</b>             |                  |
| Sgl/Dbl reinforced hub | \$16 100 for 140 |
| Dbl/Dbl reinforced hub | 19 100 for 170   |
| Not Bulk Packed        |                  |

|              |                  |
|--------------|------------------|
| <b>Dysan</b> |                  |
| Sgl/Dbl      | \$33 100 for 300 |
| Dbl/Dbl      | 39 100 for 370   |

|             |                  |
|-------------|------------------|
| <b>Fuji</b> |                  |
| Sgl/Dbl     | \$19 100 for 180 |
| Dbl/Dbl     | 25 100 for 230   |

|                 |                  |
|-----------------|------------------|
| <b>Verbatim</b> |                  |
| Sgl/Dbl         | \$26 100 for 240 |
| Dbl/Dbl         | 36 100 for 340   |

## 8" DISKETTES

|              |                  |
|--------------|------------------|
| <b>Dysan</b> |                  |
| Sgl/Sgl      | \$34 100 for 320 |
| Dbl/Dbl      | 53 100 for 480   |

|                 |                  |
|-----------------|------------------|
| <b>Verbatim</b> |                  |
| Sgl/Sgl         | \$30 100 for 280 |
| Dbl/Dbl         | 40 100 for 360   |

## DISK ACCESSORIES

|                                |      |
|--------------------------------|------|
| <b>Verbatim</b>                |      |
| 8" or 5 1/4" Head Cleaning Kit | \$ 9 |

|                                   |       |
|-----------------------------------|-------|
| <b>Flip Tub</b>                   |       |
| 5 1/4" Holds 70 disks, plexiglass | \$ 17 |

## MODEMS

|                            |       |
|----------------------------|-------|
| <b>Anchor</b>              |       |
| Mark VI 300 Baud           | \$ 99 |
| Mark VII 300 Baud External | 139   |
| Mark XII                   | 239   |

|                             |        |
|-----------------------------|--------|
| <b>Hayes Micro Computer</b> |        |
| Smart Modem 300 Baud        | \$ 205 |
| Smart Modem 1200 Baud       | 489    |
| Smart Modem 1200B for PC    | 399    |
| Micro Modem IIe             | 239    |

# Computer Components Unlimited

A California Corporation

Circle 64 on inquiry card.

**RETAIL STORE:**  
11976 Aviation Blvd.  
Inglewood, CA 90304

**MAIL ORDER:**  
P.O. Box 1936  
Hawthorne, CA 90250

No Surcharge for Credit Cards

All Prices Reflect a Cash,  
Pre-Paid Discount

This Ad Supersedes All Others

**Sales Desk**

**(800) 847-1718 (213) 643-5188**

Outside California Inside California

**Customer Service & Technical**

**(213) 643-5191**

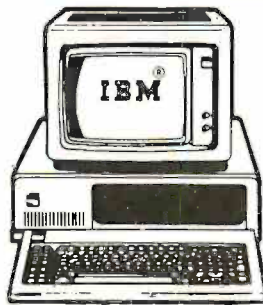
All merchandise new. We accept MC, Visa, Wire Transfer, COD Call, Certified Check, P.O.'s from qualified firms, APO accepted. Shipping: Minimum \$4.50 first 5 pounds. Tax: California Res. Only add 6 1/2% sales tax. All returns subject to 15% restocking charge. Advertised prices for Mail Order only. Retail prices slightly higher. Prices Subject to Change.

**AMERICA'S NO. 1**  
**Systems Specialists**

**WE CUSTOMIZE IBM PC SYSTEMS**

**IBM PC \$1699**

256K, two disk drives 360K each,  
 Drive Controller and Keyboard



**IBMPC w/10MB**

256K, one floppy Drive, Keyboard  
 10 MB Hard Disk with Controller  
**BOOTS FROM HARD DISK**

**\$2399**

**ALL SYSTEMS ARE CONFIGURED  
 AND TESTED AT NO EXTRA CHARGE**

**IBMPCw/30MB**

256K, one floppy Drive, Keyboard  
 30 MB Hard Disk with Controller  
 and Booster Power Supply  
**BOOTS FROM HARD DISK**

**\$3499**

★ **PRICE WAR** ★ **CALL US LAST** WITH YOUR BEST QUOTES ★

**PRINTERS**

|                    |         |                 |        |
|--------------------|---------|-----------------|--------|
| <b>EPSON</b> RX-80 | \$259   | FX-80           | \$429  |
| RX-80FT            | \$299   | FX-100          | \$629  |
| LQ-1500 Parallel   | \$1,149 | Serial          | \$1199 |
| LQ-1500 Tractor    | \$50    | Cutsheet feeder | \$399  |

|                          |       |
|--------------------------|-------|
| <b>OKIDATA</b> 92P       | \$399 |
| 93P                      | \$619 |
| INCLUDES PLUG & PLAY 84P | \$749 |

|                                           |       |
|-------------------------------------------|-------|
| <b>JUKI</b> Ltr Quality, 18 CPS, 13" wide | \$399 |
| <b>6100</b> Tractor                       | \$129 |

|                     |        |
|---------------------|--------|
| <b>TOSHIBA 1351</b> | \$1299 |
| Tractor             | \$169  |
| Cut Sheet Feeder    | \$799  |

|                    |       |
|--------------------|-------|
| <b>DYNAX DX-15</b> | \$369 |
| Keyboard           | \$149 |
| Tractor            | \$99  |
| Sheet Feeder       | \$199 |

|                      |       |                  |       |
|----------------------|-------|------------------|-------|
| <b>BROTHER</b> HR-25 | \$619 | HR-35            | \$899 |
| Tractor              | \$119 | Cut Sheet Feeder | \$199 |

|                                |        |
|--------------------------------|--------|
| <b>QUME SPRINT</b> 1140        | \$1299 |
| With IBM Interface Module 1155 | \$1499 |

|                       |        |
|-----------------------|--------|
| <b>NEC SPINWRITER</b> |        |
| 2050                  | \$799  |
| 3550                  | \$1499 |
| 8550                  | \$1899 |

|                      |       |
|----------------------|-------|
| <b>NEC PINWRITER</b> |       |
| P2                   | \$699 |
| P3                   | \$899 |

**MONITORS**

|                                    |       |
|------------------------------------|-------|
| <b>PGS</b> MAX-12 Amber—Monochrome | \$179 |
| HX-12—Hi-Res Color                 | \$449 |
| SR-12—Super Hi-Res Color           | \$649 |
| Scan Doubler                       | CALL  |

|                                                       |       |
|-------------------------------------------------------|-------|
| <b>TAXAN</b> 440 Color - Super Hi Res                 | \$599 |
| 122A(M) ... \$169 121G(M) ... \$159 116A(C) ... \$149 |       |

|                          |       |      |       |
|--------------------------|-------|------|-------|
| 300A (Composite)         | \$159 | 300G | \$139 |
| <b>AMDEK</b> 310A (Mono) | \$179 |      |       |

**MODEMS**

|                                                  |       |
|--------------------------------------------------|-------|
| <b>MICROCOM ERA 2</b>                            | \$359 |
| PC Internal 1200 Baud w/so tware, 4 Yr. Warranty |       |

|                                         |       |
|-----------------------------------------|-------|
| <b>HAYES SMARTMODEM</b> 1200 Standalone | \$469 |
| 1200B w/so tware                        | \$389 |

|                         |       |          |       |
|-------------------------|-------|----------|-------|
| <b>QUBIE</b> Standalone | \$329 | Internal | \$299 |
|-------------------------|-------|----------|-------|

|                                      |      |
|--------------------------------------|------|
| <b>POPCOM</b> Internal or Standalone | CALL |
|--------------------------------------|------|

**PROMETHEUS**

|                                 |       |
|---------------------------------|-------|
| <b>PROMODEM</b> 1200 Standalone | \$399 |
|---------------------------------|-------|

**P.O. & FOREIGN DEALERS**  
 Call, write or telex for details

**HARD DRIVES**

|                              |         |
|------------------------------|---------|
| <b>TALL GRASS TECHNOLOGY</b> |         |
| 20 MB w/20 MB Backup         | \$2,599 |
| 35 MB w/45 MB Backup         | \$3,999 |
| 70 MB w/60 MB Backup         | \$5,999 |
| Controller Card              | \$140   |
| Cartridge                    | \$40    |

|                   |       |
|-------------------|-------|
| <b>QUBIE 10MB</b> | \$888 |
|-------------------|-------|

|                    |       |
|--------------------|-------|
| <b>EVEREX 10MB</b> | \$888 |
|--------------------|-------|

|                                                        |         |
|--------------------------------------------------------|---------|
| <b>MAYNARD 10MB/30MB</b>                               |         |
| 10MB/WS-1                                              | \$888   |
| 10MB/WS-2                                              | \$1,029 |
| 30MB/WS1A                                              | \$1,999 |
| 30MB/WS-2A                                             | \$2,099 |
| WS-1 Gemini                                            | \$1,049 |
| WS-2 Gemini                                            | \$1,149 |
| "The Gemini" includes 10MB Hard Disk & Half Ht. Floppy |         |

**FLOPPY DRIVES**

|                                  |       |
|----------------------------------|-------|
| <b>TEAC</b> HALF HEIGHT 558-DSDD | \$129 |
|----------------------------------|-------|

|                            |       |
|----------------------------|-------|
| <b>CDC</b> Full Ht. - DSDD | \$199 |
|----------------------------|-------|

|                     |       |
|---------------------|-------|
| <b>TANDON 100-2</b> | \$149 |
| Full Ht. DSDD       |       |

★ **SUPER SPECIALS** ★

|                               |      |
|-------------------------------|------|
| <b>64K RAM</b> Set of 9 chips | \$36 |
|-------------------------------|------|

|                                         |       |
|-----------------------------------------|-------|
| <b>HAYES SMARTMODEM</b> 1200 Standalone | \$469 |
| 1200B w/Software                        | \$389 |

|                  |       |
|------------------|-------|
| <b>8087 CHIP</b> | \$159 |
|------------------|-------|

|                  |       |
|------------------|-------|
| <b>JUKI 6100</b> | \$399 |
|------------------|-------|

|                          |         |
|--------------------------|---------|
| <b>MAYNARD 10MB/WS-2</b> | \$1,029 |
|--------------------------|---------|

|                                   |      |
|-----------------------------------|------|
| <b>IBM PC Keyboard (original)</b> | CALL |
|-----------------------------------|------|

|                          |       |
|--------------------------|-------|
| <b>OKIDATA</b> 92P       | \$399 |
| 93P                      | \$619 |
| INCLUDES PLUG & PLAY 84P | \$749 |

|                              |       |
|------------------------------|-------|
| <b>BROTHER</b> HR-25 (23CPS) | \$619 |
| HR-35 (36CPS)                | \$899 |

|                                         |       |
|-----------------------------------------|-------|
| <b>KEYTRONIC</b> Deluxe Keyboard KB5151 | \$179 |
|-----------------------------------------|-------|

|                          |       |
|--------------------------|-------|
| <b>ORCHID TECHNOLOGY</b> |       |
| Blossom 64-K (to 384K)   | \$249 |
| Turbo 186                | CALL  |



**NETWORKING**

|                                        |       |
|----------------------------------------|-------|
| <b>ORCHID TECHNOLOGY</b>               |       |
| PC Net PLUS Starter Kit                | \$899 |
| PC netBlossom, PC turbo, PC netPlusRam | CALL  |

**IRMALINE**  
 CALL FOR YOUR BEST PRICES

**MULTI-DISPLAY CARDS**

|                              |       |
|------------------------------|-------|
| <b>PERSYST</b> Mono OR Color | \$199 |
| BOB Color                    | CALL  |

|                                        |       |
|----------------------------------------|-------|
| <b>AST</b> MonoGraph Plus w/clock & PP | \$369 |
| Serial Port Option                     | \$30  |

|                             |      |
|-----------------------------|------|
| <b>EVEREX</b> Graphics Edge | CALL |
|-----------------------------|------|

|                   |       |
|-------------------|-------|
| <b>PC PEACOCK</b> | \$219 |
|-------------------|-------|

|                               |      |
|-------------------------------|------|
| <b>TECMAR</b> Graphics Master | CALL |
|-------------------------------|------|

|                               |       |
|-------------------------------|-------|
| <b>HERCULES</b> Mono Graphics | \$329 |
| Color Graphics                | \$199 |

|                                |       |
|--------------------------------|-------|
| <b>NEW STB</b> Graphix Plus II | \$349 |
|--------------------------------|-------|

|                                           |       |
|-------------------------------------------|-------|
| <b>VUTEK</b> Color with Parallel & Serial | \$249 |
|-------------------------------------------|-------|

|                                    |       |
|------------------------------------|-------|
| <b>PARADISE</b> Multi-display Card | \$299 |
| NEW Modular Card                   | CALL  |

**MULTI-FUNCTION CARDS**

|                          |       |
|--------------------------|-------|
| <b>ORCHID TECHNOLOGY</b> |       |
| Blossom 64K (to 384K)    | \$249 |
| PC net/upgrades          | CALL  |

|                                    |       |
|------------------------------------|-------|
| <b>NEW QUADBOARD</b> 0-K (to 384K) | \$219 |
|------------------------------------|-------|

|                                       |       |
|---------------------------------------|-------|
| <b>AST SIX PAK</b> with 64K (to 384K) | \$249 |
|---------------------------------------|-------|

|                                         |       |
|-----------------------------------------|-------|
| <b>AST MEGA PLUS</b> with 64K (to 512K) | \$249 |
|-----------------------------------------|-------|

**MISC. ADD ONS**

|                  |       |
|------------------|-------|
| <b>8087 CHIP</b> | \$159 |
|------------------|-------|

|                           |      |        |      |
|---------------------------|------|--------|------|
| <b>CABLE</b> Parallel     | \$20 | Serial | \$25 |
| Keyboard Extension, 6 ft. | \$10 |        |      |

|                                     |      |
|-------------------------------------|------|
| <b>PLATINUM DISKETTES</b> Box of 10 | \$32 |
|-------------------------------------|------|

|                                         |      |
|-----------------------------------------|------|
| <b>VERBATIM</b> Datalife DSDD Box of 10 | \$29 |
|-----------------------------------------|------|

|                                            |          |           |
|--------------------------------------------|----------|-----------|
| <b>COMPUTER ACCESSORIES</b> POWER DIRECTOR | P2 \$109 | P12 \$149 |
|--------------------------------------------|----------|-----------|

|                                                  |       |
|--------------------------------------------------|-------|
| <b>STANDBY POWER SUPPLY</b> 200 WATTS            | \$279 |
| 300 WATTS                                        | \$379 |
| Surge Protection, up to 30 minutes Standby Power |       |

**WILL CALL:** Please call first for workorder number.

**COMPU**

**805-498-6635**

3541 OLD CONEJO ROAD, SUITE 102, THOUSAND OAKS, CA 91320

**TELEX 888522**

Ad #192

## DATA ACQUISITION and control for ANY computer



The Model 8232 communicates via RS-232, and has 8 analog inputs (0-5 VDC; 8bits), 8 digital inputs and outputs, and a 2000 point buffer. Suitable for field data logging or lab use, the 8232 costs only \$540. Direct bus-connect unit for TRS-80/III & 4 is \$295. Detailed manual, \$6. Phone our applications engineer or write:

★★ STARBUCK DATA COMPANY ★★

225 Crescent St., Waltham, MA 02154 • (617) 899-8629

Circle 353 on inquiry card.

Serial Parallel



### Convert What You Have To What You Want!

- RS232 Serial
- 8 Baud Rates
- Latched Outputs
- Centronics Parallel
- Handshake Signals
- Compact 2 1/2 x 4 1/2 x 1 1/2

No longer will your peripheral choices be limited by the type of port you have available! Our new High Performance 700 Series Converters provide the missing link. Based on the latest in CMOS technology, these units feature full baud rate selection to 19.2K, with handshake signals to maximize transfer efficiency. Detailed documentation allows simplified installation. Order the Model 770 (Ser/Par) or Model 775 (Par/Ser) Today!

Buffer Products  
Coming Soon!



only \$89.<sup>95</sup>  
Connector Option \$10.00  
CA Residents 6% tax  
UPS Shipping \$3.00

2734-C Johnson Dr.  
Post Office Box 3717  
Ventura, California 93006

CALL (805) 658-7466 or 658-7467

For FAST Delivery

Circle 148 on inquiry card.

## Monitor Mover Gives Back the Desk

\$149.<sup>95</sup>



- Models to fit most CRT's
- Rotates 360° on base
- Adjustable height
- Support tray swivels and tilts
- Holds up to 50 lbs
- Clamp, screw and wall mountings

Lintek

P.O. Box 8056  
Grand Rapids, MI 49508  
(616) 241-4040

Circle 230 on inquiry card.

## LIONHEART

Get ahead of the competition! You don't need to be a pro to use these professional level book/software packs. Explanatory books, compiled software

- Experimental Statistics ..... \$100
- Business Statistics ..... \$120
- Linear & Non-linear Programming ..... \$ 75
- Forecasting and Time-Series ..... \$100
- Business and Economic Forecasting ..... \$120
- Optimization ..... \$ 75
- Pert & Critical Path Techniques ..... \$ 75
- Decision Analysis Techniques ..... \$ 75
- Business and Finance Math ..... \$ 50

PC/MS-DOS, CP/M, Apple Dos 3 1/2

VISA, MasterCard, Check

LIONHEART, PO Box 379,  
Alburt, VT, 05440  
(514) 933-4918

Circle 231 on inquiry card.

## SAGE IV OWNERS

5, 10, 16 MB EXPANDED WINCH.  
BACKUPS AVAILABLE  
ON REMOVABLE  
CARTRIDGE DISK.

NOW AVAILABLE:

- TERA<sup>TM</sup> Terminals
- Removable Winchesters
- Electronic Mail
- Data Base Services:  
- FLEXWAVE<sup>TM</sup> - ALADIN<sup>TM</sup>

Contact: MASTERBYTE  
COMPUTERS OF N.Y.

Suite 815, 19 W. 34 St. N.Y., N.Y. 10001  
(212) 760-0340

Authorized STRIDE MICRO Distributor

Circle 243 on inquiry card.

## PC DRIVES



|                           | INT. | EXT. |
|---------------------------|------|------|
| Complete w/ Cont. & Soft. |      |      |
| 10Mb                      | 749  | 1095 |
| 20Mb                      | 1445 | 1745 |
| 40Mb                      | 1995 | 2295 |

## COMPUTERS & HARDWARES

- IBM PC, 256K, 2 HHFD ..... \$1,695
- IBM PC, 256K, 2 HHFD, 10Mb. \$2,499
- COLUMBIA 1600-1/1600-4. \$1,995/\$2,995
- TEAC 1/2 H 55B DRIVE ..... \$135
- EPSON FX80/FX100 ..... \$427/\$627
- JUKI 6300 (50 CPS L.Q.) ..... \$795
- JUKI 6100 (18 CPS L.Q.) ..... \$430
- OLYMPIA RO (14 CPS, L.Q.) ..... \$345
- TAXAN (TTL/COMP) ..... \$145/\$135
- POPCOM 100X (1200 BAUD) ..... \$340

64K RAM CHIPS  
150 NS \$3<sup>95</sup>

MICRO PLUS  
1020 E. EL CAMINO REAL  
SUNNYVALE, CA 94087

CALL 408-737-2525 24 hrs.  
VISA, MC or C.O.D. with DEPOSIT

Circle 260 on inquiry card.

## FREE SOFTWARE RENT THE PUBLIC DOMAIN!

User Group Software isn't copyrighted, so no fees to pay! 1000's of CP/M and IBM software programs in .COM and source code to copy yourself! Games, business, utilities! All FREE!

CP/M USERS GROUP LIBRARY  
Volumes 1-92, 46 disks rental-\$45

SIG/M USERS GROUP LIBRARY  
Volumes 1-90, 46 disks rental-\$45

Volumes 91-172, 40 disks rental-\$45  
SPECIAL! Rent all SIG/M volumes for \$85

MOST FORMATS AVAILABLE! SPECIFY.

IBM PC-SIG (PC-DOS) LIBRARY  
Volumes 1-135, 5 1/4" disks \$135

Public Domain User Group Catalog Disk \$5 pp. (CP/M only) (payment in advance, please)  
Rental is for 7 days after receipt, 3 days grace to return. Use credit card, no disk deposit.

Shipping, handling & insurance-\$7.50 per library.  
(619) 941-0925 information,  
(619) 727-1015 anytime order machine  
Have your credit card ready!

Public Domain Software Center

1533 Avohill Dr.  
Vista, CA 92083



Circle 278 on inquiry card.

## VTEK

DEC<sup>TM</sup> VT100/VT52-Tektronix<sup>TM</sup> 4010/4014  
Terminal Emulation

- PLOT10
- Cross hairs
- User defined keys
- Half and full duplex support
- Generates long and short breaks
- High resolution printer output
- Zoom and shift plots
- Line monitor mode displays all traffic
- Speedy integer arithmetic in Assembler and C
- Corona high resolution graphics
- 4014 enhanced graphics
- VT100 numeric keypad
- ASCII file transfer

Requires 192k memory in a Corona or IBM PC with color board. Prowriter, Epson, IBM and Okidata printers supported.

Price \$150. May be purchased directly from:

SCIENTIFIC ENDEAVORS / Route 4, Box 79  
Kingston, TN 37763 (615) 376-6394

Circle 335 on inquiry card.

## COMPUTER T'SHIRTS



FOR CHRISTMAS

The ULTIMATE Software!

A MUST for all computer lovers!

BRIGHT GREEN (L.C.D.) LETTERS

CUSTOM SILKSCREENED ON 50/50 BLEND

- HIGH TECH DESIGN! -

Five popular styles to choose from

Order Today! Only \$8.95 ppd

Made in U.S.A. Simply select Shirt and Color below

LET'S SEER PEER & PORE (R1); White #1 Pink #2 Blue #3

TAKE A BYTE OUT OF ME (R2); Green #4 Gray #5 Red #6

1/2 M USER FRIENDLY (R3) Black #7

HAPPINESS IS A PROGRAM THAT WORKS (R4)

♥ COMPUTERS #5 CUT SIZES S M L XL

Please send me \_\_\_\_\_

Shirt \_\_\_\_\_ Color \_\_\_\_\_ Size \_\_\_\_\_ / Shirt \_\_\_\_\_ Color \_\_\_\_\_ Size \_\_\_\_\_

Use additional sheet if necessary

COMPUTER NOVELTY CORP

P.O. BOX 2964

FREEPORT, TEXAS 77541

Enclose \$8.95 ppd each TX Res. 6% tax

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_

3454

Circle 81 on inquiry card.

**4164** 64K DYNAMIC 200ns

**9/44.95**

**SSI 263**

SPEECH SYNTHESIZER

**39.95**

**STATIC RAMS**

|             |        |                   |         |
|-------------|--------|-------------------|---------|
| 2101        | 256x4  | (450ns)           | 1.95    |
| 5101        | 256x4  | (450ns)(cmos)     | 3.95    |
| 2102-1      | 1024x4 | (450ns)           | .89     |
| 2102-4      | 1024x1 | (450ns)(LP)       | .99     |
| 2102-2      | 1024x1 | (250ns)(LP)       | 1.45    |
| 2125        | 1024x1 | (450ns)           | 2.95    |
| 2111        | 256x4  | (450ns)           | 2.45    |
| 2111L       | 256x4  | (450ns)(LP)       | 2.95    |
| 2112        | 256x4  | (450ns)           | 2.99    |
| 2114        | 1024x4 | (450ns)           | 8/9.95  |
| 2114-25     | 1024x4 | (250ns)           | 8/10.95 |
| 2114L-4     | 1024x4 | (450ns)(LP)       | 8/12.95 |
| 2114L-3     | 1024x4 | (300ns)(LP)       | 8/13.45 |
| 2114L-2     | 1024x4 | (200ns)(LP)       | 8/13.95 |
| 2114L-15    | 1024x4 | (150ns)(LP)       | 8/19.95 |
| TC5514      | 1024x4 | (650ns)(cmos)     | 4.95    |
| 2141        | 4096x1 | (200ns)           | 2.95    |
| 2147        | 4096x1 | (55ns)            | 4.95    |
| 2148        | 1024x4 | (70ns)            | 4.95    |
| TMS4044-4   | 4096x1 | (450ns)           | 2.49    |
| TMS4044-3   | 4096x1 | (300ns)           | 3.99    |
| TMS4044-2   | 4096x1 | (200ns)           | 4.49    |
| TMS4044-1   | 4096x1 | (100ns)           | 4.95    |
| UPD410      | 4096x1 | (100ns)           | 3.95    |
| MK4118      | 1024x8 | (250ns)           | 9.95    |
| TMM2016-200 | 2048x8 | (200ns)           | 4.15    |
| TMM2016-150 | 2048x8 | (150ns)           | 4.95    |
| TMM2016-100 | 2048x8 | (100ns)           | 6.15    |
| HM6116-4    | 2048x8 | (200ns)(cmos)     | 4.75    |
| HM6116-3    | 2048x8 | (150ns)(cmos)     | 4.95    |
| HM6116-2    | 2048x8 | (120ns)(cmos)     | 8.95    |
| HM6116LP-4  | 2048x8 | (200ns)(cmos)(LP) | 5.95    |
| HM6116LP-3  | 2048x8 | (150ns)(cmos)(LP) | 6.95    |
| HM6116LP-2  | 2048x8 | (120ns)(cmos)(LP) | 10.95   |
| TC5516      | 2048x8 | (250ns)(cmos)     | 9.95    |
| TMS4016     | 2048x8 | (200ns)           | 6.95    |
| Z-6132      | 4096x8 | (300ns)(Qstat)    | 34.95   |
| HM6264P-15  | 8192x8 | (150ns)(cmos)     | 34.95   |
| HM6264LP-12 | 8192x8 | (120ns)(cmos)     | 49.95   |
| HM6264LP-15 | 8192x8 | (150ns)(cmos)     | 39.95   |

LP=Low power

Ostat=Quasi-Static

**DYNAMIC RAMS**

|              |          |                      |         |
|--------------|----------|----------------------|---------|
| TMS4027      | 4096x1   | (250ns)              | 1.99    |
| 2107         | 4096x1   | (200ns)              | 1.95    |
| MM5280       | 4096x1   | (300ns)              | 1.95    |
| TMS4050      | 4096x1   | (300ns)              | 1.95    |
| UPD411       | 4096x1   | (300ns)              | 1.95    |
| TMS4060      | 4096x1   | (300ns)              | 1.95    |
| MK4108       | 8192x1   | (200ns)              | 1.95    |
| MM5298       | 8192x1   | (250ns)              | 1.85    |
| 4116-300     | 16384x1  | (300ns)              | 8/11.75 |
| 4116-250     | 16384x1  | (250ns)              | 8/12.95 |
| 4116-200     | 16384x1  | (200ns)              | 8/17.95 |
| 4116-150     | 16384x1  | (150ns)              | 8/14.95 |
| 4116-120     | 16384x1  | (120ns)              | 8/29.00 |
| 2118         | 16384x1  | (150ns)(5v)          | 4.95    |
| MK4332       | 32768x1  | (200ns)              | 9.95    |
| 4164-200     | 65536x1  | (200ns)(5v)          | 9/44.95 |
| 4164-150     | 65536x1  | (150ns)(5v)          | 9/49.00 |
| 4164-120     | 65536x1  | (120ns)(5v)          | 8.95    |
| MCM6665      | 65536x1  | (200ns)(5v)          | 8.95    |
| TMS4164      | 65536x1  | (150ns)(5v)          | 8.95    |
| 4164-REFRESH | 65536x1  | (150ns)(5v)(REFRESH) | 8.95    |
| TMS4116      | 16384x4  | (150ns)(5v)          | 9.95    |
| 41256-150    | 262144x1 | (150ns)(5v)          | 44.95   |
| 41256-200    | 262144x1 | (200ns)(5v)          | 39.95   |

5v=Single 5 Volt Supply

REFRESH=Pin 1 Refresh

**EPROMS**

|          |         |                      |       |
|----------|---------|----------------------|-------|
| 1702     | 256x8   | (1us)                | 4.50  |
| 2708     | 1024x8  | (450ns)              | 3.95  |
| 2758     | 1024x8  | (450ns)(5V)          | 5.95  |
| 2716-6   | 2048x8  | (650ns)              | 2.95  |
| 2716     | 2048x8  | (450ns)(5V)          | 3.95  |
| 2716-1   | 2048x8  | (350ns)(5V)          | 5.95  |
| TMS2516  | 2048x8  | (450ns)(5V)          | 5.50  |
| TMS2716  | 2048x8  | (450ns)              | 7.95  |
| TMS2532  | 4096x8  | (450ns)(5V)          | 5.95  |
| 2732     | 4096x8  | (450ns)(5V)          | 4.95  |
| 2732-250 | 4096x8  | (250ns)(5V)          | 8.95  |
| 2732-200 | 4096x8  | (200ns)(5V)          | 11.95 |
| 2732A-4  | 4096x8  | (450ns)(5V)(21V PGM) | 4.95  |
| 2732A-35 | 4096x8  | (350ns)(5V)(21V PGM) | 4.95  |
| 2732A    | 4096x8  | (250ns)(5V)(21V PGM) | 9.95  |
| 2732A-2  | 4096x8  | (200ns)(5V)(21V PGM) | 13.95 |
| 2764     | 8192x8  | (450ns)(5V)          | 6.95  |
| 2764-250 | 8192x8  | (250ns)(5V)          | 7.95  |
| 2764-200 | 8192x8  | (200ns)(5V)          | 19.95 |
| TMS2564  | 8192x8  | (450ns)(5V)          | 14.95 |
| MCM68764 | 8192x8  | (450ns)(5V)(24 pin)  | 39.95 |
| MCM68766 | 8192x8  | (350ns)(5V)(24 pin)  | 42.95 |
| 27128-45 | 16384x8 | (450ns)(5V)          | 19.95 |
| 27128-30 | 16384x8 | (300ns)(5V)          | 22.95 |
| 27128    | 16384x8 | (250ns)(5V)          | 24.95 |

5V=Single 5 Volt Supply 21V PGM=Program at 21 Volts

★★★★HIGH TECH★★★★

**65C02 \$12.95**  
CMOS VERSION OF THE 1 MHz 6502 MICROPROCESSOR

- LOW POWER-8ma OPERATION, 10 MICROAMP STANDBY
- SINGLE POWER SUPPLY: 3-6 VOLTS
- 27 NEW INSTRUCTIONS AND ADDRESS MODES
- PIN FOR PIN COMPATIBILITY WITH 6502
- BUS ENABLE AND MEMORY LOCK FEATURES
- USED IN APPLE™ IIc COMPUTERS

★★★★SPOTLIGHT★★★★

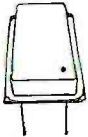
**ORDER TOLL FREE**  
**800-538-5000**  
**800-662-6279**  
(CALIFORNIA RESIDENTS)

**CRYSTALS**

|            |      |
|------------|------|
| 32.768 KHz | 1.95 |
| 1.0 MHz    | 3.95 |
| 1.8432     | 2.95 |
| 2.0        | 2.95 |
| 2.097152   | 2.95 |
| 2.4576     | 2.95 |
| 3.2768     | 2.95 |
| 3.579545   | 2.95 |
| 4.0        | 2.95 |
| 4.032      | 2.95 |
| 5.0        | 2.95 |
| 5.0688     | 2.95 |
| 5.185      | 2.95 |
| 5.7143     | 2.95 |
| 6.0        | 2.95 |
| 6.144      | 2.95 |
| 6.5536     | 2.95 |
| 8.0        | 2.95 |
| 10.0       | 2.95 |
| 10.738635  | 2.95 |
| 14.31818   | 2.95 |
| 15.0       | 2.95 |
| 16.0       | 2.95 |
| 17.430     | 2.95 |
| 18.0       | 2.95 |
| 18.432     | 2.95 |
| 20.0       | 2.95 |
| 22.1184    | 2.95 |
| 24.0       | 2.95 |
| 32.0       | 2.95 |

**CRYSTAL OSCILLATORS**

|        |      |        |      |
|--------|------|--------|------|
| 1.0MHz | 7.95 | 18.432 | 7.95 |
| 1.8432 | 7.95 | 20.0   | 7.95 |
| 2.0    | 7.95 | 24.0   | 7.95 |
| 2.4576 | 7.95 |        |      |
| 2.5    | 7.95 |        |      |
| 4.0    | 7.95 |        |      |
| 5.0688 | 7.95 |        |      |
| 6.0    | 7.95 |        |      |
| 6.144  | 7.95 |        |      |
| 8.0    | 7.95 |        |      |
| 10.0   | 7.95 |        |      |
| 12.0   | 7.95 |        |      |
| 15.0   | 7.95 |        |      |
| 16.0   | 7.95 |        |      |



**74LS00**

|         |      |         |       |
|---------|------|---------|-------|
| 74LS00  | .24  | 74LS189 | 8.95  |
| 74LS01  | .25  | 74LS190 | .89   |
| 74LS02  | .25  | 74LS191 | .89   |
| 74LS03  | .25  | 74LS192 | .79   |
| 74LS04  | .24  | 74LS193 | .79   |
| 74LS05  | .25  | 74LS194 | .69   |
| 74LS06  | .25  | 74LS195 | .69   |
| 74LS09  | .29  | 74LS196 | .79   |
| 74LS10  | .25  | 74LS197 | .79   |
| 74LS11  | .35  | 74LS221 | .89   |
| 74LS12  | .35  | 74LS240 | .95   |
| 74LS13  | .45  | 74LS241 | .99   |
| 74LS14  | .59  | 74LS242 | .99   |
| 74LS15  | .39  | 74LS243 | .99   |
| 74LS20  | .25  | 74LS244 | 1.29  |
| 74LS21  | .29  | 74LS245 | 1.49  |
| 74LS22  | .25  | 74LS247 | .75   |
| 74LS26  | .29  | 74LS248 | .99   |
| 74LS27  | .29  | 74LS249 | .99   |
| 74LS28  | .35  | 74LS251 | .59   |
| 74LS30  | .25  | 74LS253 | .59   |
| 74LS32  | .29  | 74LS257 | .59   |
| 74LS33  | .55  | 74LS258 | .59   |
| 74LS37  | .35  | 74LS259 | 2.75  |
| 74LS38  | .35  | 74LS260 | .59   |
| 74LS40  | .29  | 74LS261 | 2.25  |
| 74LS42  | .49  | 74LS266 | .55   |
| 74LS47  | .75  | 74LS273 | 1.49  |
| 74LS48  | .75  | 74LS275 | 3.35  |
| 74LS49  | .75  | 74LS279 | .49   |
| 74LS51  | .25  | 74LS280 | 1.98  |
| 74LS54  | .29  | 74LS283 | .69   |
| 74LS55  | .29  | 74LS289 | .89   |
| 74LS56  | 1.25 | 74LS293 | .99   |
| 74LS57  | .39  | 74LS295 | .99   |
| 74LS57A | .35  | 74LS298 | .89   |
| 74LS75  | .39  | 74LS299 | 1.75  |
| 74LS76  | .39  | 74LS322 | 5.95  |
| 74LS77  | .49  | 74LS323 | 3.50  |
| 74LS83  | .60  | 74LS324 | 2.50  |
| 74LS85  | .69  | 74LS348 | 2.50  |
| 74LS86  | .39  | 74LS352 | 1.29  |
| 74LS90  | .55  | 74LS353 | 1.29  |
| 74LS91  | .89  | 74LS363 | 1.35  |
| 74LS92  | .59  | 74LS364 | 1.95  |
| 74LS93  | .55  | 74LS365 | .49   |
| 74LS95  | .75  | 74LS366 | .49   |
| 74LS96  | .89  | 74LS367 | .45   |
| 74LS107 | .39  | 74LS368 | .45   |
| 74LS109 | .39  | 74LS373 | 1.39  |
| 74LS112 | .39  | 74LS374 | 1.39  |
| 74LS113 | .39  | 74LS375 | .95   |
| 74LS114 | .39  | 74LS377 | 1.39  |
| 74LS122 | .45  | 74LS378 | 1.18  |
| 74LS123 | .79  | 74LS379 | 1.35  |
| 74LS124 | 2.90 | 74LS385 | 3.90  |
| 74LS125 | .49  | 74LS386 | .45   |
| 74LS126 | .59  | 74LS387 | 1.19  |
| 74LS132 | .59  | 74LS393 | 1.19  |
| 74LS133 | .59  | 74LS395 | 1.19  |
| 74LS136 | .39  | 74LS396 | 1.89  |
| 74LS137 | .39  | 74LS399 | 1.49  |
| 74LS138 | .55  | 74LS424 | 2.95  |
| 74LS139 | .55  | 74LS447 | 1.95  |
| 74LS145 | 1.20 | 74LS90  | 1.95  |
| 74LS147 | 2.49 | 74LS540 | 1.95  |
| 74LS148 | 1.35 | 74LS541 | 1.95  |
| 74LS151 | .55  | 74LS624 | 3.99  |
| 74LS153 | .55  | 74LS640 | 2.20  |
| 74LS154 | .60  | 74LS645 | 2.20  |
| 74LS155 | .69  | 74LS668 | 1.69  |
| 74LS156 | .69  | 74LS669 | 1.89  |
| 74LS157 | .65  | 74LS670 | 1.49  |
| 74LS158 | .59  | 74LS674 | 14.95 |
| 74LS162 | .69  | 74LS684 | 3.20  |
| 74LS163 | .65  | 74LS685 | 3.20  |
| 74LS164 | .69  | 74LS688 | 2.40  |
| 74LS165 | .95  | 74LS689 | 3.20  |
| 74LS166 | 1.95 | 81LS95  | 1.49  |
| 74LS168 | 1.75 | 81LS96  | 1.49  |
| 74LS169 | 1.75 | 25LS228 | 8.15  |
| 74LS170 | 1.49 | 25LS229 | 2.80  |
| 74LS173 | .69  | 25LS238 | 3.74  |
| 74LS174 | .55  | 25LS269 | 2.80  |
| 74LS175 | .55  | 26LS31  | 2.19  |
| 74LS181 | 2.15 | 26LS32  | 2.19  |

**GENERATORS BIT RATE**

|         |       |
|---------|-------|
| MC19411 | 11.95 |
| BR19411 | 11.95 |
| 4702    | 12.95 |
| COM5016 | 16.95 |
| COM8116 | 10.95 |
| MM5307  | 10.95 |

**FUNCTION**

|        |      |
|--------|------|
| MC4024 | 3.95 |
| LM566  | 1.49 |
| XR2206 | 3.75 |
| 8038   | 3.95 |

**CRT CONTROLLERS**

|           |       |
|-----------|-------|
| 6845      | 12.95 |
| 6845A     | 19.95 |
| 6847      | 11.95 |
| 68047     | 24.95 |
| HD40505SP | 15.95 |
| MC1372    | 6.95  |
| 8275      | 29.95 |
| 7220      | 39.95 |
| CRT5027   | 19.95 |
| CRT5037   | 34.95 |
| DP9318A   | 39.95 |
| OP8950    | 49.95 |

**DISK CONTROLLERS**

|        |       |
|--------|-------|
| 1771   | 15.95 |
| 1791   | 23.95 |
| 1793   | 23.95 |
| 1795   | 23.95 |
| 1797   | 23.95 |
| 2791   | 54.95 |
| 2793   | 54.95 |
| 2795   | 59.95 |
| 2797   | 59.95 |
| 6843   | 34.95 |
| 8272   | 39.95 |
| UPD765 | 19.95 |
| MM8876 | 29.95 |
| MM8877 | 34.95 |
| 1691   | 7.95  |
| 2143   | 7.95  |

**KEYBOARD CHIPS**

|              |       |
|--------------|-------|
| AY5-2376     | 11.95 |
| AY5-3600 STD | 11.95 |
| AY5-3600 PRO | 11.95 |

**CLOCK CIRCUITS**

|            |       |
|------------|-------|
| MM5314     | 4.95  |
| MM5369     | 3.95  |
| MM5369-EST | 4.25  |
| MM5375     | 4.95  |
| MM58167    | 8.95  |
| MM58174    | 11.95 |
| MSM5832    | 3.95  |

**Z-80 2.5 MHz**

|          |       |
|----------|-------|
| Z80-CPU  | 3.95  |
| Z80-CTC  | 3.95  |
| Z80-DART | 10.95 |
| Z80-DMA  | 14.95 |
| Z80-     |       |

# 41256 256K DYNAMIC 200ns 39.95 HM6264P-15 8Kx8 STATIC 150ns 34.95

| 74S00  |      |        |       |
|--------|------|--------|-------|
| 74S00  | .32  | 74S135 | .89   |
| 74S02  | .35  | 74S138 | .85   |
| 74S03  | .35  | 74S139 | .85   |
| 74S04  | .35  | 74S140 | .85   |
| 74S05  | .35  | 74S151 | .95   |
| 74S08  | .35  | 74S153 | .95   |
| 74S09  | .40  | 74S157 | .95   |
| 74S10  | .35  | 74S158 | .95   |
| 74S11  | .35  | 74S161 | 1.95  |
| 74S15  | .35  | 74S162 | .95   |
| 74S20  | .35  | 74S163 | 1.95  |
| 74S22  | .35  | 74S168 | 3.95  |
| 74S30  | .35  | 74S169 | 3.95  |
| 74S32  | .40  | 74S174 | .95   |
| 74S37  | .88  | 74S175 | .95   |
| 74S38  | .88  | 74S180 | 1.95  |
| 74S40  | .35  | 74S181 | 3.95  |
| 74S51  | .35  | 74S182 | 2.95  |
| 74S64  | .40  | 74S185 | 16.95 |
| 74S65  | .40  | 74S188 | 1.95  |
| 74S74  | .50  | 74S189 | 6.95  |
| 74S85  | 1.99 | 74S194 | 1.49  |
| 74S86  | .50  | 74S195 | 1.49  |
| 74S112 | .50  | 74S196 | 1.49  |
| 74S113 | .50  | 74S197 | 1.49  |
| 74S114 | .55  | 74S201 | 6.95  |
| 74S124 | 2.75 | 74S225 | 7.95  |
| 74S132 | 1.24 | 74S240 | 2.20  |
| 74S133 | .45  | 74S240 | 2.20  |
| 74S134 | .50  | 74S241 | 2.20  |

| CMOS  |       |        |       |
|-------|-------|--------|-------|
| 4000  | .29   | 4532   | 1.95  |
| 4001  | .25   | 4538   | 1.95  |
| 4002  | .25   | 4539   | 1.95  |
| 4006  | .89   | 4541   | 2.64  |
| 4007  | .29   | 4543   | 1.19  |
| 4008  | .95   | 4553   | 5.79  |
| 4009  | .39   | 4555   | .95   |
| 4010  | .45   | 4556   | .95   |
| 4011  | .25   | 4558   | 2.45  |
| 4012  | .25   | 4560   | 4.25  |
| 4013  | .38   | 4569   | 3.49  |
| 4014  | .79   | 4581   | 1.95  |
| 4015  | .39   | 4582   | 1.95  |
| 4016  | .39   | 4584   | .75   |
| 4017  | .69   | 4585   | .75   |
| 4018  | .79   | 4515   | 12.95 |
| 4019  | .39   | 7410   | 3.35  |
| 4020  | .75   | 4724   | 1.50  |
| 4021  | .79   | 74C00  | .35   |
| 4022  | .79   | 74C02  | .35   |
| 4023  | .29   | 74C04  | .35   |
| 4024  | .65   | 74C08  | .35   |
| 4025  | .29   | 74C10  | .35   |
| 4026  | 1.65  | 74C14  | .59   |
| 4027  | .45   | 74C20  | .35   |
| 4028  | .69   | 74C30  | .35   |
| 4029  | .79   | 74C32  | .39   |
| 4030  | .39   | 74C42  | 1.29  |
| 4031  | 1.95  | 74C48  | 1.99  |
| 4035  | .85   | 74C73  | .65   |
| 4040  | .75   | 74C74  | .65   |
| 4041  | .75   | 74C76  | .80   |
| 4042  | .69   | 74C83  | 1.95  |
| 4043  | .85   | 74C85  | 1.95  |
| 4044  | .79   | 74C86  | .95   |
| 4046  | .85   | 74C89  | 4.50  |
| 4047  | .95   | 74C90  | 1.19  |
| 4048  | .69   | 74C93  | 1.75  |
| 4049  | .35   | 74C95  | .99   |
| 4050  | .35   | 74C100 | 5.75  |
| 4051  | .79   | 74C151 | 2.25  |
| 4052  | 1.95  | 74C152 | 1.95  |
| 4053  | .79   | 74C157 | 1.75  |
| 4056  | .89   | 74C160 | 1.19  |
| 4060  | .39   | 74C161 | 1.19  |
| 4068  | .39   | 74C162 | 1.19  |
| 4069  | .25   | 74C163 | 1.19  |
| 4070  | .35   | 74C164 | 1.19  |
| 4071  | .29   | 74C165 | 2.00  |
| 4072  | .29   | 74C173 | .79   |
| 4073  | .29   | 74C174 | 1.19  |
| 4075  | .29   | 74C175 | 1.19  |
| 4076  | .79   | 74C192 | 1.49  |
| 4077  | .59   | 74C193 | 1.49  |
| 4078  | .29   | 74C195 | 1.49  |
| 4081  | .29   | 74C200 | 5.75  |
| 4082  | .29   | 74C221 | 1.75  |
| 4085  | .95   | 74C224 | 2.25  |
| 4086  | .95   | 74C273 | 2.45  |
| 4087  | .49   | 74C374 | 2.45  |
| 4089  | 2.99  | 74C381 | .39   |
| 4098  | 2.49  | 74C902 | .85   |
| 4099  | 1.95  | 74C903 | .85   |
| 14409 | 12.95 | 74C905 | 10.95 |
| 14410 | 12.95 | 74C906 | .95   |
| 14411 | 11.95 | 74C907 | 1.00  |
| 14412 | 12.95 | 74C908 | 2.00  |
| 14419 | 7.95  | 74C909 | 2.95  |
| 14423 | 14.95 | 74C910 | 9.95  |
| 4502  | .95   | 74C911 | 8.95  |
| 4503  | .65   | 74C912 | 8.95  |
| 4507  | 1.25  | 74C914 | 1.95  |
| 4508  | 1.95  | 74C915 | 1.19  |
| 4510  | .85   | 74C918 | 2.75  |
| 4511  | .85   | 74C920 | 17.95 |
| 4512  | .85   | 74C921 | 15.95 |
| 4514  | 1.25  | 74C922 | 4.49  |
| 4515  | 1.79  | 74C923 | 4.95  |
| 4516  | 1.55  | 74C925 | 5.95  |
| 4518  | .89   | 74C926 | 7.95  |
| 4519  | .39   | 74C927 | 7.95  |
| 4520  | .79   | 74C928 | 7.95  |
| 4521  | 4.99  | 74C929 | 19.95 |
| 4522  | 1.25  | 74C930 | 4.95  |
| 4526  | 1.25  | 80C95  | .85   |
| 4527  | 1.95  | 80C96  | .95   |
| 4528  | 1.19  | 80C99  | .95   |
| 4529  | 2.95  | 80C98  | 1.20  |
| 4531  | .95   |        |       |

| HIGH SPEED CMOS                                                                                                                                                                                                                             |      |          |      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------|------|
| A new family of high speed CMOS logic featuring the speed of low power Schottky (8ns typical gate propagation delay), combined with the advantages of CMOS: very low power consumption, superior noise immunity, and improved output drive. |      |          |      |
| 74HC00                                                                                                                                                                                                                                      |      |          |      |
| 74HC: Operate at CMOS logic levels and are ideal for new, all-CMOS designs.                                                                                                                                                                 |      |          |      |
| 74HC00                                                                                                                                                                                                                                      | .59  | 74HC175  | .99  |
| 74HC02                                                                                                                                                                                                                                      | .59  | 74HC193  | 1.25 |
| 74HC04                                                                                                                                                                                                                                      | .59  | 74HC194  | 1.04 |
| 74HC08                                                                                                                                                                                                                                      | .59  | 74HC195  | 1.09 |
| 74HC10                                                                                                                                                                                                                                      | .59  | 74HC238  | 1.35 |
| 74HC11                                                                                                                                                                                                                                      | .59  | 74HC240  | 1.89 |
| 74HC14                                                                                                                                                                                                                                      | .79  | 74HC241  | 1.89 |
| 74HC20                                                                                                                                                                                                                                      | .59  | 74HC242  | 1.89 |
| 74HC27                                                                                                                                                                                                                                      | .59  | 74HC243  | 1.89 |
| 74HC32                                                                                                                                                                                                                                      | .69  | 74HC244  | 1.89 |
| 74HC51                                                                                                                                                                                                                                      | .59  | 74HC245  | 1.89 |
| 74HC74                                                                                                                                                                                                                                      | .75  | 74HC251  | .89  |
| 74HC79                                                                                                                                                                                                                                      | .59  | 74HC257  | .85  |
| 74HC85                                                                                                                                                                                                                                      | 1.35 | 74HC259  | 1.39 |
| 74HC86                                                                                                                                                                                                                                      | .69  | 74HC273  | 1.89 |
| 74HC93                                                                                                                                                                                                                                      | 1.19 | 74HC299  | 4.99 |
| 74HC125                                                                                                                                                                                                                                     | 1.19 | 74HC367  | .99  |
| 74HC132                                                                                                                                                                                                                                     | 1.19 | 74HC373  | 2.29 |
| 74HC138                                                                                                                                                                                                                                     | .99  | 74HC374  | 2.29 |
| 74HC139                                                                                                                                                                                                                                     | .99  | 74HC393  | 1.39 |
| 74HC151                                                                                                                                                                                                                                     | .89  | 74HC407  | 1.99 |
| 74HC152                                                                                                                                                                                                                                     | 2.49 | 74HC4020 | 1.39 |
| 74HC153                                                                                                                                                                                                                                     | .89  | 74HC4024 | 1.59 |
| 74HC154                                                                                                                                                                                                                                     | 2.49 | 74HC4040 | 1.39 |
| 74HC157                                                                                                                                                                                                                                     | .89  | 74HC4049 | .89  |
| 74HC161                                                                                                                                                                                                                                     | 1.15 | 74HC4050 | .89  |
| 74HC164                                                                                                                                                                                                                                     | 1.25 | 74HC4050 | 1.29 |
| 74HC166                                                                                                                                                                                                                                     | 2.95 | 74HC4511 | 2.39 |
| 74HC174                                                                                                                                                                                                                                     | .99  | 74HC4538 | 2.29 |

| VOLTAGE REGULATORS  |              |        |       |
|---------------------|--------------|--------|-------|
| TO-220 CASE PACKAGE |              |        |       |
| 7805T               | .75          | 7905T  | .85   |
| 7808T               | .75          | 7908T  | .85   |
| 7812T               | .75          | 7912T  | .85   |
| 7815T               | .75          | 7915T  | .85   |
| 7824T               | .75          | 7924T  | .85   |
| TO-3 CASE PACKAGE   |              |        |       |
| 7805K               | 1.39         | 7905K  | 1.49  |
| 7812K               | 1.39         | 7912K  | 1.49  |
| 7815K               | 1.39         | 7915K  | 1.49  |
| 7824K               | 1.39         | 7924K  | 1.49  |
| TO-92 CASE PACKAGE  |              |        |       |
| 78L05               | .69          | 79L05  | .79   |
| 78L12               | .69          | 79L12  | .79   |
| 78L15               | .69          | 79L15  | .79   |
| OTHER VOLTAGE REGS  |              |        |       |
| 78M05C              | 5volt 1/2amp | TO-220 | .35   |
| LM233K              | 5volt 3amp   | TO-3   | 4.95  |
| LM338K              | Adj. 5amp    | TO-3   | 3.95  |
| 78H05K              | 5volt 5amp   | TO-3   | 9.95  |
| 78H12K              | 12volt 5amp  | TO-3   | 9.95  |
| 78P05K              | 5volt 10amp  | TO-3   | 14.95 |
| UA7854D             | FAIRCHILD    | DIP    | 1.95  |

| 7400 |      |       |      |
|------|------|-------|------|
| 7400 | .19  | 7483  | .50  |
| 7401 | .19  | 7485  | .59  |
| 7402 | .19  | 7486  | .35  |
| 7403 | .19  | 7489  | 2.15 |
| 7404 | .19  | 7490  | .35  |
| 7405 | .25  | 7491  | .40  |
| 7406 | .29  | 7492  | .50  |
| 7407 | .29  | 7493  | .35  |
| 7408 | .24  | 7494  | .65  |
| 7409 | .19  | 7495  | .55  |
| 7410 | .19  | 7496  | .70  |
| 7411 | .25  | 7497  | 2.75 |
| 7412 | .30  | 74100 | 1.75 |
| 7413 | .35  | 74105 | 1.14 |
| 7414 | .49  | 74107 | .30  |
| 7416 | .25  | 74109 | .45  |
| 7417 | .25  | 74110 | .45  |
| 7420 | .19  | 74111 | .55  |
| 7421 | .35  | 74116 | 1.55 |
| 7422 | .35  | 74120 | 1.20 |
| 7423 | .29  | 74121 | .29  |
| 7425 | .29  | 74122 | .45  |
| 7426 | .29  | 74123 | .49  |
| 7427 | .29  | 74124 | .45  |
| 7428 | .45  | 74126 | .45  |
| 7430 | .19  | 74128 | .55  |
| 7432 | .29  | 74132 | .45  |
| 7433 | .45  | 74136 | .50  |
| 7437 | .29  | 74141 | .65  |
| 7438 | .29  | 74142 | 2.95 |
| 7439 | .79  | 74143 | .65  |
| 7440 | .19  | 74144 | 2.95 |
| 7442 | .49  | 74145 | .60  |
| 7443 | .65  | 74147 | 1.75 |
| 7444 | .69  | 74148 | 1.20 |
| 7445 | .69  | 74150 | 1.35 |
| 7446 | .69  | 74151 | .75  |
| 7447 | .69  | 74152 | .65  |
| 7448 | .69  | 74153 | .55  |
| 7450 | .19  | 74154 | 1.25 |
| 7451 | .23  | 74155 | .75  |
| 7453 | .23  | 74156 | .65  |
| 7454 | .23  | 74157 | .65  |
| 7460 | .35  | 74159 | 1.65 |
| 7470 | .35  | 74160 | .85  |
| 7472 | .29  | 74161 | .69  |
| 7473 | .34  | 74162 | .85  |
| 7474 | .33  | 74163 | .69  |
| 7475 | .45  | 74164 | .85  |
| 7476 | .35  | 74165 | .85  |
| 7480 | .59  | 74166 | 1.00 |
| 7481 | 1.10 | 74167 | 2.96 |
| 7482 | .95  | 74170 | 1.65 |

| 74120 |      |       |      |
|-------|------|-------|------|
| 74120 | 5.95 | 74172 | 5.95 |
| 74173 | .75  | 74173 | .75  |
| 74174 | .89  | 74174 | .89  |
| 74175 | .89  | 74175 | .89  |
| 74176 | .89  | 74176 | .89  |
| 74177 | .75  | 74177 | .75  |
| 74178 | 1.15 | 74178 | 1.15 |
| 74179 | 1.75 | 74179 | 1.75 |
| 74180 | .75  | 74180 | .75  |
| 74181 | 2.25 | 74181 | 2.25 |
| 74182 | 2.00 | 74182 | 2.00 |
| 74183 | .79  | 74183 | .79  |
| 74184 | 2.75 | 74184 | 2.75 |
| 74185 | 2.00 | 74185 | 2.00 |
| 74189 | 2.99 | 74189 | 2.99 |
| 74190 | 1.15 | 74190 | 1.15 |
| 74191 | 1.15 | 74191 | 1.15 |
| 74192 | .79  | 74192 | .79  |
| 74193 | .79  | 74193 | .79  |
| 74194 | .85  | 74194 | .85  |
| 74195 | .85  | 74195 | .85  |
| 74196 | .79  | 74196 | .79  |
| 74197 | .75  | 74197 | .75  |
| 74198 | 1.35 | 74198 | 1.35 |
| 74199 | 1.35 | 74199 | 1.35 |
| 74221 | .45  | 74221 | .45  |
| 74246 | 1.35 | 74246 | 1.35 |
| 74247 | 1.25 | 74247 | 1.25 |
| 74248 | 1.85 | 74248 | 1.85 |
| 74249 | 1.95 | 74249 | 1.95 |
| 74251 | 7.75 | 74251 | 7.75 |
| 74252 | 7.75 | 74252 | 7.75 |
| 74253 | 2.25 | 74253 | 2.25 |
| 74254 | 6.55 | 74254 | 6.55 |
| 74265 | 1.35 | 74265 | 1.35 |
| 74273 | 1.95 | 74273 | 1.95 |
| 74276 | 1.25 | 74276 | 1.25 |
| 74278 | 3.11 | 74278 | 3.11 |
| 74279 | .75  | 74279 | .75  |
| 74283 | 2.00 | 74283 | 2.00 |
| 74284 | 3.75 | 74284 | 3.75 |
| 74285 | 3.75 | 74285 | 3.75 |
| 74289 | 2.00 | 74289 | 2.00 |
| 74290 | .95  | 74290 | .95  |
| 74293 | .75  | 74293 | .75  |
| 74298 | .85  | 74298 | .85  |
| 74351 | 2.25 | 74351 | 2.25 |
| 74365 | .65  | 74365 | .65  |
| 74366 | .65  | 74366 | .65  |
| 74367 | .65  | 74367 | .65  |
| 74368 | .65  | 74368 | .65  |
| 74376 | 2.20 | 74376 | 2.20 |
| 74390 | 1.75 | 74390 | 1.75 |
| 74393 | 1.35 | 74393 | 1.35 |
| 74425 | 3.15 | 74425 | 3.15 |
| 74426 | .85  | 74426 | .85  |
| 74429 | 2.95 | 74429 | 2.95 |
| 74490 | 2.55 | 74490 | 2.55 |

| 74HCT00                                                                                             |     |          |      |
|-----------------------------------------------------------------------------------------------------|-----|----------|------|
| 74HCT: Direct, drop-in replacements for LS TTL and can be intermixed with 74LS in the same circuit. |     |          |      |
| 74HCT00                                                                                             | .69 | 74HCT175 | 1.09 |
| 74HCT02                                                                                             | .69 | 74HCT193 | 1.39 |
| 74HCT04                                                                                             | .69 | 74HCT194 | 1.19 |
| 74HCT08                                                                                             | .69 | 74HCT195 | 1.29 |
| 74HCT10                                                                                             | .69 | 74HCT238 | 1.49 |
| 74HCT1                                                                                              |     |          |      |

27128

16Kx8 EPROM  
250ns

24.95

4116

16K DYNAMIC  
250ns

8/7.95

**BARGAIN HUNTERS CORNER**  
**2 LEVEL WIRE WRAP SOCKETS**

THESE SOCKETS HAVE .50" LEADS. JUST A LITTLE SHORTER THAN THE STANDARD 3 LEVEL WIRE WRAP SOCKETS WITH .67" LEADS.

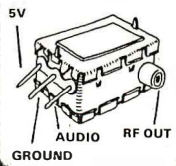
|             |      |        |
|-------------|------|--------|
|             | 1-99 | 100-UP |
| 8 PIN WW-2  | .40  | .35    |
| 14 PIN WW-2 | .45  | .38    |
| 16 PIN WW-2 | .45  | .39    |
| 20 PIN WW-2 | .75  | .59    |
| 22 PIN WW-2 | .50  | .39    |
| 24 PIN WW-2 | .89  | .75    |
| 28 PIN WW-2 | .89  | .75    |
| 40 PIN WW-2 | .99  | .89    |

**SPECIALS END 1/31/85**

**RF MODULATOR**  
(ASTEC UM1082)

- QUANTITIES LIMITED
- PRESET TO CHANNEL 3
- USE TO BUILD TV COMPUTER INTERFACE
- +5 VOLT OPERATION

**\$6.95**



**EMI FILTER**  
• MFG BY CORONA  
• LOW COST  
• FITS LC-HP BELOW

**\$4.95**

- LINE CORDS**
- LC-2 2 CONDUCTOR 6 FT .39
  - LC-3 3 CONDUCTOR 6 FT .39
  - LC-HP 3 CONDUCTOR WITH STANDARD FEMALE SOCKET 6 FT 1.49
  - LC-CIR CIGARETTE LIGHTER PLUG WITH 6 FT COILED CORD 2.95

- MUFFIN FANS**
- 4.68" SQUARE 14.95
  - 3.125" SQUARE 14.95

- RESISTORS**  
1/4 WATT 5% CARBON FILM  
ALL STANDARD VALUES  
FROM 1 OHM TO 10 MEG OHM
- 50 PIECES SAME VALUE .025
  - 100 PIECES SAME VALUE .02
  - 1000 PIECES SAME VALUE .015

- BYPASS CAPS**
- .01 µf DISC 100/\$6.00
  - .01 µf MONOLITHIC 100/\$12.00
  - .1 µf DISC 100/\$8.00
  - .1 µf MONOLITHIC 100/\$15.00

- DIODES**
- 1N751 5.1 VOLT ZENER .25
  - 1N759 12.0 VOLT ZENER .25
  - 1N4148 1N94 SWITCHING 25/1.00
  - 1N4001 50PIV 1A 12/1.00
  - 1N4004 400PIV RECTIFIER 10/1.00
  - 1N5402 200PIV 3A .25
  - KBP02 200PIV 1.5A BRIDGE .45
  - KBP04 400PIV 1.5A BRIDGE .55
  - MDA801 50PIV 12A BRIDGE 1.39
  - MDA901 50PIV 12A BRIDGE 1.95
  - MDA980-2 100PIV 12A BRIDGE 2.25
  - VM48 DIP-BRIDGE .35

**CAPACITORS TANTALUM**

|       |          |       |          |
|-------|----------|-------|----------|
| 1.0µf | 15V .40  | .47µf | 35V .50  |
| 6.8   | 15V .70  | 1.0   | 35V .45  |
| 10    | 15V .80  | 2.2   | 35V .65  |
| 22    | 15V 1.35 | 4.7   | 35V .85  |
| .22   | 35V .40  | 10    | 35V 1.00 |

**DISC**

|      |         |        |         |
|------|---------|--------|---------|
| 10µf | 50V .05 | 560    | 50V .05 |
| 22   | 50V .05 | 680    | 50V .05 |
| 25   | 50V .05 | 820    | 50V .05 |
| 27   | 50V .05 | .001µf | 50V .05 |
| 33   | 50V .05 | .0015  | 50V .05 |
| 47   | 50V .05 | .0022  | 50V .05 |
| 56   | 50V .05 | .005   | 50V .05 |
| 68   | 50V .05 | .01    | 50V .07 |
| 82   | 50V .05 | .02    | 50V .07 |
| 100  | 50V .05 | .05    | 50V .07 |
| 220  | 50V .05 | .1     | 12V .10 |

**MONOLITHIC**

|        |         |       |         |
|--------|---------|-------|---------|
| .01µf  | 50V .14 | .1µf  | 50V .18 |
| .047µf | 50V .15 | .47µf | 50V .25 |

**ELECTROLYTIC**

|      |         |     |         |
|------|---------|-----|---------|
| 1µf  | 25V .14 | 1µf | 50V .14 |
| 2.2  | 35V .15 | 4.7 | 16V .14 |
| 4.7  | 50V .15 | 10  | 16V .14 |
| 10   | 50V .15 | 10  | 50V .16 |
| 47   | 35V .18 | 22  | 16V .14 |
| 100  | 16V .18 | 47  | 50V .20 |
| 220  | 35V .20 | 100 | 15V .20 |
| 470  | 25V .30 | 100 | 35V .25 |
| 2200 | 16V .60 | 220 | 25V .30 |
|      |         | 330 | 16V .40 |

**COMPUTER GRADE**

|              |      |      |         |
|--------------|------|------|---------|
| 44,000µf 30V | 3.95 | 550  | 16V .42 |
|              |      | 1000 | 16V .60 |
|              |      | 2200 | 16V .70 |
|              |      | 6000 | 16V .85 |

**LED DISPLAYS**

|                         |       |       |      |
|-------------------------|-------|-------|------|
| HP5082-7760             | CC    | 43"   | 1.29 |
| MAN-72                  | CA    | 3"    | .99  |
| MAN-74                  | CC    | 3"    | .99  |
| FND-537(359)            | CC    | .375" | 1.25 |
| FND-500(503)            | CC    | .5"   | 1.49 |
| FND-507(510)            | CA    | .5"   | 1.49 |
| TIL-311 4x7 HEX W/LOGIC | .270" |       | 9.95 |

**DIFFUSED LEADS**

|              |        |      |        |
|--------------|--------|------|--------|
| JUMBO RED    | T1 1/4 | 1.99 | 100-up |
| JUMBO GREEN  | T1 1/4 | .10  | .09    |
| JUMBO YELLOW | T1 1/4 | .18  | .15    |
| MOUNTING HDW | T1 1/4 | .10  | .09    |
| MINI RED     | T1     | .10  | .09    |
| MINI GREEN   | T1     | .18  | .15    |
| MINI YELLOW  | T1     | .18  | .15    |
| RECT RED     | 2x5mm  | .25  | .22    |
| RECT GREEN   | 2x5mm  | .30  | .27    |
| RECT YELLOW  | 2x5mm  | .30  | .27    |

**HARD TO FIND "SNAPABLE" HEADERS**

Can easily be snapped apart to make any size header, all with .1" centers

|                    |      |
|--------------------|------|
| 1x36 STRAIGHT LEAD | .99  |
| 2x40 STRAIGHT LEAD | 2.49 |
| 2x40 RIGHT ANGLE   | 2.99 |

**SHORTING BLOCKS**

SPACED AT .1" CENTERS IDEAL FOR DISK DRIVES OR ANY .1" HEADER

**5/1.00**

**DIP SWITCHES**

|             |      |
|-------------|------|
| 4 POSITION  | .85  |
| 5 POSITION  | .90  |
| 6 POSITION  | .90  |
| 7 POSITION  | .95  |
| 8 POSITION  | .95  |
| 10 POSITION | 1.29 |

**36 PIN CENTRONICS**

|                               |      |
|-------------------------------|------|
| IDCEN36 RIBBON CABLE MALE     | 8.95 |
| IDCEN36/F RIBBON CABLE FEMALE | 8.95 |
| CEN36 SOLDER CUP MALE         | 7.95 |

**EDGE CARD CONNECTORS**

|           |      |
|-----------|------|
| S-100 ST  | 3.95 |
| S-100 WW  | 4.95 |
| 72 PIN ST | 6.95 |
| 72 PIN WW | 7.95 |
| 62 PIN ST | 4.95 |
| 50 PIN ST | 4.95 |
| 44 PIN ST | 2.95 |
| 44 PIN WW | 4.95 |

**DIP CONNECTORS**

| DESCRIPTION                           | ORDER BY  | CONTACTS |      |      |      |      |      |      |      |      |
|---------------------------------------|-----------|----------|------|------|------|------|------|------|------|------|
|                                       |           | 8        | 14   | 16   | 18   | 20   | 22   | 24   | 28   | 40   |
| HIGH RELIABILITY TOOLED ST IC SOCKETS | AUGATxxST | .99      | .99  | .99  | 1.69 | 1.89 | 1.89 | 1.99 | 2.49 | 2.99 |
| HIGH RELIABILITY TOOLED WW IC SOCKETS | AUGATxxWW | 1.30     | 1.80 | 2.10 | 2.40 | 2.50 | 2.90 | 3.15 | 3.70 | 5.40 |
| COMPONENT CARRIES (DIP HEADERS)       | ICCxx     | .65      | .75  | .85  | 1.00 | 1.25 | 1.25 | 1.35 | 1.50 | 2.10 |
| RIBBON CABLE DIP PLUGS (IDC)          | IDPxx     | ---      | 1.45 | 1.65 | ---  | ---  | ---  | 2.50 | ---  | 4.15 |

FOR ORDERING INSTRUCTIONS SEE IDC CONNECTORS BELOW

**D-SUBMINIATURE**

| DESCRIPTION           | ORDER BY       | CONTACTS |      |      |       |      |
|-----------------------|----------------|----------|------|------|-------|------|
|                       |                | 9        | 15   | 25   | 37    | 50   |
| SOLDER CUP            | MALE DBxxP     | 2.08     | 2.69 | 2.50 | 4.80  | 6.06 |
|                       | FEMALE DBxxS   | 2.66     | 3.63 | 3.25 | 7.11  | 9.24 |
| RIGHT ANGLE PC SOLDER | MALE DBxxPR    | 1.65     | 2.20 | 3.00 | 4.83  | ---  |
|                       | FEMALE DBxxSR  | 2.18     | 3.03 | 4.42 | 6.19  | ---  |
| WIRE WRAP             | MALE DBxxPWW   | 1.69     | 2.56 | 3.89 | 5.60  | ---  |
|                       | FEMALE DBxxSww | 2.76     | 4.27 | 6.84 | 9.95  | ---  |
| IDC RIBBON CABLE      | MALE IDBxxP    | 3.37     | 4.70 | 6.23 | 9.22  | ---  |
|                       | FEMALE IDBxxS  | 3.69     | 5.13 | 6.84 | 10.08 | ---  |
| HOODS                 | BLACK HOOD-B   | ---      | ---  | 1.25 | ---   | ---  |
|                       | GREY HOOD      | 1.60     | 1.60 | 1.25 | 2.95  | 3.50 |

**MOUNTING HARDWARE - \$1.00**

FOR ORDERING INSTRUCTIONS SEE IDC CONNECTORS BELOW



IDB37S



DB37S

**TEXTTOOL ZERO INSERTION FORCE SOCKETS AND RECEPTILES**



| TYPE          | CONTACTS |      |      |       |       |
|---------------|----------|------|------|-------|-------|
|               | 14       | 16   | 24   | 28    | 40    |
| ECONO ZIF     | ---      | 4.95 | 6.75 | 7.75  | 9.95  |
| ZIF SOCKET    | 5.95     | 5.95 | 7.95 | 8.95  | 10.95 |
| ZIF RECEPTILE | 8.25     | 8.75 | 9.75 | 10.50 | 12.75 |

**IDC CONNECTORS**

| DESCRIPTION               | ORDER BY | CONTACTS |      |      |      |      |      |
|---------------------------|----------|----------|------|------|------|------|------|
|                           |          | 10       | 20   | 26   | 34   | 50   |      |
| SOLDER HEADER             | IDHxxS   | .82      | 1.29 | 1.68 | 2.20 | 2.58 | 3.24 |
| RIGHT ANGLE SOLDER HEADER | IDHxxSR  | .85      | 1.35 | 1.76 | 2.31 | 2.72 | 3.39 |
| WW HEADER                 | IDHxxW   | 1.86     | 2.98 | 3.84 | 4.50 | 5.28 | 6.63 |
| RIGHT ANGLE WW HEADER     | IDHxxWR  | 2.05     | 3.28 | 4.22 | 4.45 | 4.80 | 7.30 |
| RIBBON HEADER SOCKET      | IDSxx    | 1.15     | 1.86 | 2.43 | 3.15 | 3.73 | 4.65 |
| RIBBON HEADER             | IDMxx    | ---      | 5.50 | 6.25 | 7.00 | 7.50 | 8.50 |
| RIBBON EDGE CARD          | IDExx    | 2.25     | 2.36 | 2.65 | 3.25 | 3.80 | 4.74 |



IDH20WR



IDE50

**RIBBON CABLE**

| CONTACTS | SINGLE COLOR |       |      |       | COLOR CODED |     |    |     |
|----------|--------------|-------|------|-------|-------------|-----|----|-----|
|          | 1'           | 10'   | 1'   | 10'   | 1'          | 10' | 1' | 10' |
| 10       | .50          | 4.40  | .83  | 7.30  |             |     |    |     |
| 16       | .55          | 4.80  | 1.00 | 8.80  |             |     |    |     |
| 20       | .65          | 5.70  | 1.25 | 11.00 |             |     |    |     |
| 25       | .75          | 6.60  | 1.32 | 11.60 |             |     |    |     |
| 26       | .75          | 6.60  | 1.32 | 11.60 |             |     |    |     |
| 34       | .98          | 8.60  | 1.65 | 14.50 |             |     |    |     |
| 40       | 1.32         | 11.60 | 1.92 | 16.80 |             |     |    |     |
| 50       | 1.38         | 12.10 | 2.50 | 22.00 |             |     |    |     |

**VISIT OUR NEW, EXPANDED RETAIL STORE AT 1256 SOUTH BASCOM IN SAN JOSE**

HOURS: M-W-F, 9-5 T-TH, 9-9 SAT., 10-3



**JDR Microdevices**  
1224 S. Bascom Avenue, San Jose, CA 95128  
800-538-5000 • 800-662-6279 (CA)  
(408) 995-5430 • Telex 171-110  
FAX (408) 275-8415

PLEASE USE YOUR CUSTOMER NUMBER WHEN ORDERING

TERMS: Minimum order \$10. For shipping and handling include \$2.50 for UPS Ground and \$3.50 for UPS Air. Orders over 1 lb. and foreign orders may require additional shipping charges - please contact our sales department for the amount. CA residents must include 6% sales tax. Bay Area and LA residents include 6.75%. Prices subject to change without notice. We are not responsible for typographical errors. We reserve the right to limit quantities and to substitute manufacturer. All merchandise subject to prior sale.

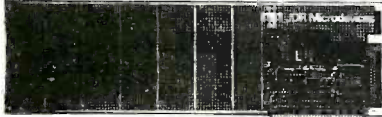
© Copyright 1984 JDR Microdevices



**HM6116-4** 2Kx8 STATIC CMOS 200ns **4.75**

**2732** 4Kx8 EPROM 450ns **4.95**

**WIRE WRAP PROTOTYPE CARDS**  
FR-4 EPOXY GLASS LAMINATE  
WITH GOLD-PLATED EDGE-CARD FINGERS



**IBM-PR2**  
**IBM**  
BOTH CARDS HAVE SILK SCREENED LEDGENDS AND INCLUDES MOUNTING BRACKET

IBM-PR1 WITH +5V AND GROUND PLANE . . . \$27.95  
IBM-PR2 AS ABOVE WITH GROUNDING AREA . . . \$27.95

**S-100**

P100-1 BARE - NO FOIL PADS . . . \$15.15  
P100-2 HORIZONTAL BUS . . . \$21.80  
P100-3 VERTICAL BUS . . . \$21.80  
P100-4 SINGLE FOIL PADS PER HOLE . . . \$22.75

**APPLE**

P500-1 BARE - NO FOIL PADS . . . \$15.15  
P500-3 HORIZONTAL BUS . . . \$22.75  
P500-4 SINGLE FOIL PADS PER HOLE . . . \$21.80  
7060-45 FOR APPLE IIe AUX SLOT . . . \$30.00

**GENERAL PURPOSE**  
22/44 PIN EDGE-CARD (.156" SPACING)

P441-1 BARE - NO FOIL PADS 4.5" x 6.0" . . . \$9.45  
P441-3 VERTICAL BUS 4.5" x 6.0" . . . \$13.95  
P441-4 SINGLE FOIL PADS 4.5" x 6.0" . . . \$14.20  
P442-1 BARE - NO FOIL PADS 4.5" x 9.0" . . . \$10.40  
P442-3 VERTICAL BUS 4.5" x 9.0" . . . \$14.20  
P442-4 SINGLE FOIL PADS 4.5" x 9.0" . . . \$13.50

36/72 PIN EDGE-CARD (.1" SPACING)

P721-1 BARE - NO FOIL PADS 4.5" x 6.0" . . . \$9.45  
P721-3 VERTICAL BUS 4.5" x 6.0" . . . \$13.25  
P721-4 SINGLE FOIL PADS 4.5" x 6.0" . . . \$14.20  
P722-1 BARE - NO FOIL PADS 4.5" x 9.0" . . . \$10.40  
P722-3 VERTICAL BUS 4.5" x 9.0" . . . \$14.20  
P722-4 SINGLE FOIL PADS 4.5" x 9.0" . . . \$15.15

**BARE GLASS BOARDS** **EXTENDER CARDS**  
NO EDGE-CARD FINGERS OR FOIL

P25x45 2.5" x 4.5" \$2.40 IBM \$45.00  
P45x65 4.5" x 6.5" \$4.70 APPLE \$45.00  
P45x85 4.5" x 8.5" \$6.20 MULTIBUS \$86.00  
P45x170 4.5" x 17.0" \$11.35  
P85x170 8.5" x 17.0" \$18.95

**WIRE WRAP WIRE**  
PRECUT AND STRIPPED

Note: 1 inch of insulation is stripped on each end. A 3.5" wire has only 1.5" of insulation.

| LENGTH (INCHES) | QUANTITY | 100   | 500   | 1000 |
|-----------------|----------|-------|-------|------|
| 2.5             | 1.60     | 4.70  | 8.20  |      |
| 3               | 1.60     | 4.70  | 8.20  |      |
| 3.5             | 1.65     | 5.00  | 8.90  |      |
| 4               | 1.75     | 5.40  | 9.60  |      |
| 4.5             | 1.80     | 5.75  | 10.30 |      |
| 5               | 1.85     | 6.10  | 11.00 |      |
| 5.5             | 1.90     | 6.50  | 11.75 |      |
| 6               | 2.00     | 6.85  | 12.50 |      |
| 6.5             | 2.30     | 7.80  | 14.30 |      |
| 7               | 2.40     | 8.20  | 15.05 |      |
| 7.5             | 2.50     | 8.55  | 15.95 |      |
| 8               | 2.60     | 8.95  | 16.60 |      |
| 8.5             | 2.65     | 9.30  | 17.40 |      |
| 9               | 2.70     | 9.80  | 18.15 |      |
| 9.5             | 2.80     | 10.00 | 18.95 |      |
| 10              | 2.90     | 10.50 | 19.70 |      |

**PRECUT ASSORTMENT**  
IN ASSORTED COLORS \$27.50

100ea: 5.5", 6", 6.5", 7"  
250ea: 2.5", 4.5", 5"  
500ea: 3", 3.5", 4"

**SPOOLS**

100 feet \$4.30 250 feet \$7.25  
500 feet \$13.25 1000 feet \$21.95

Please specify color:  
Blue, Black, Yellow or Red

**GE NICKEL-CADIUM RECHARGABLE BATTERIES**

**NI-CARD CHARGER PACKAGE**  
PRICE INCLUDES CHARGER (WALL PLUG), BATTERIES, & MODULAR BATTERY HOLDER

| AAA CELLS | QTY. 2 | \$11.71 |
|-----------|--------|---------|
| AA CELLS  | QTY. 2 | \$11.71 |
| C CELLS   | QTY. 2 | \$13.21 |
| D CELLS   | QTY. 2 | \$13.21 |
| 9 VOLT    | QTY. 1 | \$13.21 |

**BATTERIES ONLY**

| AAA CELLS | PKG. 2 | \$6.07 pr. |
|-----------|--------|------------|
| AA CELLS  | PKG. 1 | \$3.93 ea. |
| C CELLS   | PKG. 1 | \$3.78 ea. |
| D CELLS   | PKG. 1 | \$3.78 ea. |
| 9 VOLT    | PKG. 1 | \$7.57 ea. |

**DISK DRIVES**

**TANDON**  
TM 100-1 5 1/4" (FOR IBM) SS/DD \$199.00  
TM 100-2 5 1/4" (FOR IBM) DS/DD \$199.00

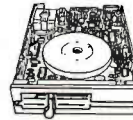
**MPI**  
MPI-B52 5 1/4" (FOR IBM) DS/DD \$139.95

**TEAC**  
FD-55B 1/2 HEIGHT DS/DD \$159.00  
FD-55F 1/2 HEIGHT DS/QUAD \$200.00

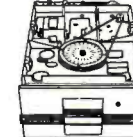
**SHUGART**  
SA 400L 5 1/4" (40 TRACK) SS/DD \$199.95  
SA 460 5 1/4" (80 TRACK) DS/QUAD \$199.95

**8" DISK DRIVES**  
FD100-8 BY SIEMENS, SHUGART 801 EQUIV. SS/DD 10 \$129.95 ea. \$149.95  
FD200-8 BY SIEMENS, SHUGART 851 EQUIV. DS/DD 10 \$185.00 ea. \$195.00

**JFORMAT-2 \$59.95**  
SUPPORT FOR QUAD DENSITY DRIVES FROM ALL TREE SYSTEMS  
PLEASE INCLUDE SUFFICIENT AMOUNT FOR SHIPPING ON ABOVE ITEMS



TEAC FD-55B



TANDON TM100-2

**DISK DRIVE CABINETS**

**CABINET #1 \$29.95**  
• Fits one full height 5 1/4" disk drive  
• Color matches Apple

**CABINET #2 \$79.00**  
• Fits one full height 5 1/4" disk drive  
• Complete with power supply, switch, line cord, fuse and standard power connector  
• Please specify Grey or Tan

**CABINET #3 \$89.95**  
• Fits one full height 5 1/4" disk drive  
• Complete with power supply, switch, line cord, fuse and standard power connectors

**8" DISK DRIVE CABINETS ALSO AVAILABLE-PLEASE CALL**  
PLEASE INCLUDE SUFFICIENT AMOUNT FOR SHIPPING ON ABOVE ITEMS

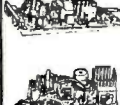
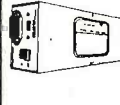
**SWITCHING POWER SUPPLIES**

**PS-IBM \$175.00**  
• FOR IBM PC-XT COMPATIBLE  
• 130 WATTS  
• +5V @ 15A, +12V @ 4.2A  
• -5V @ 5A, -12V @ .5A  
• ONE YEAR WARRANTY

**PS-A \$49.95**  
• USE TO POWER APPLE TYPE SYSTEMS  
• +5V @ 4A, +12V @ 2.5A  
• -5V @ 5A, -12V @ 5A  
• APPLE POWER CONNECTOR

**PS-3 \$39.95**  
• AS USED IN APPLE III  
• +5V @ 4A, +12V @ 2.5A  
• -5V @ 25A, -12V @ 30A,  
• 15.5" x 4.5" x 2", .884 LBS.

**PS-TDK \$59.95**  
• +5V @ 4A, +12V @ 2A  
• +12V @ 2.8A, -12V @ .30A  
• BOTH +12 VOLTS OUTPUTS CAN BE USED AS +24 VOLTS  
• 6.2" x 7.4" x 1.7", 1.6 LBS.



**OK INDUSTRIES**

**EX-1 IC EXTRACTION TOOL**  
• ONE PIECE METAL CONSTRUCTION  
• EASILY EXTRACTS 8-24 PIN DEVICES  
• LOW COST \$2.19

**EX-2 IC EXTRACTION TOOL**  
• EXTRACTS 24-40 PIN DEVICES  
• HEAVY DUTY METAL CONSTRUCTION  
• GROUND LUGS FOR MOS EXTRACTIONS  
• EASY ONE HAND OPERATION \$12.74

**IC INSERTION TOOLS**  
INS-1416 for 14-16 pin IC's \$5.15  
MOS-1416 for 14-16 pin IC's \$10.92  
MOS-2428 for 24-28 pin IC's \$10.92  
MOS-40 for 40 pin IC's \$12.43  
MOS series insertion tools have metal construction and include grounding lug for CMOS applications.

**BW-630 WIRE WRAP GUN**  
• BATTERY POWERED-USES 2 NI-CAD C CELLS (NOT INCLUDED)  
• POSITIVE INDEXING  
• ANTI-OVERWRAP DEVICE \$41.55

**WSU-30 WIRE WRAP TOOLS**  
• WRAPS, STRIPS, AND UNWRAPS  
• WSU-30M WRAPS AN EXTRA TURN OF INSULATION  
WSU-30 88.84/WSU-30M \$10.14



**WIRE WRAP TERMINALS**  
WWT-1 SLOTTED 25/\$7.06  
WWT-2 SINGLE SIDED 25/\$4.25  
WWT-3 IC SOCKET 25/\$7.06  
WWT-4 DOUBLE SIDED 25/\$2.80  
INS-1 INSERTION TOOL \$3.64

**WIRE DISPENSER**  
• WITH 50' ROLL OF WIRE  
• BUILT IN PLUNGER CUTS WIRE  
• BUILT IN STRIPPER STRIPES 1"  
• REFILLABLE

**WD-30 \$6.50 WD-30TRI \$9.50**  
Specify Blue, white, Yellow or Red With 50' of each: Red, Blue and White

**SOCKET-WRAP I.D.™**  
• SLIPS OVER WIRE WRAP PINS  
• IDENTIFIES PIN NUMBERS ON WRAP SIDE OF BOARD  
• CAN WRITE ON PLASTIC; SUCH AS IC #

| PINS | PART#     | PCK. OF | PRICE |
|------|-----------|---------|-------|
| 8    | IDWRAP 08 | 10      | 1.95  |
| 14   | IDWRAP 14 | 10      | 1.95  |
| 16   | IDWRAP 16 | 10      | 1.95  |
| 18   | IDWRAP 18 | 5       | 1.95  |
| 20   | IDWRAP 20 | 5       | 1.95  |
| 22   | IDWRAP 22 | 5       | 1.95  |
| 24   | IDWRAP 24 | 5       | 1.95  |
| 28   | IDWRAP 28 | 5       | 1.95  |
| 40   | IDWRAP 40 | 5       | 1.95  |

PLEASE ORDER BY NUMBER OF PACKAGES (PCK. OF)

**TRANSFORMERS**

**FRAME STYLE**

| 12.6V AC    | 2 AMP | 4.95  |
|-------------|-------|-------|
| 12.6V AC CT | 2 AMP | 5.95  |
| 12.6V AC CT | 4 AMP | 7.95  |
| 12.6V AC CT | 8 AMP | 10.95 |
| 25.2V AC CT | 2 AMP | 7.95  |

**PLUG CASE STYLE**

| 12V AC                              | 250ma | 3.95 |
|-------------------------------------|-------|------|
| 12V AC <td>500ma</td> <td>4.95</td> | 500ma | 4.95 |
| 12V AC                              | 1 AMP | 5.95 |
| 12V AC                              | 2 AMP | 6.95 |

**DC ADAPTER**  
6, 9, 12V DC SELECTABLE WITH UNIVERSAL ADAPTER 8.95

**MICROCOMPUTER HARDWARE HANDBOOK**

FROM ELCOMP \$14.95  
Over 800 pages of manufacturer's data sheets on the most commonly used IC's

- TTL - 74, 74LS & 74F
- CMOS
- Voltage regulators
- Memory - RAM, ROM, EPROM
- CPU'S - 6800, 6500, Z80, 8080, 8085 & 8086/8
- MPU Support & Interface, 6800, 6500, Z80, 8200, etc.

**ORDER TOLL FREE**  
**800-538-5000**  
**800-662-6279**  
(CALIFORNIA RESIDENTS)

**20 MHz DUAL TRACE OSCILLOSCOPE**

FROM **RAMSEY ELECTRONICS**  
UNSURPASSED QUALITY AT AN UNBEATABLE PRICE

- BAND WIDTH-DC: DC TO 20MHz (-3db) AC: 10Hz TO 20MHz (-3db)
- SWEEP TIME- 2 μSEC TO .5 SEC/DIV ON 20 RANGES
- VERT./HORZ. DEFLECTION: 5mV TO 20V/DIV ON 20 RANGES
- COMPLETE MANUAL AND HIGH QUALITY HOOK-ON PROBES INCLUDED
- INPUT IMPEDANCE: 1 MEG OHM
- TV VIDEO SYNC FILTER
- X, Y AND Z AXIS OPERATION
- 110/220 VOLT 50/60Hz OPERATION
- COMPONENT TESTER
- LP CONSUMPTION-19 WATTS
- BUILT IN CALIBRATOR
- AUTOMATIC OR TRIGGERED TIMEBASE

**\$399.95 WITH PROBES**  
**FULL ONE YEAR WARRANTY**



**MULTIMETER PEN**

**AUTO RANGING, POLARITY & DECIMAL!**

• LARGE 3 1/2" DIGIT DISPLAY  
• DATA HOLD SWITCH FREEZES READING  
• FAST, AUDIBLE CONTINUITY TEST  
• LOW BATTERY INDICATOR  
• OVERLOAD PROTECTION  
• ONLY 1 1/2" x 6 1/4" x 3 1/4"  
• DC VOLTS 3.1mV-500V  
• AC VOLTS 1mV-500V  
• 1 OHM-20 MEG OHMS  
• WEIGHS ONLY 1.3 OUNCES  
• LOW PARTS COUNT- CUSTOM 80 PIN LSI INSURES RELIABILITY  
• INCLUDES MANUAL, BATTERIES, SOFT CASE, 2 PROBE TIPS, AND ALLIGATOR CLIP

**ONLY \$49.95**



# MPI B52 DS/DD FULL HEIGHT FDD FOR IBM \$139.95

## EPROM PROGRAMMER FOR APPLE COMPUTERS RP525 \$79.95

- \* LOW COST
- \* DUPLICATE OR BURN ANY STANDARD 2700 SERIES EPROM
- \* MENU DRIVEN SOFTWARE INCLUDED-NO ADDITIONAL SOFTWARE REQUIRED
- \* AUTOMATIC SELECTION FOR 2716, 2732, 2732A, 2764 & 27128
- \* LED INDICATORS FOR ACTIVITY
- \* HIGH SPEED WRITE ALGORITHM
- \* NO EXTERNAL POWER SUPPLY



**MAXIMIZE YOUR IBM PC OR XT!**  
**MAXIMUM FLEXIBILITY**-All of the most asked for support features on one card plus SOFTDISK and SPOOL software to increase your PC's productivity!  
**MAXIMUM PERFORMANCE PER DOLLAR**-Compare features with the best selling multifunction card and save!  
**MAXIMUM RELIABILITY**-The MAXIMIZER features the highest quality 4-LAYER board construction, sockets for all RAM, and is backed by a full ONE YEAR WARRANTY



SIGMA DESIGNS, INC.

## MAXIMIZER

COMPARE!

|                | MAXIMIZER  | AST 6-PACK + |
|----------------|------------|--------------|
| Maximum Memory | 384K/512K* | 384K         |
| RS-232 Serial  | 2†         | 1            |
| Parallel Port  | 1          | 1            |
| Clock Calendar | YES        | YES          |
| Game Adaptor   | Optional   | Optional     |

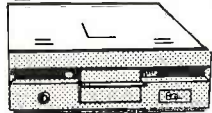
\*with optional 128K MAXISTACK  
 †second serial port optional

**\$259<sup>95</sup>**  
(64K)

OPTIONS:

- \* 2nd Serial Port \$49<sup>95</sup>
- \* Game Adaptor \$29<sup>95</sup>
- \* 128K MAXISTACK \$159<sup>95</sup>
- \* Additional 64K RAM \$49<sup>95</sup>

## APPLE ACCESSORIES



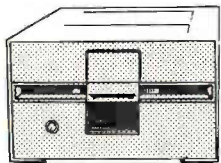
**BAL-525**  
**\$139.95**

- \* 1/2 HEIGHT-ALPS MECHANISM
- \* 100% APPLE COMPATIBLE
- \* FULL 1 YEAR WARRANTY



**BAL-500**  
**\$169.95**

- \* TEAC MECHANISM-DIRECT DRIVE
- \* 100%APPLE COMPATIBLE- 35 TRACK
- \* 40 TRACK WHEN USED WITH OPTIONAL CONTROLLER



**MITAC AD-1**  
**\$179.95**

- \* FULL HEIGHT SHUGART MECHANISM
- \* DIRECT REPLACEMENT FOR APPLE DISK II



**JDR 16K RAM CARD**  
**\$39.95**

- \* BARE PC CARD AND INSTRUCTIONS \$9.95
- \* 2 YEAR WARRANTY
- \* EXPAND YOUR 48K APPLE TO 64K
- \* USE IN PLACE OF APPLE LANGUAGE CARD

### OTHER ACCESSORIES

|                           |          |
|---------------------------|----------|
| BMC BX-80 CONTROLLER CARD | \$249.00 |
| VIEWMAX-80                | \$49.95  |
| VIEWMAX-80e               | \$159.95 |
| GRAPHMAX                  | \$129.95 |
| THUNDERCLOCK              | \$129.95 |
| KRAFT JOYSTICK            | \$39.95  |
| POWER SUPPLY              | \$49.95  |
| ZVM-123 GREEN MON         | \$105.00 |
| BMC AU9191U COLOR MON     | \$279.00 |

## DISKETTE FILE

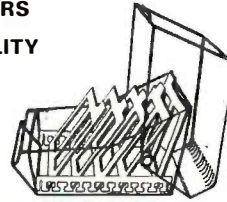
**\$8.95**

IF PURCHASED WITH 50 DISKETTES OR MORE

\$9.95 IF PURCHASED ALONE

**BY DEALING DIRECT WITH THE FACTORY, WE CAN MAKE THIS UNBEATABLE OFFER**

- \* ATTRACTIVE, SMOKED ACRYLIC CASE WITH SIX INDEXED DIVIDERS
- \* RUGGED, HIGH QUALITY CONSTRUCTION
- \* HOLDS 70 5 1/4" DISKETTES, WITH ROOM TO SPARE



## \*NASHUA DISKETTES

5 1/4" SOFT SECTOR  
 DOUBLE SIDED, DOUBLE DENSITY  
 WITH HUB RINGS

BULK PACKAGED IN FACTORY SEALED BAGS OF .50. INCLUDES DISKETTE SLEEVES AND WRITE PROTECT TABS. IDEAL FOR SCHOOLS, CLUBS, AND USERS GROUPS. THIS IS A SPECIAL PURCHASE. QUANTITIES ARE LIMITED. 5 YEAR WARRANTY.

**\$1.39ea.**  
QTY 250

**\$1.49ea.**  
QTY 100

**\$1.59ea.**  
QTY 50

\*NASHUA DISKETTES WERE JUDGED TO HAVE THE HIGHEST POLISH AND RECORDED AMPLITUDE OF ANY DISKETTES TESTED. (SEE "COMPARING FLOPPY DISKS", BYTE9/84)

## DISK DRIVES FOR YOUR IBM

|                          |                             |                    |
|--------------------------|-----------------------------|--------------------|
| TEAC FD55B<br>1/2 HEIGHT | MPI 52B<br>(same as Tandon) | TANDON<br>TM 100-2 |
| <b>\$139.95</b>          | <b>\$139.95</b>             | <b>\$199.95</b>    |

**WANT TO ADD AN INTERNAL HARD DISK DRIVE TO YOUR IBM PC?**

...BUT DISCOVER THAT YOUR POWER SUPPLY CAN'T HANDLE THE LOAD?

JDR HAS CAREFULLY SELECTED THE HIGHEST QUALITY FULLY IBM COMPATIBLE POWER SUPPLY AVAILABLE.

### COMPARE THESE FEATURES

- \* XT COMPATIBLE
- \* 1 YEAR WARRANTY
- \* HIGH QUALITY CONSTRUCTION
- \* PLUG COMPATIBLE CONNECTORS
- \* FITS INTO EXISTING MOUNTING HOLES
- \* SOLID 130 WATT OUTPUT  
 +5V @ 15A +12V @ 4.2A  
 -5V @ .5A -12V @ .5A



**\$175.00**

## VERBATIM

DATALIFE DISKETTES

|                 |         |
|-----------------|---------|
| SS/DD SOFT      | \$29.95 |
| SS/DD 10 SECTOR | \$29.95 |
| DS/DD SOT       | \$34.95 |

**VISIT OUR NEW, EXPANDED RETAIL STORE AT 1256 SOUTH BASCOM IN SAN JOSE**

HOURS: M-W-F, 9-5

T-TH., 9-9

SAT., 10-3



**JDR Microdevices**

1224 S. Bascom Avenue, San Jose, CA 95128

800-538-5000 • 800-662-6279 (CA)

(408) 995-5430 • Telex 171-110

FAX (408) 275-8415

PLEASE USE YOUR CUSTOMER NUMBER WHEN ORDERING

TERMS: Minimum order \$10. For shipping and handling include \$2.50 for UPS Ground and \$3.50 for UPS Air. Orders over 1 lb. and foreign orders may require additional shipping charges - please contact our sales department for the amount. CA residents must include 6% sales tax. Bay Area and LA residents include 6.5%. Prices subject to change without notice. We are not responsible for typographical errors. We reserve the right to limit quantities and to substitute manufacturer. All merchandise subject to prior sale.

APPLE IS A TRADEMARK OF APPLE COMPUTER CO.

# U·N·C·L·A·S·S·I·F·I·E·D A·D·S

*BYTE is concerned about software piracy. Unclassified ads proposing exchanges of software must specify that the software was written by the individual or is in the public domain. BYTE reserves the right to reject any unclassified ad that does not meet this criterion.*

**WANTED:** The Children's Haven School in Azrou, Morocco, seeks tax-deductible donation of any disk-based microcomputer system with printer for educational purposes. The Children's Haven is a non-denominational children's home. Fellowship of Independent Missions, POB 72, Fairless Hills, PA 19030, (215) 752-1170.

**WANTED:** Appalachian early-childhood program seeks donations of computer equipment and peripherals for database statistics and child-education modules. All donations covered under 1954 IRS 501 (c) (3) rules to a private, nonprofit corporation. Robert Hall, Knox County Economic Opportunity Council Inc., POB 135, Barbourville, KY 40906-0135, (606) 546-3152.

**NEEDED:** Nonprofit community agency seeks tax-deductible donation of microcomputer system for referral network, information management, and office assistance. Agency coordinates child-care resources for working families, private and government agency users, and handicapped children. Faith Rodgers, Community Coordinated Child Care of Union County, 60 Prince St., Elizabeth, NJ 07208, (201) 353-1621.

**WANTED:** Nonprofit group researching schizophrenia needs computer, disk drives, printer and A/D board for analysis of EEGs. PSR Research Group Ltd., 651 Lakecrest Dr., Menasha, WI 54952, (414) 722-9626.

**WANTED:** Small Lutheran grade school seeks tax-deductible donation of Commodore 64, datasette, disk drive, printer, or monitor, or Hewlett-Packard 85 for students to learn BASIC and Logo programming. Mike Hanke, Principal, St. James Lutheran School, 901 Shawano Ave., Green Bay, WI 54303, (414) 494-7782.

**WANTED:** Christian worker seeks tax-deductible donation of computer with word-processing capabilities for assisting with communication needs. Dan Rusch, c/o Overseas Missionary Fellowship, Batangas City 4201, Philippines.

**WANTED:** Tax-exempt, nonprofit, educational institution seeks information, suggestions, programs, and equipment for a business bulletin-board system at Tulane University. Anticipate tying together faculty, students, administration, alumni, and friends, but open to all ideas for potential uses. John Page, School of Business, Tulane University, New Orleans, LA 70118.

**WANTED:** Programmer father of visually impaired child seeks donation of powerful voice-activated computer to develop learning tools for the visually impaired. Tobias Jesso, 162 West 29th St., North Vancouver, British Columbia V7N 2I8, Canada.

**WANTED:** Computer-science student seeks donations of discarded, unused, or reparable computer equipment, especially ICs, monitors, keyboards, disk drives, to allow hands-on experience. Lucasz Batko, 30-328 Cracow, ul.Praska 8a, Poland.

**FOR SALE:** IBM PC, 128K, one disk drive, Epson RX-80 printer with parallel card, color-graphics adapter, and amber monitor: \$2100. Andy Grosland, 604 19th St. NW, Austin, MN 55912, (507) 437-2465.

**NEEDED:** Pages 43-54 of Processor Technology's FOCAL interpreter listing, since mine are missing. Will pay for copy and shipment. H.-G. Willers, Blumenstrasse 28 D-8047, Karlsruhe, West Germany.

**FOR SALE:** Mountain Apple II cards, used. Five A/D+ D/A cards: \$175 each. Two multifunction cards: \$150 each. Five Romplus+ cards: \$100 each. Dixon Purcell, 7 Harvard Square, Brookline, MA 02146, (617) 738-4500.

**FOR SALE:** IBM I/O 735 typewriter-printer like new. Includes Selectric Computer Interface from December 1983 *Computers & Electronics*. Never used. Two type balls, spare parts, and factory timing tools. Complete package: \$650 or best offer. Julian E. Jetzer, 6400 Hawthorn Rd., Sheboygan, WI 53081, (414) 457-3366 after 5 p.m.

**FOR SALE:** Alphamic Systems Model AMI000 desktop computer, 68K with 128K memory, 10-

megabyte hard disk, floppy disk, and VCR interface. Less than one year old, mint condition. Asking \$7500 or best offer; \$9500 value. Tommy Hawkins, 1128 Palm Dr., Burlingame, CA 94010, (415) 343-3853.

**FOR SALE:** 320K-byte IBM PC with two 180K and two 811K drives, green screen and adapter, serial port, 8087, NEC 8032A printer, and more. Best offer over \$3500. Mark Bellon, 20 Elliott Ave., Centereach, NY 11720, (516) 585-5530.

**WANTED:** I want to hear from others interested in making the H/Z-19, the Imaginator graphics board, and the Super-19 PROM work together as a unit or in creating firmware to that end. I also want to compare notes with others using the Morrow DJDMA S-100 FDC board. Object is creating a BIOS to read/write additional formats. Carl Camper, POB 877, Colstrip, MT 59323.

**WANTED:** Your broken TRS-80 Color Computer and LPVII or DMP-100 printer. Give details. Joe Torzewski, 51625 Chestnut Rd., Granger, IN 46530.

**FOR SALE:** BYTE August 1981-July 1982, 12 issues: \$35, postage paid in the US. Send check. If issues are sold, check will be returned immediately. David Cohen, 119 Surrey Lane, Westfield, NJ 07090.

**FOR SALE:** Radio Shack 16K memory upgrade (for Model III) in mint condition. Jed Weinrob, Apt. II-D, 372 Central Park West, New York, NY 10025, (212) 663-8648.

**WANTED:** Junior high student needs complete micro system (prefers Apple) for programming and intellectual development. Would like 1200-bps modem and any unwanted peripherals. Will pay shipping. Robby Swenson, 660 West 5th, Colby, KS 67701.

**WANTED:** Readers who desire access to public-domain programs primarily for the Apple II. Includes utilities, games, graphics, business, educational, hobby, music, CP/M, Pascal, Apple III, and EAMON adventures. Will send a catalog if you send one 20c postage stamp. Please contact me if you want to start an Apple computer club. Daniel H. Lefler, POB 1962, Boulder, CO 80306.

**WANTED:** Student computer enthusiasts seek donation of printer that prints 10, 12, or 17 characters per inch and disk drives for TRS-80 Color Computer. Will pay shipping charges. Deborah Tisdale, 1026 Cedar Highland, Daytona Beach, FL 32017.

**WANTED:** High school electronics program seeks donations of electronic and computer hardware or components. Trying to run high-tech program on low-tech budget. Will pay shipping charges. William Stefek, Oswego High School, Rt. 71, Oswego, IL 60543, (312) 554-8256.

**WANTED:** People who have or need information on word processing in foreign languages. Send a SASE to Jerry Luzuriaga, 3149 Pebblestone Place, Simi Valley, CA 93063.

**FOR SALE:** Timex Sinclair 1000 with 16K memory module, all unused. Larry Martin, 13022 Lakeview Granada, Lakeside, CA 92040, (619) 443-3655.

**WANTED:** NEC PC-8000, PC-8200, or PC-8800 owners interested in a newsletter. Matthew Levie, 131 Riverside Dr., New York, NY 10024.

**WANTED:** Sanyo MBC owner starting informal users group to exchange information for Sanyo and other MS-DOS machines. Michael Russell, POB 2084CS, Pullman, WA 99163, (509) 878-1714.

**WANTED:** Users of 16-bit Perkin-Elmer computers. B. Freydn, POB 1407, DC21, TIS, Houston, TX 77251, (713) 972-4718.

**WANTED:** Used Osborne 1, prefer with DD. Will take subject to repair. F.L. Plotnick, POB 11264, Elkins Park, PA 19117, (215) 487-1443.

**FOR SALE:** Altair 8800B. MITS 300-55 with 5 megabytes fixed, 5 removable. Many manuals. 64K static RAM, turnkey panel, three serial, two parallel ports, Pertec 3442 10-megabyte disk drive with seven blank packs. Vector Graphic FD/HD disk controller included. Will split up. \$1200 plus shipping. Joe Heck, 44 Commonwealth Ave., Stoughton, MA 02072, (617) 344-5009 evenings, weekends.

**FOR SALE:** Xerox 820 CPU board: \$150. Commodore 64 with disk drive: \$350. 80-column board: \$125. Cardco printer interface: \$40. Monitor: \$40. 14-inch 26-megabyte Winchester: \$200. Shugart SA851 without logic board: \$50. Assorted magazines. Will

consider offers. Dave Edick, POB 20673, Castro Valley, CA 94546, (415) 276-0981, 3-9 p.m.

**FOR SALE:** Eagle-PC2 includes 256K, two DS/DD drives, monitor, keyboard, two serial, one parallel port, service manual, Centronics parallel cable. All for \$2650. Viriya Nimboonchaj, 2137 East 125th St., Brooklyn, NY 11229, (212) 645-1419 after 8 p.m.

**FOR SALE:** Sanyo 15-inch black-and-white monitor: \$100. Tektronix RM503 oscilloscope. 500-KHz bandwidth, 1-mv sensitivity: \$250. Micro-Sci disk controller for Apple II drive: \$40. IDS 460G dot-matrix printer with serial/parallel interfaces and graphics capability: \$500. Walter Sikonowicz, 2 Petre Dr., Auburn, NY 13021, (315) 252-3960 after 4:30 p.m.

**FOR SALE:** Hayes Smartmodem 300 bps: \$200. Mountain Hardware multifunction card: \$125. Used only two months. Bill Wilcox, POB 749, Pittsburg, CA 94565-0074, (415) 427-5994.

**WANTED:** Apple II+ compatible public-domain software that teaches Japanese on a basic or intermediate level. Also, public-domain database manager to handle comic-book collection. Marilyn I.M.C. McInnis, Box 1591, Honolulu, HI 96806.

**FOR SALE:** 48K Atari 400 with disk and tape drive, color monitor/TV joysticks, magazines, books, and manuals: \$1800. Includes shipping. O. Chomer, 31175 Minton, Livonia, MI 48150, (313) 522-4953.

**FOR SALE:** Expanded Netronics Explorer 85 computer, like new. Includes six-slot S-100 card frame, 64K dynamic memory board, on-board monitor disk boot ROM, two 5¼-inch Tandon floppy-disk drives, disk-controller card, keyboard/video terminal with graphics, and complete documentation: \$1500 negotiable. Robert Havanec, 106 Newport Ave., Shelton, CT 06484, (203) 735-4585 after 5:30 p.m.

**WANTED:** Living-room-quality furniture for IBM PC, plus monitor and Mannesmann Tally Spirit 80 printer. Prefer lockable, enclosed cabinet or desk. T. Woods, 2651 Pacific Way, Longview, WA 98632.

**WANTED:** Correspondence, communication, literature for computer enthusiast in prison. Lee M. Robertson, POB 107, B-25493, Tehachapi, CA 93561.

**FOR SALE:** Franklin 1200 office management system and C/toh Prowriter printer. Includes 280 and 6502 processors, 128K RAM, 80 columns. BMC monitor, cables, serial/parallel ports, extra manuals, and freight charge: \$1850 or best offer. John Fellmeth, Box 1169, Monticello, UT 84535, (801) 587-2309.

**FOR SALE:** Apple II RV611C parallel printer interface in excellent condition: \$50. Green Apple III monitor that could use cleaning: \$50 or best offer. Kelly Priestly, 6554 McGill Way, Anchorage, AK 99502.

**FOR SALE:** IMSAI 8080 with 280 and 8080 boards, MIO, VTI, 24K static, and 16K dynamic memory. North Star disk drive and controller. IBM Selectric and interface, 9-inch monitor, and two keyboards. Needs minor work. Best offer. Austin L. Ely, Rt. 1, Box 234-C, Lindale, TX 75771, (214) 882-9195.

**FOR SALE:** Memory chips 2708 1024x8 EPROMs: \$3. 74S475 512x8 PROMs: \$4. 82S23 32x8 PROM: \$2. 4027 4Kx1 dynamic RAMs: \$2. Bill Gill, 310 Portsmouth Rd., Cherry Hill, NJ 08034, (609) 428-0943.

(continued)

UNCLASSIFIED POLICY: Readers who have computer equipment to buy, sell, or trade or who are requesting or giving advice may send a notice to *BYTE* for inclusion in the *Unclassified Ads* section. To be considered for publication, an advertisement must be noncommercial and nonprofit (individuals or bona fide computer clubs), typed double-spaced, contain 60 words or less, and include name and address. This is a free service; notices are printed as space permits. Your confirmation of placement is appearance in an issue of *BYTE* as we engage in no correspondence. Please allow at least four months for your ad to appear. Send your notices to *BYTE*, *Unclassified Ads*, POB 372, Hancock, NH 03449.

# UNCLASSIFIED ADS

- FOR SALE:** *Softalk for IBM*: July 1982, September 1982-March 1984. *PC Tech*: Vol. 1 No. 1-7. *PC Age*: April 1982, September 1982-September 1984. *PC Magazine*: Vol. 1 No. 2-Vol. 3 No. 8. *PC World*: Vol. 1 No. 1-Vol. 2 No. 5. *BYTE*: April 1983-April 1984. Best offer per issue or set. Ken Holcombe, 178 Tipperary, San Antonio, TX 78223, (512) 333-5442.
- FOR SALE:** S-100 bus computer system, four slots. Z80A with 64K, two RS-232 ports, one Centronics parallel port, two 5/4-inch single-sided quad-density drives with controller (takes 8-inch drives), Liberty 50 terminal, Gemini-10X printer, and full documentation. Cost \$3700; asking \$2200 or offer. Robert Franklin, 36 Fiesta Dr., Joliet, IL 60432, (815) 722-3550.
- FOR SALE:** Cromemco Z2D; TeleVideo 920C with second page and cover. Motherboard: 21 slots, S-100. Boards: 16FDC Rev E (needs work), 64KZ(NW), PRI, ZPU Rev E. Disk drives: two Tandon TM100, 5/4-inch DS/DD, 360K/disk. All manuals and I/O News. Value new: \$5660; best offer. Barry Norris, 17 Danbury Rd., Apt. #3, Ridgefield, CT 06877, (203) 431-6868.
- FOR SALE:** New Heath H-89 microcomputer. Professionally built with deluxe amber CRT, single floppy-disk drive, 48K RAM. Epson RX-80 printer with interface. Includes all manuals and dust covers: \$1000. Will deliver within 125 miles (NW Illinois). James Pepper, 808 East Third St., Sterling, IL 61081, (815) 625-0560 weekdays 8-5.
- FOR SALE:** Epson Super Terminal printer, MP-80 F/T type 2 (bit image) with Graftrax 80 (same as MX-80): \$200. Yukio Masuda, 109 Country Place Nells Rock Rd., Shelton, CT 06484.
- FOR SALE:** Used El Cid interface between any computer and a phototypesetter: \$600 (\$700 new). Works great. Sam Warren, 2543 Broadway, San Diego, CA 92102, (619) 232-5901 after 6 p.m.
- FOR SALE OR TRADE:** Epson HX-20 notebook portable computer; can include some free phone consulting. \$700 or best offer. Eric Balkan, 14704 Seneca Castle Court, Gaithersburg, MD 20878, (301) 762-7145.
- FOR SALE:** HP 85 portable with 32K main memory, 32-character internal thermal printer, 255 by 191 high-resolution graphics display, and 210K tape drive. Peripherals are built in. Includes application books and case: \$800 or best offer. Alex Witkowski, 6 East 97th St., New York, NY 10029, (212) 289-7578.
- FOR SALE:** Shugart disk drive Model SA-400 in good working condition: \$55 UPS postpaid. R. Mendelson, 27 Somersset Place, Murray Hill, NJ 07974.
- FOR SALE:** Victor 9000: 8086 16-bit 128K RAM expandable with two 640K 5/4-inch single-sided disk drives, green phosphor graphics monitor, and programmer's keyboard. List \$3495; asking \$2000. J. T. Gruber, 154 Shady Oak Trail, Charlotte, NC 28210, (704) 554-0833.
- WANTED:** 16K, 32K, or 64K TRS-80, Apple, Atari, or Adam. David Ford, 7747 Weston Richmond Heights, St. Louis, MO 63117.
- FOR SALE:** Xerox 820 IDS, including display and two drives, in excellent condition: \$1195. 3M 051 copier: \$50. H. L. Whitaker, 9639 Dorothy Ave., South Gate, CA 90280, (213) 567-8758.
- FOR SALE:** Hewlett-Packard HP 85A, 16K memory module (32K RAM), ROM driver, matrix ROM, documentation, dust cover, paper: \$1500. Gregory Wolters, 13812 Winding Way, Nevada City, CA 95959, (916) 265-9445 days, (916) 273-1728 evenings.
- FOR SALE:** TRS-80 Model III, 48K RAM: \$550. Radio Shack Line Printer VII: \$400. Both one year old and in excellent condition. Nathan Nathan, 104-20 Queens Blvd. #6W, Forest Hills, NY 11375, (212) 275-2052 evenings.
- NEEDED:** TRS-80 Model III users interested in starting an Adventure Club. Your adventure programs would be appreciated for a newsletter. Eric Yoxtheimer, 486 Cedar Cove Rd., Ellensburg, WA 98926.
- WANTED:** High school student seeks donation of computer system and peripherals, disks, or books for programming and experimentation. Will pay postage. Jim Jenkinson, 17 Marion Rd., Montvale, NJ 07645.
- WANTED:** High school student seeks donation of electronic or computer equipment. Will pay postage. Chris Rosin, 6565 North Pine Shore Dr., Glendale, WI 53209.
- FOR SALE:** Five Digital VK100-AA (GIGI), with keyboard overlays and three carrying cases. Never unpacked. List price \$12,750; asking \$7500. Agustin Dorantes, 5 Footpath Rd., Chelmsford, MA 01824, (617) 251-7235 evenings.
- FOR SALE:** Fortune System 10 multiuser system with 512K memo y, asynchronous ports, and NEC 3500 printer. Will consider trade for Apple or IBM PC. M. B. Motwani, 2741 Binbrooke, Troy, MI 48084.
- FOR SALE:** TRS-80 Level II BASIC and programming book in excellent condition: \$14. Andrew Spinola, 8 Masefield Dr., Greenlawn, NY 11740.
- FOR SALE:** Pronto Series 16 computer, MS-DOS 2.0 and IBMPC compatible. 256K RAM, green swivel/tilt high-resolution monitor. Uses Intel 80186 CPU. One 800K floppy-disk drive and one removable Winchester cartridge (5 megabytes): \$3995 or best offer. David Klotzbach, 25 Columbia Circle, Plymouth, MA 02360, (617) 747-0430.
- FOR SALE:** HP9831A: \$575. HP9866B: \$850. Pay by certified check or money order. Wanted: HP98032A OPT 062 parallel interface, HP98036A serial interface (preferably OPT 071), HP98223A ROM, HP98218 ROM, HP9885MS flexible disk drives. R. W. Houston, Box 1881, APO San Francisco, CA 96328.
- FOR SALE:** Alpha-Micro computer, AM-1000VWF; two TeleVideo CRTs, one Texas Instruments 810 printer and stand, 10-megabyte Winchester disk add-on (20-megabyte total), one telephone modem: six months old. Originally \$27,500; asking \$20,000 or best offer. Arthur C. Jay, 350 N 400W, Lebanon, IN 46052, (317) 482-6138 after 5 p.m.
- FOR SALE:** Frieden/Singer Flexowriter printing terminal with illuminated status panel, 110 baud, block type (upper- and lowercase), 115 vac, Spare electronics package (slightly cannibalized). Each package contains thirteen 7- by 9-inch cards in cage. Full documentation. Best offer, no shipping, local pickup only. William Simpson, 5600 Glenford St., Los Angeles, CA 90008, (213) 293-2959.
- WANTED:** College student seeks donation of computer equipment and books for experimentation and programming. David Wagenknecht, 2421 Beeler Ave., York, PA 17404.
- FOR SALE:** Panasonic JR-2000 personal computer, new. 16K ROM containing BASIC and machine-code monitor. 32K usable RAM, Centronics-type printer port, expansion bus, high-speed cassette interface, sound generator, cables, and technical manuals: \$150. Joe Smiley, 11-A Rector Court, Wilmington, DE 19810, (302) 453-3616 days, (302) 475-8879 nights.
- WANTED:** Altos U.K. 5-5 hard disk for Altos 5-15D computer. Mr. Scott, Scott & Byrd, P.A., P.O. Drawer 6105, Florence, SC 29502.
- WANTED:** College student seeks donation of technical drawing equipment. Valdemir Santos, Rua Madre Cabrini, 406-11, São Paulo-SP, Brazil 04020.
- WANTED:** Used Anchor Automation Signalman Mark XII 300/1200-bps modem or Hayes Smartmodem. Also, help finding a VT102 emulator for the Lobo MAX-80 running under CP/M-80 2.2: David Lewis, Union College, Box 1927, Schenectady, NY 12308.
- FOR SALE:** Radio Shack PC-2 pocket computer: \$120. POC-2 plotter/printer interface: \$140. RS-232C: \$160. 8K RAM expansion module: \$100. Vinyl case for PC-2 and plotter/printer: \$15. Excellent condition, includes documentation. \$1200 value; asking \$500 for package. Linwood McDowell, 821 North McKnight Rd. #D, University City, MO 63132, (314) 993-5068 evenings before 10 p.m.
- FOR SALE:** Excellent letter-quality Smith Corona TP-1 printer. Parallel interface. 10 characters per inch, two daisy wheels, two ribbons, dust cover. Retail \$895; asking \$275, plus free shipping. Brett Bobley, 98 High Farms Rd., Glen Head, NY 11545, (516) 671-6707.
- FOR SALE:** BYTE Vol. 5 No. 4 through present. First money order for \$2000 receives set. Include SASE. Rick Kosakowski, 13 Columbia Dr., Feeding Hills, MA 01030.
- WANTED:** High school student seeks donated computer equipment or books in any condition, especially for Apple II. Commodore 64, or Timex. Will pay postage. Boyce Johnson, 221 East Minnesota St., Cannon Falls, MN 55009.
- WANTED:** High school student seeks donation of Apple IIc, Password modem, Apple II disk drive, or color monitor. Steven L. Pfirman, RD #1, Box 212, Mifflinburg, PA 17844, (717) 966-1734.
- FOR SALE:** Complete set of *BYTE* in good condition from issue No. 1 to the present: \$400. Robert G. Lloyd, 7554 Southgate Rd., Fayetteville, NC 28304, (919) 867-5822 after 6 p.m.
- FOR SALE:** IBM Selectric-to-microcomputer (RS-232) interface box by Escon Products. Like new: \$199 or offer. Gary Gordon, 21112 Bank Mill Rd., Saratoga, CA 95070, (415) 857-4958 days, (408) 867-6796.
- WANTED:** Electrical engineering student would appreciate donated computer or electronic equipment in any condition. Will pay postage. Wayne Poole, 8926 Byron Ave., Surfside, FL 33154.
- FOR SALE:** Texas Instruments 99/4A, joysticks, dual cassette cable, five issues of *99'er*. Includes books and connections. In very good condition: \$300 or best offer. Steven Jabitsky, 440 Bradley Ave., Staten Island, NY 10314, (212) 698-4705.
- WANTED:** Hard disk for DEC Rainbow or separate controller. 10 megabyte preferred, 5 considered. Adam Cohen, 38800 Hastings St., Apt. 93, Fremont, CA 94536.
- FOR SALE:** Five boxes (50) brand new Verbatim MD525-01 SS/SD 5/4-inch soft-sectored floppy disks: \$110 includes shipping. Michael Collins, 5619 West Commonwealth Place, Chandler, AZ 85224.
- FOR SALE:** S-100 boards. CompuPro RAM20 32K static RAM: \$150. Measurement Systems DMB6400 64K dynamic RAM: \$200. Mountain 100,000 day clock: \$150. All plus UPS COD. Jerry Throckmorton, (513) 426-8781.
- FOR SALE:** IMSAI 8080 microprocessor. 22 slots. 28-amp supply fan, PIO-4, SIO-2, and Op-panel. Other boards: 48K DRAM (SDS ExpandoRAM), two 8K RAMs, VDM-1, extender board, and custom WW board, GR1 keyboard, two PHI-DECK drives, and controller. Original documents. Complete set: \$1000. Tandon TM100-I: \$100. Steven Munroe, 613 30th St. NE, Rochester, MN 55904, (507) 289-3359 after 6 p.m.
- FOR SALE:** Xerox 820-II computer system with 80-column black-and-white display/processor, dual 8-inch SS/DD drives, advanced keyboard, and more. All manuals and cables. In perfect condition—less than 40 hours logged. Total value \$5700; asking \$2900. C. Wolma, P.O.B. 959, Galveston, TX 77553.
- FOR SALE:** Compucolor II, keyboard, dual drives, 32K, documentation: \$1200. Morrow Micro Decision, disk drives, 64K, documentation, no monitor: \$900. Diablo 630, print wheels: \$1500. Votrax Type N Talk: \$110. Novation CAT modem: \$70. MFJ RS-232 transfer switches: \$40 and \$50. TDC RS-232 junction box: \$25. TI SR-52 and programmer calculators: \$40 each. Novus 6010 calculator: \$25. W. A. Shanks, 1345 West Escoria, Mesa, AZ 85201.
- FOR SALE:** Micromint MPX-16 computer board with power supply and keyboard adapter. 64K and support ROMs for a terminal or IBM-type keyboard and graphics card. New \$1500; sell \$1050. Also, Hazelcine 1421 terminal: \$375. Radio Shack Modem II: \$125. Frank Wasacz, 1256 Pennsylvania Ave., Columbus, OH 43201, (614) 424-4053 days, (614) 291-2166 evenings.
- WANTED:** High school student would appreciate any unwanted computer parts, accessories, or systems for educational purposes. Derek Badour, 1124 Clay Rd., Union City, MI 49094.
- FOR SALE:** Epson QX-10 computer with 256K dual disk drives and monitor in excellent condition. Used two months. Best offer over \$2200. G. Jamriska, 2960 Hawkridge Dr., La Crescenta, CA 91214.
- FOR SALE:** New Diablo P-11 dot-matrix printer with parallel interface, italics, underlining, compressed/expanded characters. 10-inch carriage, 100 cps: \$274 (list: \$649) with warranty. Erin Williamson, Rt. 2, 35 Totteridge Dr., Wellford, SC 29385, (803) 877-9828.
- FOR SALE:** IBM PCjr with 128K and built-in DS/DD drive. Purchased February 1984 for \$1300; sacrifice at \$995. Tom, 609 South Escondido Blvd. #101, Escondido, CA 92025, (619) 743-0494.
- FOR SALE:** Used TI 763 silent 70-printing terminal with 20K bubble memory, RS-232, works well; best offer at least \$500. Qume QVT-102 green 80 by 24 terminal: \$550 delivered, firm. Irving Wolfe, 119 Aloha St., Seattle, WA 98109, (206) 282-9598.
- FOR SALE:** Two ADM 31 smart terminals: Intermecc 9300 bar-code reader and 9400 po table reader with wands, interface, and power adapters: two Apple III floppy-disk drives: Silentyper thermal printer: Super Serial card for Apple II. All manuals

# UNCLASSIFIED ADS

included. Excellent condition. Mark Kuster, 521 Scott Ave., Dalhart, TX 79022, (806) 249-5287.

**FOR SALE:** Hewlett-Packard 9816S, 512K bytes of RAM, 9121D dual disk drive, HP-IB and serial interface, HP-IB cable. Like new. HP catalog price over \$10,000; sacrifice at \$5995. Will ship UPS insured for \$30. Kerry Newcom, 10 Evergreen Ave., Burlington, MA 01803, (617) 273-1818.

**WANTED:** Two Osborne/McGraw-Hill books: *Z-80 Programming for Logic Design and An Introduction to Microcomputers: Vol. 3—Some Real Support Devices*. Describe condition and price. Bruce Welch, 12 Sage Grouse Rd., Novato, CA 94947.

**WANTED:** People interested in a Sanyo MBC-550 users club for the Detroit area. David P. Stroup, 45448 Margate Dr., Mt. Clemens, MI 48044.

**FOR SALE:** VIC 1525 graphics printer; best offer. Teri Grossman, 1111 River Rd., Edgewater, NJ 07020, (201) 886-0980.

**FOR SALE:** Heathkit H14 printer with variable columns per line, type fonts, baud rates, and many other features; requires serial RS-232 interface: \$300 or best offer. Complete set of Model 28 Teletype manuals: \$50 or best offer. Used RF signal generator and 10,000-volt power supply: \$10 plus postage. Donald Mayes, 8515 Greenwood Ave., Apt. 3, Takoma Park, MD 20912, (301) 589-4190.

**WANTED:** High school student needs Apple equipment and peripherals for programming. Will pay postage. Jean-Paul Catiavela, 300 East Bellevue #209, Pasadena, CA 91101, (818) 792-8921.

**WANTED:** VIC-20 owners who want to trade magazines, books, information, ideas for good programs, and VIC tricks. Neil Phillips, POB 1489, Niagara-on-the-Lake, Ontario L0S 1J0, Canada.

**FOR SALE:** Quadlink by Quadram (to make an IBM PC Apple-compatible). Includes board, all necessary software, and manual. Works like new. Original cost \$680; sell for \$450. I. Theodore Repa, 18 Bonnett Ave., Larchmont, NY 10538, (914) 834-7207 evenings.

**FOR SALE:** BYTE, excellent condition, 1977-1983 (except November 1982 missing and September 1979 damaged); \$300 plus shipping. J. E. Burchfield, 6 Bonus Hill Dr., Scotch Plains, NJ 07076, (201) 757-9441.

**FOR SALE:** BYTE April 1980-December 1982: \$80 or best offer. Jonathan Marshall, 10 Ibbetson, Somerville, MA 02143.

**FOR SALE:** Visual 500 graphics terminal five months old: \$1795. Freedom 100 terminal: \$375. Buzz Coors, 2107 Artesia Blvd., Redondo Beach, CA 90278.

**WANTED:** *Compute!'s Gazette*: December 1983-February 1984. *RUN*: January and February 1984. J. E. Pritchett, POB 127, Thomaston, AL 36783.

**FOR SALE:** Hewlett-Packard HP 85A with 32K memory, advanced programming ROM, plotter/printer ROM, input/output ROM, mass storage ROM, matrix ROM, assembler ROM, HP-IB, and carrying case. John M. Uber, 1154 North Howard St., Akron, OH 44310, (216) 923-2074.

**FOR SALE:** Rodime ROI00 hard disk, 5.33 megabytes formatted, unused, tested with certification, ST506 protocol: \$500. Mark Cohen, Box 223, 1230 York Ave., New York, NY 10021, (212) 570-8667 days, (212) 988-6203 evenings.

**FOR SALE:** BYTE No. 1 through June 1984: \$325 plus UPS. *Kilobaud* No. 1-48 except No. 31: \$110 plus UPS. R. W. Moell, 513 Stillwood Dr., Wake Forest, NC 27587, (919) 228-2713.

**FOR SALE:** TRS-80 Model 100 (28K) used 10 hours, with cassette recorder, printer, and modem cables: \$700. Lynn Morano, 87 Sand Pit Rd., Danbury, CT 06810, (203) 743-6868.

**WANTED:** Student seeks donation of any computer equipment for research. Michael Santos, 20 North Domingo St., San Juan, Metro Manila, 3134, Philippines.

**FOR SALE:** 40-80-column Apple switch box, microwave antenna, satellite TV receiver. Mr. Wang, POB 68-1257, Taipei, Taiwan.

**FOR SALE:** Hewlett-Packard 7470A digital plotter in excellent condition: \$850. Also, Houston Instruments DMP-7 digital plotter in good condition: \$400. Lawrence L. Morton, 21671 Superior Lane, Lake Forest, CA 92630, (714) 859-6015.

**WANTED:** Schematics for Data General Nova 2 mini-computer. Will pay postage and reasonable copying costs. Irvin Van Dreuvel, RD #2, Solon Pond Rd.,

Cincinnati, NY 13040, (607) 863-3568.

**WANTED:** Any unwanted Apple peripherals, cards, manuals, books, or magazines for student. Tay Teck Wah, 51, Jalan Batai, Damansara Heights, Kuala Lumpur, Malaysia.

**FOR SALE:** Hewlett-Packard Series 80 (for 85, 86, 87) 82909 RS-232 interface: \$300. IDS 560G 200-cps printer: \$850. 9130A disk drive for 86A: \$450. Customized HP-41C calculator with modules: \$285; 82161 HP-IL tape drive: \$285. Both for \$580. Randy Webb, 622 East 11th St., Bloomington, IN 47401, (812) 335-1858 days, (812) 339-7661 after 5 p.m.

**WANTED:** High school student seeks donation of computer system, disk drive, books, printer, or disks for school projects and experimentation. Will pay postage. Also, selling TS 1000 with 16K pack, typewriter keyboard, books, adapter, and cables. New \$270; sell at \$125. Peter Huss, 229 Misty Way, Grayling, MI 49738, (517) 348-8062.

**WANTED:** Disabled person with extensive knowledge of COBOL, RPG II, CBASIC, MBASIC, and PL/I seeks donation of boards, disk drives, monitor, etc. (Apple IIe or Commodore 64) for development of educational software. Will pay shipping and issue receipt. Lloyd Wynter, 170-20 130 Ave., #2d, NY 11434.

**WANTED:** High school student seeks donation of computer system with disk drive and books, preferably with printer and IBM compatible. George F. Gomes, 17112 Willard St., Van Nuys, CA 91406.

**FOR SALE:** BYTE Vol. I, No. 3, November 1975: \$5. Dave Lambarth, Old Amherst Rd., Mont Vernon, NH 03057, (603) 884-6177 days, (603) 673-3566 evenings and weekends.

**FOR SALE:** TRS-80 Model 100, 32K RAM, disk/video interface (single drive), cables, bar-code reader, and Epson MX-80 printer with Graftrax: \$1800 negotiable. TRS-80 Model III, 48K RAM, two disk drives, printer cable, and Daisy Wheel II printer: \$2200 negotiable. Both include manuals, books, and magazines. Mark Paulhus, 52 Dwight St., New Britain, CT 06051, (203) 224-3309.

**FOR SALE:** 2164 64Kx1 dynamic RAMs 150 nanosecond. Nine for \$39. Joseph Hoock, 50 Hazelhurst Dr., Rochester, NY 14606.

**FOR SALE:** HP 9830A computer (with BASIC and one-line display), HP9866A thermal printer, and magnetic card reader. All in good working condition; best offer. Ezra Malek 72-81 113 St., Forest Hills, NY 11375, (212) 263-6056.

**FOR SALE:** Micromint COMM-80 TRS-80 serial/parallel interface with manual, never used: \$100. Zenith ZT-1 communications terminal, built-in 300-bps modem, parallel printer port, detached keyboard, and green phosphor monitor, new condition: \$400. Apple II monitor: \$150. Jeff Shumate, 5807 Warwick Place, Columbus, GA 31904, (404) 876-3240.

**FOR SALE:** Almost new Apple IIe 80-column card: \$90. Timex/Sinclair Zon X-81 music and sound synthesizer: \$50. DKtronics character generator: \$45. 16K RAM: \$30. All in good condition. Tim Edwards, POB 56, Smithfield, VA 23430.

**FOR SALE:** TI 99/4A with peripheral expansion system, disk-controller card (with disk manager cartridge), disk drive, memory expansion card (32K RAM), RS-232 card, Gemini-IOX printer, and manuals: \$1700. Tony Auter, 3505 Mina Court, Louisville, KY 40220, (502) 454-4410.

**FOR SALE:** BYTE No. 1 through August 1979, mint: \$120 includes shipping. John Gibson, 1075 Sterling, Berkeley, CA 94708.

**WANTED:** First 16 issues of BYTE: name your price. Larry Coulter, Box 441, Pequot Lakes, MN 56472, (218) 568-4115 days, (218) 543-4446 evenings.

**WANTED:** Someone to trade MS-DOS public-domain software. Clint Wall, 4102 Tanglewood, Bryan, TX 77802.

**FOR SALE:** BYTE in binders, July 1976-February 1983, immaculate: \$50. 19-inch color monitor, documentation, top quality: \$350. Digital VOM meter (lab quality), immaculate, provision for battery, BCD output, documentation: \$250. Analog VOM meter (top quality), palm-sized: \$25. Jim Rosa, 6401 Crescent Ave., Buena Park, CA 90620, (714) 937-1771/827-6334.

**FOR SALE:** 128K Apple III with parallel interface card and green monitor, Apple dot-matrix printer, external disk drive, and custom table: \$4200 negotiable. Will consider selling by piece. Marilyn Beckett, 227 East Third St., Moscow, ID 83843, (208) 882-2330.

U.S. POSTAL SERVICE  
STATEMENT OF OWNERSHIP, MANAGEMENT  
AND CIRCULATION  
(Act of August 12, 1970, Section 3685, Title 39,  
United States Code)

- Title of publication: BYTE
- Date of filing: October 1, 1984
- Frequency of issue: Monthly
- 3A. Number of issues published annually: 13
- 3B. Annual subscription price: \$21.00
4. Location of known office of publication: 70 Main St., Peterborough, NH 03458
5. Location of headquarters or general business offices of the publisher: 1221 Ave. of the Americas, New York, NY 10020
6. Names and addresses of publisher, editor, and managing editor: Publisher, Gene W. Simpson—70 Main St., Peterborough, NH 03458; Editor, Philip Lemmons—70 Main St., Peterborough, NH 03458; Managing Editor, Gene Smarte—70 Main St., Peterborough, NH 03458
7. The owner is McGraw-Hill, Inc., 1221 Avenue of the Americas, New York, NY 10020. Stockholders holding 1 percent or more of stock are: Donald C. McGraw Jr.; Harold W. McGraw, Jr.; John L. McGraw; William H. McGraw; June M. McBroom; Elizabeth McGraw Webster; all in care of McGraw-Hill, Inc., 1221 Avenue of the Americas, New York, NY 10020; DuPont Pension c/o Wilmington Trust Company, Rodney Square North, Wilmington, DE 19890; Public Employees Retirement System of Ohio, 277 East Town Street, Columbus, OH 43215; State of California c/o Security Pacific National Bank, P.O. Box 7636, San Francisco, CA 94120.
8. Known bondholders, mortgages, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages or other securities: None
9. Not applicable.
10. Extent and nature of circulation:

|                                                                                                     | Average No. Copies Each Issue During Preceding 12 Months | Actual No. Copies of Single Issue Published Nearest to Filing Date |
|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------|--------------------------------------------------------------------|
| A. Total No. Copies Printed                                                                         | 494,808                                                  | 483,500                                                            |
| B. Paid Circulation                                                                                 |                                                          |                                                                    |
| 1. Sales through dealers and carriers, street vendors and counter sales                             | 116,784                                                  | 163,838                                                            |
| 2. Mail subscriptions                                                                               | 309,955                                                  | 306,861                                                            |
| C. Total Paid Circulation                                                                           | 426,739                                                  | 470,699                                                            |
| D. Free Distribution by Mail, Carrier or Other Means: Samples, Complimentary, and Other Free Copies | 9,068                                                    | 7,327                                                              |
| E. Total Distribution                                                                               | 435,807                                                  | 478,026                                                            |
| F. Copies Not Distributed                                                                           |                                                          |                                                                    |
| 1. Office use, left over, unaccounted, spoiled after printing                                       | 5,065                                                    | 5,474                                                              |
| 2. Return from news agents                                                                          | 53,936                                                   | none to date                                                       |
| G. Total                                                                                            | 494,808                                                  | 483,500                                                            |

11. I certify that the statements made by me above are correct and complete.

—Gene W. Simpson, Publisher

# B·O·M·B

## BYTE'S ONGOING MONITOR BOX

| ARTICLE# | PAGE | ARTICLE                                                      | AUTHOR(S)           |
|----------|------|--------------------------------------------------------------|---------------------|
| 1        | 98   | The Tandy 1000.....                                          | Vose                |
| 2        | 105  | Ciarcia's Circuit Cellar:<br>Build the Power I/O System..... | Ciarcia             |
| 3        | 119  | C-Language Development Tools.....                            | Vose                |
| 4        | 121  | An Introduction to Fiber Optics, Part I.....                 | Shuford             |
| 5        | 124  | Software Frameworks.....                                     | Williams            |
| 6        | 131  | The Evolution of a Standard Ethernet.....                    | Mier                |
| 7        | 147  | Local-Area Networks for the IBM PC.....                      | Haugdahl            |
| 8        | 179  | High-Speed Dial-Up Modems.....                               | Maxwell             |
| 9        | 187  | Writing Communications in BASIC.....                         | Arnou               |
| 10       | 199  | Looking for the Perfect Program.....                         | Barr,<br>Rogers     |
| 11       | 215  | The On-Line Search.....                                      | Lisanti             |
| 12       | 239  | The Tandy Model 2000.....                                    | Jennings            |
| 13       | 252  | The Zenith Z-150 PC.....                                     | Rash                |
| 14       | 263  | TK!Solver.....                                               | Miller              |
| 15       | 277  | WordPerfect.....                                             | Birmele             |
| 16       | 293  | The Epson LQ-1500.....                                       | Sheldon             |
| 17       | 307  | Computing at Chaos Manor:<br>Home Again.....                 | Pournelle           |
| 18       | 343  | BYTE West Coast: Happenings.....                             | Markoff,<br>Shapiro |
| 19       | 355  | BYTE U.K.: Prolog on Microcomputers.....                     | Pountain            |
| 20       | 365  | BYTE Japan: Hand-held Computers<br>and MSX Standards.....    | Raiko               |

### DISK INTEREST

Robert Rodina wins \$100 for his first-place subjective evaluation, "Comparing Floppy Disks," which appeared in the September issue of BYTE. In second place is Lester E. Thompson's clarification on the incompatibility and standardization of "Floppy-Disk Formats." Mr. Thompson wins \$50. "Fractals," Peter Sørensen's exposé on mathematical discoveries in fractional dimensions, won third place. Jerry Pournelle's Computing at Chaos Manor came in fourth, written while he was "On the Road." And in fifth place is Steve Ciarcia's "Build the AC Power Monitor." Congratulations, authors.

### BYTE ADVERTISING SALES STAFF:

**J. Peter Huestis, Advertising Sales Manager, 70 Main Street, Peterborough, NH 03458, tel. (603) 924-9281**

#### NEW ENGLAND

ME, NH, VT, MA, RI  
Paul McPherson Jr. (617) 262-1160  
McGraw-Hill Publications  
575 Boylston Street  
Boston, MA 02116

#### ATLANTIC

NY, NYC, CT  
Dick McGurk (212) 512-3588  
Leah Goldman (212) 512-2096  
McGraw-Hill Publications  
1221 Avenue of the Americas—  
39th Floor  
New York, NY 10020

#### EAST

PA (EAST), NJ (SOUTH),  
MD, VA, W.VA, DE, D.C.  
Daniel Ferro (215) 496-3833  
McGraw-Hill Publications  
Three Parkway  
Philadelphia, PA 19102

#### SOUTHEAST

NC, SC, GA, FL, AL, TN  
Maggie M. Dorvee (404) 252-0626  
McGraw-Hill Publications  
4170 Ashford-Dunwoody Road—  
Suite 420  
Atlanta, GA 30319

#### MIDWEST

IL, MO, KS, IA, ND, SD, MN, WI, NB  
Bob Denmead (312) 751-3740  
McGraw-Hill Publications  
Blair Building  
645 North Michigan Ave.  
Chicago, IL 60611

#### GREAT LAKES, OHIO REGION

MI, OH, PA (ALLEGHENY), KY, IN,  
EASTERN CANADA  
Mike Kisseberth (313) 352-9760  
McGraw-Hill Publications  
4000 Town Center—Suite 770  
Southfield, MI 48075

#### SOUTHWEST, ROCKY MOUNTAIN

UT, CO, WY, OK, TX, AR, MS, LA  
Dennis Riley (214) 458-2400  
McGraw-Hill Publications  
Prestonwood Tower—Suite 907  
5151 Beltline  
Dallas, TX 75240

#### SOUTH PACIFIC

SOUTHERN CA, AZ, NM, LAS VEGAS  
Jack Anderson (714) 557-6292  
McGraw-Hill Publications  
3001 Red Hill Ave.  
Building #1—Suite 222  
Costa Mesa, CA 92626

Karen Niles (213) 480-5243, 487-1160

McGraw-Hill Publications  
3333 Wilshire Boulevard #407  
Los Angeles, CA 90010

#### NORTH PACIFIC

HI, WA, OR, ID, MT, NORTHERN CA,  
NV (except LAS VEGAS), W. CANADA  
David Iern (415) 362-4600  
McGraw-Hill Publications  
425 Battery Street  
San Francisco, CA 94111

Bill McAfee (415) 964-0624

McGraw-Hill Publications  
1000 Elwell Court—Suite 225  
Palo Alto, CA 94303

#### WEST COAST SURPLUS

#### AND RETAIL ACCOUNTS

Tom Harvey (805) 964-8577  
3463 State Street—Suite 256  
Santa Barbara, CA 93105

#### Post Card Mailings

##### National

Bradley Browne (603) 924-6166  
BYTE Publications  
70 Main Street  
Peterborough, NH 03458

### International Advertising Sales Representatives:

Mr. Hans Csokor  
Reisnerstrasse 61  
A-1037 Vienna, Austria

Mrs. Gurit Gepner  
McGraw-Hill Publishing Co.  
PO Box 2156  
Bat Yam, 59121 Israel  
866 561 321 39

Mr. Fritz Krusebecker  
McGraw-Hill Publishing Co.  
Liebigstrasse 19  
D-6000 Frankfurt/Main 1  
West Germany  
72 01 81

Mrs. Maria Sarmiento  
Pedro Teixeira 8, Off. 320  
Iberia Mart 1  
Madrid 4, Spain  
45 52 891

Mr. Andrew Karnig  
Andrew Karnig & Associates  
Finnbodavagen  
S-131 31 Nacka, Sweden  
46-8-44 0005

Mr. Jean Christian Acis  
McGraw-Hill Publishing Co.  
17 rue Georges Bizet  
F 75116 Paris  
France  
720 33 42

Mr. Arthur Scheffer  
McGraw-Hill Publishing Co.  
34 Dover St.  
London W1X 3RA  
England 01 493 1451

Mr. Savio Pesavento  
McGraw-Hill Publishing Co.  
Via Flavio Baracchini 1  
20123 Milan, Italy  
86 90 656

Seavex Ltd.  
400 Orchard Road, #10-01  
Singapore 0923  
Republic of Singapore  
Tel: 734-9790  
Telex: RS35539 SEAVEX

Seavex Ltd.  
503 Wilson House  
19-27 Wyndham St.  
Central, Hong Kong  
Tel: 5-260149  
Telex: 60904 SEVEX HX

Hiro Morita  
McGraw-Hill Publishing Co.  
Overseas Corp.  
Room 1528  
Kasumigaseki Bldg.  
3-2-5 Kasumigaseki  
Chiyoda-Ku  
Tokyo 100, Japan  
581 9811

# R·E·A·D·E·R S·E·R·V·I·C·E

| Inquiry No.                | Page No.      | Inquiry No.                 | Page No.     | Inquiry No.                | Page No.     | Inquiry No.                 | Page No. |
|----------------------------|---------------|-----------------------------|--------------|----------------------------|--------------|-----------------------------|----------|
| 1                          | 350           | 77                          | 455          | 146                        | 249          | 216                         | 267      |
| 2                          | 340, 341      | * COMPUTER CONTINUUM        | 462          | * ELLIS COMPUTING INC.     | 93           | 217                         | 92       |
| 3                          | 450           | 78                          | 409          | * EMPIRICAL RESEARCH GROUP | 194          | * KUTZTOWN UNIVERSITY       | 450      |
| 4                          | 141           | 79                          | 310          | 147                        | 452          | 218                         | 138      |
| 5                          | 424           | 80                          | 332, 333     | 149                        | 464          | 219                         | 372, 373 |
| 6                          | 19            | 81                          | 485          | 150                        | 441          | 221                         | 414, 415 |
| 7                          | 19            | 82                          | 463          | 151                        | 357          | 223                         | 464      |
| 8                          | 451           | 83                          | 18           | 152                        | 403          | 224                         | 166      |
| 414                        | 378           | 86                          | 384          | 153                        | 450          | 225                         | 69       |
| 102                        | 448           | 87                          | 460          | 154                        | 142          | 226                         | 44       |
| 12                         | 95            | * COMPUTER WAREHOUSE        | 139          | 156                        | 465          | 227                         | 462      |
| 10                         | 450           | 88                          | 66           | 157                        | 465          | 228                         | 450      |
| 11                         | 457           | 89                          | 448          | 158                        | 296          | 229                         | 303      |
| 13                         | 382           | 90                          | 318          | 159                        | 448          | 230                         | 485      |
| 14                         | 351           | 404                         | 90           | 394                        | 260, 261     | 231                         | 485      |
| 15                         | 351           | 91                          | 325          | 160                        | 268          | 232                         | 218      |
| 16                         | 368           | 401                         | 356          | 161                        | 269          | 233                         | 60       |
| 17                         | 322           | 92                          | 337          | 162                        | 406, 407     | 234                         | 69       |
| 18                         | 304           | 93                          | 196, 197     | 164                        | 452          | 235                         | 203      |
| 21                         | 385           | 94                          | 196, 197     | 165                        | 173          | 236                         | 78       |
| 22                         | 161           | 95                          | 196, 197     | 392                        | 31           | 237                         | 456      |
| 24                         | 62, 63        | 97                          | 225          | 166                        | 183          | 238                         | 342      |
| * AMPRO COMPUTERS INC.     | 84            | * COSMOSSMARTWARE           | INSERT 32A-L | 167                        | 464          | 239                         | 206      |
| 26                         | 226           | 98                          | 5            | 420                        | 405          | 25                          | 306      |
| 27                         | 152           | 99                          | 358          | 168                        | 454          | 240                         | 52       |
| 28                         | 444           | 402                         | 442          | 408                        | 283          | 241                         | 53       |
| * APPLE COMPUTER INC.      | CII, I        | 403                         | 443          | 169                        | 46, 47       | 245                         | 133      |
| 29                         | 462           | 103                         | 181          | 170                        | 468, 469     | 242                         | 462      |
| 30                         | 150           | 104                         | 181          | 171                        | 91           | 243                         | 485      |
| 31                         | 151           | * DANA'S COMP. DISCOUNT     | 396          | 399                        | 146          | 244                         | 209      |
| 407                        | 514           | 106                         | 186          | 172                        | 459          | 245                         | 458      |
| 32                         | 460           | 107                         | 186          | 173                        | 418          | 246                         | 82       |
| 419                        | 472           | 108                         | 448          | 174                        | 464          | 247                         | 462      |
| 33                         | 472           | 109                         | 456          | 175                        | 80, 81       | 248                         | 238      |
| 34                         | 92            | 111                         | 84           | * HAYES MICROCOMP. PROD.   | 391          | 249                         | 460      |
| 35                         | 12, 13        | 112                         | 84           | 176                        | 25           | 250                         | 462      |
| 416                        | 378           | 113                         | 300          | 177                        | 245          | 251                         | 454      |
| * AT&T INT'L.              | 425           | 114                         | 374          | 178                        | 458          | 395                         | 404      |
| * AT&T TECHNOLOGY          | 297, 298, 299 | 115                         | 231          | 179                        | 393          | 252                         | 320      |
| 36                         | 159           | 116                         | 412          | 180                        | 271          | 253                         | 347      |
| 37                         | 454           | * DIGITAL RESEARCH COMP.    | 68           | 181                        | 287          | 254                         | 155      |
| 38                         | 458           | 117                         | 418          | 182                        | 316          | 255                         | 420, 421 |
| 39                         | 363           | 118                         | 456          | 183                        | 472          | 256                         | 135      |
| 40                         | 190           | 119                         | 188          | 184                        | 17           | 258                         | 171      |
| 41                         | 23            | * DISCOUNT COMPUTER CENTERS | 137          | 185                        | 17           | 259                         | 72, 73   |
| * BELLSOUTH ADV. & PUBL.   | 429           | 96                          | 464          | 186                        | 220, 221     | 260                         | 485      |
| 42                         | 460           | 120                         | 460          | * IBM CORP.                | INSERT 64A-D | 261                         | 447      |
| * BORLAND INT'L.           | 28, 29        | 121                         | 424          | 190                        | 176, 177     | 262                         | 86       |
| 43                         | 41            | 122                         | 219          | 191                        | 168, 169     | 263                         | 448      |
| 44                         | 317           | 123                         | 315          | 192                        | 154          | 264                         | 461      |
| 45                         | 450           | 124                         | 338          | 193                        | 43           | 265                         | 461      |
| 46                         | 67            | 125                         | 376          | 194                        | 334          | * MICROSOFT CORP.           | 144, 145 |
| * BYTE ADVERTISING MESSAGE | 445           | 126                         | 458          | 195                        | 400          | * MICROSOFT CORP.           | 327      |
| * BYTE BACK ISSUES         | 229           | 127                         | 471          | 196                        | 285          | * MICROSOFT CORP.           | 329      |
| * BYTE SUBSCRIBER NOTICE   | 422           | 128                         | 422          | 197                        | 54           | 266                         | 389      |
| * BYTE SUBSCRIBER SERVICE  | 228           | 130                         | 478, 479     | 198                        | 76           | 267                         | 4        |
| 48                         | 140           | 131                         | 480, 481     | 199                        | 32           | 268                         | 472      |
| * C WARE/DESMET C          | 330           | 393                         | 74           | 200                        | 32           | 269                         | 214      |
| 49                         | 472           | 132                         | 288          | * INTERFACE TECH. CORP.    | 212, 213     | 270                         | 50       |
| 50                         | 38            | 133                         | 458          | 201                        | 15           | 271                         | 70       |
| 51                         | 38            | 134                         | 308          | 204                        | 473          | 272                         | 284      |
| * CALIF. DIGITAL           | 466, 467      | 135                         | 7            | 205                        | 474, 475     | 273                         | 472      |
| * CALIF. MICRO COMP.       | 454           | 136                         | 7            | 206                        | 348          | 274                         | 364      |
| 52                         | 448           | 138                         | 352, 353     | 207                        | 349          | 275                         | 408      |
| 53                         | 75            | * ECONOMY SOFTWARE          | 248          | 208                        | 223          | 276                         | 202      |
| 54                         | 77            | 139                         | 408          | 209                        | 486, 487     | 277                         | 94       |
| 55                         | 326           | 140                         | 456          | 210                        | 488, 489     | 278                         | 485      |
| 56                         | 450           | 141                         | 452          | 211                        | 490          | 284                         | 236      |
| 57                         | 513           | 142                         | 454          | 421                        | 162          | 280                         | 34       |
| 58                         | 456           | 143                         | 456          | 213                        | 448          | 281                         | 381      |
| 59                         | 387           | 144                         | 460          | 214                        | 153          | * NAVAL UNDERWATER SYS. CTR | 399      |
| 60                         | 290, 291      | 145                         | 464          | 215                        | 345          | 66                          | 448      |
| 61                         | 460           |                             |              |                            |              | 282                         | 21       |
| 62                         | 460           |                             |              |                            |              | 283                         | CIII     |
| 63                         | 331           |                             |              |                            |              | 279                         | 369      |
| 64                         | 482, 483      |                             |              |                            |              | 285                         | 366      |
| 65                         | 94            |                             |              |                            |              | 286                         | 462      |
| 67                         | 16            |                             |              |                            |              | 287                         | 464      |
| 68                         | 484           |                             |              |                            |              | 288                         | 247      |
| 70                         | 472           |                             |              |                            |              | 292                         | 143      |
| 71                         | 262           |                             |              |                            |              | 293                         | 143      |
| 72                         | 383           |                             |              |                            |              | 294                         | 265      |
| 73                         | 464           |                             |              |                            |              | 295                         | 292      |
| 74                         | 280           |                             |              |                            |              | 296                         | 448      |
| 75                         | 204           |                             |              |                            |              | 297                         | 158      |
| 76                         | 205           |                             |              |                            |              | 66                          | 21       |
|                            |               |                             |              |                            |              | 282                         | 448      |
|                            |               |                             |              |                            |              | 283                         | 20, 21   |
|                            |               |                             |              |                            |              | 279                         | 369      |
|                            |               |                             |              |                            |              | 285                         | 366      |
|                            |               |                             |              |                            |              | 286                         | 462      |
|                            |               |                             |              |                            |              | 287                         | 464      |
|                            |               |                             |              |                            |              | 288                         | 247      |
|                            |               |                             |              |                            |              | 292                         | 143      |
|                            |               |                             |              |                            |              | 293                         | 143      |
|                            |               |                             |              |                            |              | 294                         | 265      |
|                            |               |                             |              |                            |              | 295                         | 292      |
|                            |               |                             |              |                            |              | 296                         | 448      |
|                            |               |                             |              |                            |              | 297                         | 158      |
|                            |               |                             |              |                            |              | 396                         | 426, 427 |

TO GET FURTHER information on the products advertised in BYTE, fill out the reader service card with your name and address. Then circle the appropriate numbers for the advertisers you select from the list. Add a 20-cent stamp to the card, then drop it in the mail. Not only do you gain information, but our advertisers are encouraged to use the marketplace provided by BYTE. This helps us bring you a bigger BYTE. The index is provided as an additional service by the publisher, who assumes no liability for errors or omissions.

\*Correspond directly with company.





# BYTE READER SERVICE



Fill out this coupon carefully. PLEASE PRINT. Requests cannot be honored unless the zip code is included. This card is valid for 6 months from cover date.

Name \_\_\_\_\_ DECEMBER 1984  
41C4  
(Title) \_\_\_\_\_ (Company) \_\_\_\_\_  
Address \_\_\_\_\_ Telephone \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

I purchased this copy by  Subscription  Newsstand, computer store, or bookstore

|    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1  | 23 | 45 | 67 | 89  | 111 | 133 | 155 | 177 | 199 | 221 | 243 | 265 | 287 | 309 | 331 | 353 | 375 | 397 | 419 | 441 | 463 | 485 | 507 | 529 | 551 | 573 | 595 | 617 | 639 |
| 2  | 24 | 46 | 68 | 90  | 112 | 134 | 156 | 178 | 200 | 222 | 244 | 266 | 288 | 310 | 332 | 354 | 376 | 398 | 420 | 442 | 464 | 486 | 508 | 530 | 552 | 574 | 596 | 618 | 640 |
| 3  | 25 | 47 | 69 | 91  | 113 | 135 | 157 | 179 | 201 | 223 | 245 | 267 | 289 | 311 | 333 | 355 | 377 | 399 | 421 | 443 | 465 | 487 | 509 | 531 | 553 | 575 | 597 | 619 | 641 |
| 4  | 26 | 48 | 70 | 92  | 114 | 136 | 158 | 180 | 202 | 224 | 246 | 268 | 290 | 312 | 334 | 356 | 378 | 400 | 422 | 444 | 466 | 488 | 510 | 532 | 554 | 576 | 598 | 620 | 642 |
| 5  | 27 | 49 | 71 | 93  | 115 | 137 | 159 | 181 | 203 | 225 | 247 | 269 | 291 | 313 | 335 | 357 | 379 | 401 | 423 | 445 | 467 | 489 | 511 | 533 | 555 | 577 | 599 | 621 | 643 |
| 6  | 28 | 50 | 72 | 94  | 116 | 138 | 160 | 182 | 204 | 226 | 248 | 270 | 292 | 314 | 336 | 358 | 380 | 402 | 424 | 446 | 468 | 490 | 512 | 534 | 556 | 578 | 600 | 622 | 644 |
| 7  | 29 | 51 | 73 | 95  | 117 | 139 | 161 | 183 | 205 | 227 | 249 | 271 | 293 | 315 | 337 | 359 | 381 | 403 | 425 | 447 | 469 | 491 | 513 | 535 | 557 | 579 | 601 | 623 | 645 |
| 8  | 30 | 52 | 74 | 96  | 118 | 140 | 162 | 184 | 206 | 228 | 250 | 272 | 294 | 316 | 338 | 360 | 382 | 404 | 426 | 448 | 470 | 492 | 514 | 536 | 558 | 580 | 602 | 624 | 646 |
| 9  | 31 | 53 | 75 | 97  | 119 | 141 | 163 | 185 | 207 | 229 | 251 | 273 | 295 | 317 | 339 | 361 | 383 | 405 | 427 | 449 | 471 | 493 | 515 | 537 | 559 | 581 | 603 | 625 | 647 |
| 10 | 32 | 54 | 76 | 98  | 120 | 142 | 164 | 186 | 208 | 230 | 252 | 274 | 296 | 318 | 340 | 362 | 384 | 406 | 428 | 450 | 472 | 494 | 516 | 538 | 560 | 582 | 604 | 626 | 648 |
| 11 | 33 | 55 | 77 | 99  | 121 | 143 | 165 | 187 | 209 | 231 | 253 | 275 | 297 | 319 | 341 | 363 | 385 | 407 | 429 | 451 | 473 | 495 | 517 | 539 | 561 | 583 | 605 | 627 | 649 |
| 12 | 34 | 56 | 78 | 100 | 122 | 144 | 166 | 188 | 210 | 232 | 254 | 276 | 298 | 320 | 342 | 364 | 386 | 408 | 430 | 452 | 474 | 496 | 518 | 540 | 562 | 584 | 606 | 628 | 650 |
| 13 | 35 | 57 | 79 | 101 | 123 | 145 | 167 | 189 | 211 | 233 | 255 | 277 | 299 | 321 | 343 | 365 | 387 | 409 | 431 | 453 | 475 | 497 | 519 | 541 | 563 | 585 | 607 | 629 | 651 |
| 14 | 36 | 58 | 80 | 102 | 124 | 146 | 168 | 190 | 212 | 234 | 256 | 278 | 300 | 322 | 344 | 366 | 388 | 410 | 432 | 454 | 476 | 498 | 520 | 542 | 564 | 586 | 608 | 630 | 652 |
| 15 | 37 | 59 | 81 | 103 | 125 | 147 | 169 | 191 | 213 | 235 | 257 | 279 | 301 | 323 | 345 | 367 | 389 | 411 | 433 | 455 | 477 | 499 | 521 | 543 | 565 | 587 | 609 | 631 | 653 |
| 16 | 38 | 60 | 82 | 104 | 126 | 148 | 170 | 192 | 214 | 236 | 258 | 280 | 302 | 324 | 346 | 368 | 390 | 412 | 434 | 456 | 478 | 500 | 522 | 544 | 566 | 588 | 610 | 632 | 654 |
| 17 | 39 | 61 | 83 | 105 | 127 | 149 | 171 | 193 | 215 | 237 | 259 | 281 | 303 | 325 | 347 | 369 | 391 | 413 | 435 | 457 | 479 | 501 | 523 | 545 | 567 | 589 | 611 | 633 | 655 |
| 18 | 40 | 62 | 84 | 106 | 128 | 150 | 172 | 194 | 216 | 238 | 260 | 282 | 304 | 326 | 348 | 370 | 392 | 414 | 436 | 458 | 480 | 502 | 524 | 546 | 568 | 590 | 612 | 634 | 656 |
| 19 | 41 | 63 | 85 | 107 | 129 | 151 | 173 | 195 | 217 | 239 | 261 | 283 | 305 | 327 | 349 | 371 | 393 | 415 | 437 | 459 | 481 | 503 | 525 | 547 | 569 | 591 | 613 | 635 | 657 |
| 20 | 42 | 64 | 86 | 108 | 130 | 152 | 174 | 196 | 218 | 240 | 262 | 284 | 306 | 328 | 350 | 372 | 394 | 416 | 438 | 460 | 482 | 504 | 526 | 548 | 570 | 592 | 614 | 636 | 658 |
| 21 | 43 | 65 | 87 | 109 | 131 | 153 | 175 | 197 | 219 | 241 | 263 | 285 | 307 | 329 | 351 | 373 | 395 | 417 | 439 | 461 | 483 | 505 | 527 | 549 | 571 | 593 | 615 | 637 | 659 |
| 22 | 44 | 66 | 88 | 110 | 132 | 154 | 176 | 198 | 220 | 242 | 264 | 286 | 308 | 330 | 352 | 374 | 396 | 418 | 440 | 462 | 484 | 506 | 528 | 550 | 572 | 594 | 616 | 638 | 660 |

**BYTE'S BOMB** is your direct line to the editor's desk. Each month, the two top-rated authors receive bonuses based on your evaluation. First look at the list of this month's articles and corresponding article numbers (located on the page preceding the Reader Service list), then rate each article you've read as Excellent, Good, Fair, or Poor, based on your overall impression of the article, by circling the appropriate number in each column below. Your feedback helps us produce the best possible magazine each month.

| Article No. | 1 | 2 | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25  |
|-------------|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|
| Excellent   | 1 | 5 | 9  | 13 | 17 | 21 | 25 | 29 | 33 | 37 | 41 | 45 | 49 | 53 | 57 | 61 | 65 | 69 | 73 | 77 | 81 | 85 | 89 | 93 | 97  |
| Good        | 2 | 6 | 10 | 14 | 18 | 22 | 26 | 30 | 34 | 38 | 42 | 46 | 50 | 54 | 58 | 62 | 66 | 70 | 74 | 78 | 82 | 86 | 90 | 94 | 98  |
| Fair        | 3 | 7 | 11 | 15 | 19 | 23 | 27 | 31 | 35 | 39 | 43 | 47 | 51 | 55 | 59 | 63 | 67 | 71 | 75 | 79 | 83 | 87 | 91 | 95 | 99  |
| Poor        | 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 | 40 | 44 | 48 | 52 | 56 | 60 | 64 | 68 | 72 | 76 | 80 | 84 | 88 | 92 | 96 | 100 |

| Article No. | 26  | 27  | 28  | 29  | 30  | 31  | 32  | 33  | 34  | 35  | 36  | 37  | 38  | 39  | 40  | 41  | 42  | 43  | 44  | 45  | 46  | 47  | 48  | 49  | 50  |
|-------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Excellent   | 101 | 105 | 109 | 113 | 117 | 121 | 125 | 129 | 133 | 137 | 141 | 145 | 149 | 153 | 157 | 161 | 165 | 169 | 173 | 177 | 181 | 185 | 189 | 193 | 197 |
| Good        | 102 | 106 | 110 | 114 | 118 | 122 | 126 | 130 | 134 | 138 | 142 | 146 | 150 | 154 | 158 | 162 | 166 | 170 | 174 | 178 | 182 | 186 | 190 | 194 | 198 |
| Fair        | 103 | 107 | 111 | 115 | 119 | 123 | 127 | 131 | 135 | 139 | 143 | 147 | 151 | 155 | 159 | 163 | 167 | 171 | 175 | 179 | 183 | 187 | 191 | 195 | 199 |
| Poor        | 104 | 108 | 112 | 116 | 120 | 124 | 128 | 132 | 136 | 140 | 144 | 148 | 152 | 156 | 160 | 164 | 168 | 172 | 176 | 180 | 184 | 188 | 192 | 196 | 200 |

# BYTE READER SERVICE



Fill out this coupon carefully. PLEASE PRINT. Requests cannot be honored unless the zip code is included. This card is valid for 6 months from cover date.

Name \_\_\_\_\_ DECEMBER 1984  
41C4  
(Title) \_\_\_\_\_ (Company) \_\_\_\_\_  
Address \_\_\_\_\_ Telephone \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

I purchased this copy by  Subscription  Newsstand, computer store, or bookstore

|    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |       |     |     |     |     |     |     |     |
|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|-----|-----|-----|-----|-----|-----|-----|
| 1  | 23 | 45 | 67 | 89  | 111 | 133 | 155 | 177 | 199 | 221 | 243 | 265 | 287 | 309 | 331 | 353 | 375 | 397 | 419 | 441 | 463 | 485   | 507 | 529 | 551 | 573 | 595 | 617 | 639 |
| 2  | 24 | 46 | 68 | 90  | 112 | 134 | 156 | 178 | 200 | 222 | 244 | 266 | 288 | 310 | 332 | 354 | 376 | 398 | 420 | 442 | 464 | 486   | 508 | 530 | 552 | 574 | 596 | 618 | 640 |
| 3  | 25 | 47 | 69 | 91  | 113 | 135 | 157 | 179 | 201 | 223 | 245 | 267 | 289 | 311 | 333 | 355 | 377 | 399 | 421 | 443 | 465 | 487   | 509 | 531 | 553 | 575 | 597 | 619 | 641 |
| 4  | 26 | 48 | 70 | 92  | 114 | 136 | 158 | 180 | 202 | 224 | 246 | 268 | 290 | 312 | 334 | 356 | 378 | 400 | 422 | 444 | 466 | 488   | 510 | 532 | 554 | 576 | 598 | 620 | 642 |
| 5  | 27 | 49 | 71 | 93  | 115 | 137 | 159 | 181 | 203 | 225 | 247 | 269 | 291 | 313 | 335 | 357 | 379 | 401 | 423 | 445 | 467 | 489   | 511 | 533 | 555 | 577 | 599 | 621 | 643 |
| 6  | 28 | 50 | 72 | 94  | 116 | 138 | 160 | 182 | 204 | 226 | 248 | 270 | 292 | 314 | 336 | 358 | 380 | 402 | 424 | 446 | 468 | 490   | 512 | 534 | 556 | 578 | 600 | 622 | 644 |
| 7  | 29 | 51 | 73 | 95  | 117 | 139 | 161 | 183 | 205 | 227 | 249 | 271 | 293 | 315 | 337 | 359 | 381 | 403 | 425 | 447 | 469 | 491   | 513 | 535 | 557 | 579 | 601 | 623 | 645 |
| 8  | 30 | 52 | 74 | 96  | 118 | 140 | 162 | 184 | 206 | 228 | 250 | 272 | 294 | 316 | 338 | 360 | 382 | 404 | 426 | 448 | 470 | 492   | 514 | 536 | 558 | 580 | 602 | 624 | 646 |
| 9  | 31 | 53 | 75 | 97  | 119 | 141 | 163 | 185 | 207 | 229 | 251 | 273 | 295 | 317 | 339 | 361 | 383 | 405 | 427 | 449 | 471 | 493   | 515 | 537 | 559 | 581 | 603 | 625 | 647 |
| 10 | 32 | 54 | 76 | 98  | 120 | 142 | 164 | 186 | 208 | 230 | 252 | 274 | 296 | 318 | 340 | 362 | 384 | 406 | 428 | 450 | 472 | 494   | 516 | 538 | 560 | 582 | 604 | 626 | 648 |
| 11 | 33 | 55 | 77 | 99  | 121 | 143 | 165 | 187 | 209 | 231 | 253 | 275 | 297 | 319 | 341 | 363 | 385 | 407 | 429 | 451 | 473 | 495   | 517 | 539 | 561 | 583 | 605 | 627 | 649 |
| 12 | 34 | 56 | 78 | 100 | 122 | 144 | 166 | 188 | 210 | 232 | 254 | 276 | 298 | 320 | 342 | 364 | 386 | 408 | 430 | 452 | 474 | 496   | 518 | 540 | 562 | 584 | 606 | 628 | 650 |
| 13 | 35 | 57 | 79 | 101 | 123 | 145 | 167 | 189 | 211 | 233 | 255 | 277 | 299 | 321 | 343 | 365 | 387 | 409 | 431 | 453 | 475 | 497   | 519 | 541 | 563 | 585 | 607 | 629 | 651 |
| 14 | 36 | 58 | 80 | 102 | 124 | 146 | 168 | 190 | 212 | 234 | 256 | 278 | 300 | 322 | 344 | 366 | 388 | 410 | 432 | 454 | 476 | 498   | 520 | 542 | 564 | 586 | 608 | 630 | 652 |
| 15 | 37 | 59 | 81 | 103 | 125 | 147 | 169 | 191 | 213 | 235 | 257 | 279 | 301 | 323 | 345 | 367 | 389 | 411 | 433 | 455 | 477 | 499   | 521 | 543 | 565 | 587 | 609 | 631 | 653 |
| 16 | 38 | 60 | 82 | 104 | 126 | 148 | 170 | 192 | 214 | 236 | 258 | 280 | 302 | 324 | 346 | 368 | 390 | 412 | 434 | 456 | 478 | 500   | 522 | 544 | 566 | 588 | 610 | 632 | 654 |
| 17 | 39 | 61 | 83 | 105 | 127 | 149 | 171 | 193 | 215 | 237 | 259 | 281 | 303 | 325 | 347 | 369 | 391 | 413 | 435 | 457 | 479 | 501   | 523 | 545 | 567 | 589 | 611 | 633 | 655 |
| 18 | 40 | 62 | 84 | 106 | 128 | 150 | 172 | 194 | 216 | 238 | 260 | 282 | 304 | 326 | 348 | 370 | 392 | 414 | 436 | 458 | 480 | 502</ |     |     |     |     |     |     |     |

PLACE  
20c POSTAGE  
HERE

**BYTE**

READER SERVICE  
PO BOX 298  
DALTON, MA 01227-0298  
USA

PLACE  
20c POSTAGE  
HERE

**BYTE**

READER SERVICE  
PO BOX 298  
DALTON, MA 01227-0298  
USA

# BYTE

## SUBSCRIPTIONS

41C4

For a subscription to BYTE, please complete this card.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_ Country \_\_\_\_\_

Card No. \_\_\_\_\_

Expiration date \_\_\_\_\_

Four digits above name—Master Charge only \_\_\_\_\_

Signature \_\_\_\_\_ Date \_\_\_\_\_

Please allow eight weeks for processing. Thank you.

USA

Canada  
Mexico

- |                                  |                               |                               |
|----------------------------------|-------------------------------|-------------------------------|
| <input type="checkbox"/> 1 year  | <input type="checkbox"/> \$21 | <input type="checkbox"/> \$23 |
| <input type="checkbox"/> 2 years | <input type="checkbox"/> \$38 | <input type="checkbox"/> \$42 |
| <input type="checkbox"/> 3 years | <input type="checkbox"/> \$55 | <input type="checkbox"/> \$61 |

- \$53 Europe (air delivery) payment enclosed  
 \$37 Elsewhere (surface mail) payment enclosed

(Air mail rates available upon request)

Please remit in US funds drawn on a US bank. Thank you.

- Check enclosed (Bonus: (North American only) one EXTRA issue—receive 13 issues for the price of 12)



- Bill me (North America only)

# BYTE

## SUBSCRIPTIONS

41C4

For a subscription to BYTE, please complete this card.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_ Country \_\_\_\_\_

Card No. \_\_\_\_\_

Expiration date \_\_\_\_\_

Four digits above name—Master Charge only \_\_\_\_\_

Signature \_\_\_\_\_ Date \_\_\_\_\_

Please allow eight weeks for processing. Thank you.

USA

Canada  
Mexico

- |                                  |                               |                               |
|----------------------------------|-------------------------------|-------------------------------|
| <input type="checkbox"/> 1 year  | <input type="checkbox"/> \$21 | <input type="checkbox"/> \$23 |
| <input type="checkbox"/> 2 years | <input type="checkbox"/> \$38 | <input type="checkbox"/> \$42 |
| <input type="checkbox"/> 3 years | <input type="checkbox"/> \$55 | <input type="checkbox"/> \$61 |

- \$53 Europe (air delivery) payment enclosed  
 \$37 Elsewhere (surface mail) payment enclosed

(Air mail rates available upon request)

Please remit in US funds drawn on a US bank. Thank you.

- Check enclosed (Bonus: (North American only) one EXTRA issue—receive 13 issues for the price of 12)



- Bill me (North America only)

*Note our special offer!  
Send cash with your order  
and receive 13 issues  
for the price of 12 for  
each year you subscribe.  
(North America only, please.)*

## Don't Miss An Issue!

### Have BYTE delivered to your door.

Each month BYTE will bring you the latest in microcomputer technology.

DISCOVER and IMPLEMENT new ideas. Don't miss the original information presented in the pages of BYTE.

With BYTE you'll always be among the first to know about the important breakthroughs, worthwhile new equipment, and innovative projects in the world of computing.

CHALLENGE US to deliver the very best idea in microcomputers and advanced technology to you. Return the attached card today!

Subscribe to BYTE—the world's leading computer magazine.

PLACE  
20c POSTAGE  
HERE

**BYTE** SUBSCRIPTIONS

PO Box 590  
Martinsville, NJ 08836  
USA

PLACE  
20c POSTAGE  
HERE

**BYTE** SUBSCRIPTIONS

PO Box 590  
Martinsville, NJ 08836  
USA

# BYTE

THE SMALL SYSTEMS JOURNAL



uide  
to the **APPLE**  
**P**ersonal  
**C**omputers

Apple IIe

Apple IIc

Macintosh

Lisa 2

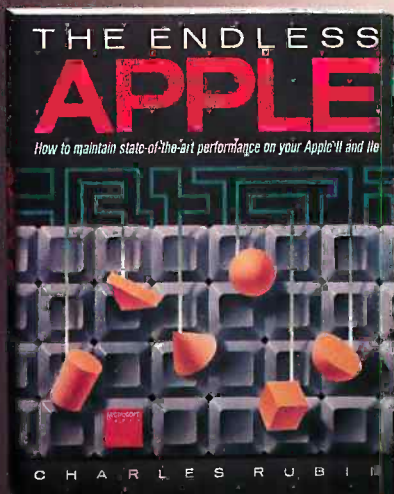
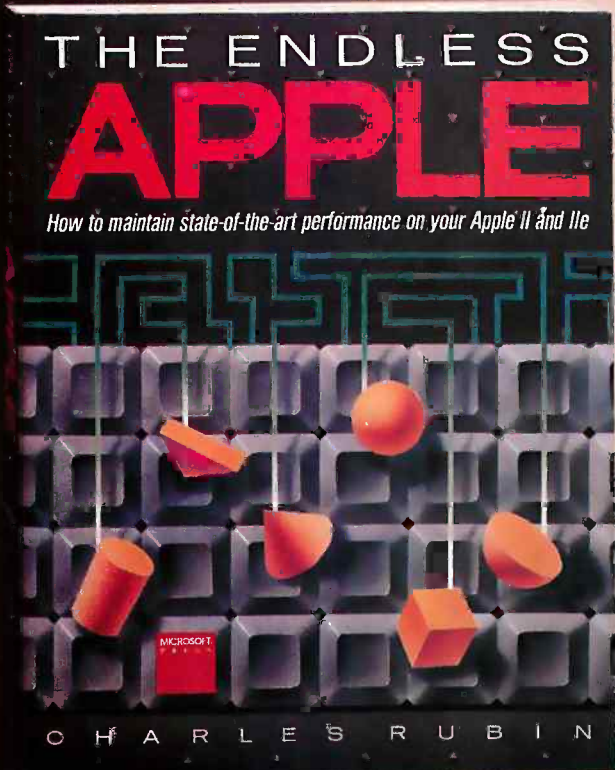
# YESTERDAY...TODAY...TOMORROW

Now you can realize the latest in performance and technology on Apple II and IIe computers. *The Endless Apple* offers you detailed information for dozens of cost-effective and convenient hardware and software options that will transform your Apple from a workhorse to a thoroughbred. Charles Rubin, contributing editor to *Personal Computing* magazine, shows you how each enhancement works and how it compares in terms of price and ease of use.

Here, for the first time, you can discover creative alternatives for advanced word processing, superior spreadsheet choices, integrated software, more effective data-base management, state-of-the-art graphics, and even how to run MS-DOS software on your Apple.

Microsoft Press  
10700 Northup Way  
Bellevue, Washington 98004

The Apple II  
Yesterday... Innovative  
Today... A standard  
Tomorrow... Still state of the art!  
*The Endless Apple*...  
Rekindle the romance.  
\$15.95 Wherever fine books are sold.



MICROSOFT  
PRESS

# APPLE *guide*

**Editorial** *by Phil Lemmons* . . . . A4

**PART I: THE APPLE II, A COMPUTER THAT ENDURES** . . . . A7

**ARTISTIC TOOLS FOR THE APPLE II FAMILY**  
*by Eric Eldred* . . . . . A8

Apple's new Mouse versus Koala's lightpen.

**APPLEWORKS: AN INTEGRATED OFFICE PRODUCT**  
*by Karen Cmar* . . . . . A18

The right tool for the small office—with limitations.

**PRESHIFT-TABLE GRAPHICS ON YOUR APPLE**  
*by Bill Budge, with Gregg Williams and Rob Moore* . . . . . A23

Move blocks of pixels across the screen with only 3K bytes of overhead.

**LOW-COST WORD PROCESSING ON THE APPLE**  
*by Daniel J. Gingras* . . . . . A30

A number of low-priced WPs offer high-priced features.

**ALF'S 8088 COPROCESSOR FOR YOUR APPLE**  
*by David Morganstein* . . . . . A38

Can you turn your Apple into an IBM? Not quite.

**EXPANDING YOUR APPLE'S APPLICATIONS**  
*by Robert Peck* . . . . . A45

Your Apple can run thousands of CP/M programs.

**THE SEARCH FOR SPEECH**  
*by Joe Lazzaro* . . . . . A48

Speech synthesizers have become working tools for computerists.

**APPLE'S NEW MODEM AND ACCESS II**  
*by Henry Brugsch* . . . . . A58

Smart packaging for Apple's brightest modem.

**PART II: THE PERSPECTIVE, VIEWS FROM WITHIN** . . . . . A65

**THE APPLE STORY. PART I: EARLY HISTORY AN INTERVIEW WITH STEVE WOZNIAK**  
*conducted by Gregg Williams and Rob Moore* . . . . . A67

Wozniak tells BYTE how his company began.

**"C" IS FOR CRUNCH AN INTERVIEW WITH PETER QUINN**  
*conducted by Gregg Williams* . . . . A75

An Apple design manager talks candidly about the origins of the IIe and the IIc.

**PART III: THE MACINTOSH AND THE LISA 2, THE FUTURE OF APPLE** . . . . . A79

**EXTRA STORAGE ON THE MAC**  
*by Dave Smith* . . . . . A80

Tecmar and Davong develop two different approaches to mass storage.

**MULTIPLAN/CHART ON THE MACINTOSH**  
*by Mitch Trachtenberg* . . . . . A85

Two reliable management tools make their debut on the Mac.

**EVALUATING THE MACINTOSH FINDER**  
*by Mark S. Jennings* . . . . . A94

Sure, it's friendly to the novice, but a programmer is a novice only once.

**HABADEx ON APPLE'S MACINTOSH**  
*by Léo Laporte* . . . . . A102

A time manager/appointment book that is too little, too early.

**THE LISA 2: APPLE'S ABLEST COMPUTER**  
*by David D. Redhed* . . . . . A106

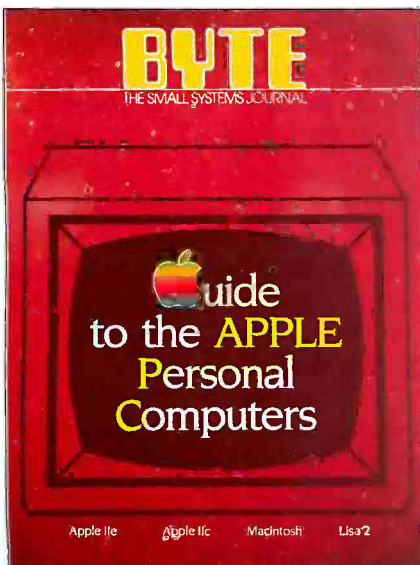
The top of Apple's line is both underrated and underused.

**THE FIRST LOOK AT FORTH ON THE MAC**  
*by Gregg Williams* . . . . . A115

A difficult language made no simpler on the Mac.

**WHAT'S NEW** . . . . . A133

A special section of products that will interest the Apple owner.



Managing Editor, Michael J. Comendul • Technical Editor, Bruce Roberts  
Chief Copy Editor, Nancy Hayes  
Art Director, Ellen Klempner-Beguinn • Copy Editors, Barbara Jatkola, Hilary Selby Poik  
Contributing Technical Editors, Ralph Baumgartner, Chris Brown, Steve Harding,  
Nancy Robertson

## APPLE AND ITS PERSONAL COMPUTERS

**T**here are two kinds of people in the world: people who say Apple isn't just a company, it's a cause; and people who say Apple isn't a cause, it's just a company. Both groups are right. Nature has suspended the principle of noncontradiction where Apple is concerned.

Apple is more than just a company because its founding has some of the qualities of myth. Yes, Jobs and Wozniak made specific decisions that made Apple successful. They gave us the autoboot ROM, the first "warm" plastic computer, and the open hardware bus. But Apple is more than the insight reflected in those decisions. Apple is two guys in a garage undertaking the mission of bringing computing power, once reserved for big corporations, to ordinary individuals with ordinary budgets. The company's growth from two guys to a billion-dollar corporation exemplifies the American Dream. Even as a large corporation, Apple plays David to IBM's Goliath, and thus has the sympathetic role in that myth.

Our minds automatically make a lot of allowances for Apple. If it takes eight years for Apple to bring out an 80-column card, we'll wait or settle for a nonstandard card that does the job. We can read a slogan such as "Apple II Forever," which defies everything we know about rapid technological progress, and feel nostalgic rather than derisive. We can forgive the Lisa's performance problems because we embraced the concept of the user interface. We can wait months for the essential second drive for Macintosh and write scarcely a word of criticism.

But Apple the myth causes us to expose Apple the company to some forms of criticism that we don't make of its competitors. If another company's prices seem high, we criticize them but don't feel betrayed. Apple's high prices seem to betray its mission. If another company makes high profits, we think that's probably good because the company will continue to support its products. If Apple's profits go up sixfold in

one quarter, we wonder again if the company is betraying its mission of bringing computer power to ordinary people. If Apple introduces a computer with no expansion slots, it isn't just a bad decision. It's almost like the violation of an implied warranty. That famous Apple logo seems to promise openness in every respect.

Apple's computers make a strange and wonderful family. As a product line, they are coherent even though they lack media and data compatibility (again defying the principle of noncontradiction). The Apple II computers, the Apple III, the Macintoshes, and the Lisas all have different operating systems and disk formats. Each of the individual machines is an anomaly. Macintosh has a vast memory-address space and severely constrained memory. Lisa has lots of memory and 10 megabytes of hard disk and still runs slowly. The Apple IIc would be a portable, but it lacks a power supply, a power source, and a flat display. It would be Apple II-compatible, but it has differences in ROM and a processor with additional instructions. The Apple IIe is a refined version of a 10-year-old machine that expands memory to 128K by mirroring the strange addressing of the first 64K. The Apple III is a refined version of a 10-year-old machine that uses clever hardware to address 256K bytes of RAM without bank switching.

What makes all this coherent? What makes these machines sell like mad? It isn't the myth, it's the ethos. All these different machines are unmistakably Apple. They are an oasis of defiance in a sea of compatibility. And most important, all these machines let you run applications software by using a mouse to point and select.

It's the commitment to ease of use that salvages part of Apple's mission. Maybe Saints Steve and Steve aren't making computer power easy for everyone to afford, but they are making it easy for everyone to use. Qualified sainthood is better than none.

—Phil Lemmons, Editor in Chief

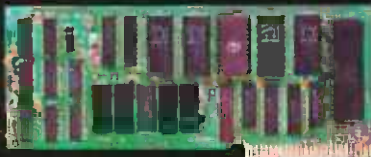


# SUPERCHARGES WITHOUT OVERCHARGING.



## RUN YOUR APPLE II, II+, IIe 3½ TIMES FASTER FOR \$295

Life just isn't fair. You spend good money to buy an Apple™ computer so you can be more productive, but it seems like you spend half your time waiting for the computer to finish its computing. You wait while it recalculates your VisiCalc™ spreadsheet. You wait while your word processor moves a paragraph. And if you write your own programs you can grow old waiting for compilers and assemblers to finish. At last, there is something you can do to win the waiting game. You can get a SpeedDemon™, the Apple speed-up card. Just open the cover, plug it into the expansion slot and PRESTO! — your Apple runs up to 3½ times faster! Yes, it works with all Apple software. Yes, it works with all standard Apple peripheral cards. Yes, it works with whatever amount of RAM



you have. It only costs \$295, far less than competing brands. How can this be? Simple. SpeedDemon surgically replaces the slow Apple processor with a high speed 65C02 processor and fast cache memory to execute your software internally at high speed, but still accesses Apple RAM at normal speed. Your Apple will love it. You will love it. Here's how to order: Order direct from M-c-T by mail to: 1745 21st Street, Santa Monica, CA 90404. Or for faster service dial direct at (213) 829-3643. VISA / MasterCard / American Express or check accepted.



Dealer Inquiries Invited

MICRO COMPUTER TECHNOLOGIES

M-c-T 

Apple is a registered trademark of Apple Computer Inc. VisiCalc is a registered trademark of VisiCorp. SpeedDemon is a registered trademark of M-c-T



## THE NAME TO LOOK FOR WHEN YOU BUY A PERSONAL PRINTER ISN'T APPLE®.

**It's Okidata.** If you're buying an Apple printer to go with your Apple computer, we're sorry to disillusion you, but that printer isn't really an Apple down to the core.

In fact, peel away the logo glued on the front and you have a printer made by some other company that just wears the Apple name.

We tell you this because having the right printer is very important. (Without it, how are you going to get all that valuable information that's up on the screen down on the paper?) So, when you buy you should know what you're getting, and with an Okidata you know you'll be getting the very best printer there is.

**We live, sleep and breathe printers.** We specialize in building printers . . . seven different printer models to be exact. (Apple only gives you four.)

We make fast printers. Apple's speed stops at 120 characters per second in text. But that's where Okidata's speed starts . . . 120 up to 200 char-

acters per second. That's three pages in just one minute.

We make versatile printers. Okidata gives you three print modes; data processing, enhanced/emphasized and correspondence. (You-know-who only gives you two.) Our letter quality is as good as most daisywheels at twice the speed of an Apple. We print all kinds of graphics and charts, and even let you print custom typefaces and symbols.

**Mixing Apples with Oki's.** If you're wondering how compatible your Okidata will be with your Apple computer, the answer is "completely." And that includes the Macintosh™ as well! Okidata is fully compatible with all popular software packages and personal computers. In fact, with Okidata's unique Plug 'n Play™ kit you can be hooked up to your Apple and printing in virtually minutes.

And if you're wondering about service, it's available nationwide through Xerox Service Centers. Of course,

chances are you won't need it. Okidata has the best reliability record in the industry, with a warranty claim rate of less than 1/2 of 1%.

**Select, don't settle.** So, just because you pick an Apple, don't think you have to buy the whole orchard. Pick the printer with the name that's come to mean performance. Okidata.

Call 1-800-OKIDATA (609-235-2600 in New Jersey) for the name of the Authorized Okidata Dealer nearest you. Okidata, Mt. Laurel, NJ 08054.



**OKIDATA**  
an OKI AMERICA company

Apple and the Apple logo are registered trademarks of Apple Computer Inc. Macintosh is a trademark of Apple Computer Inc.

---

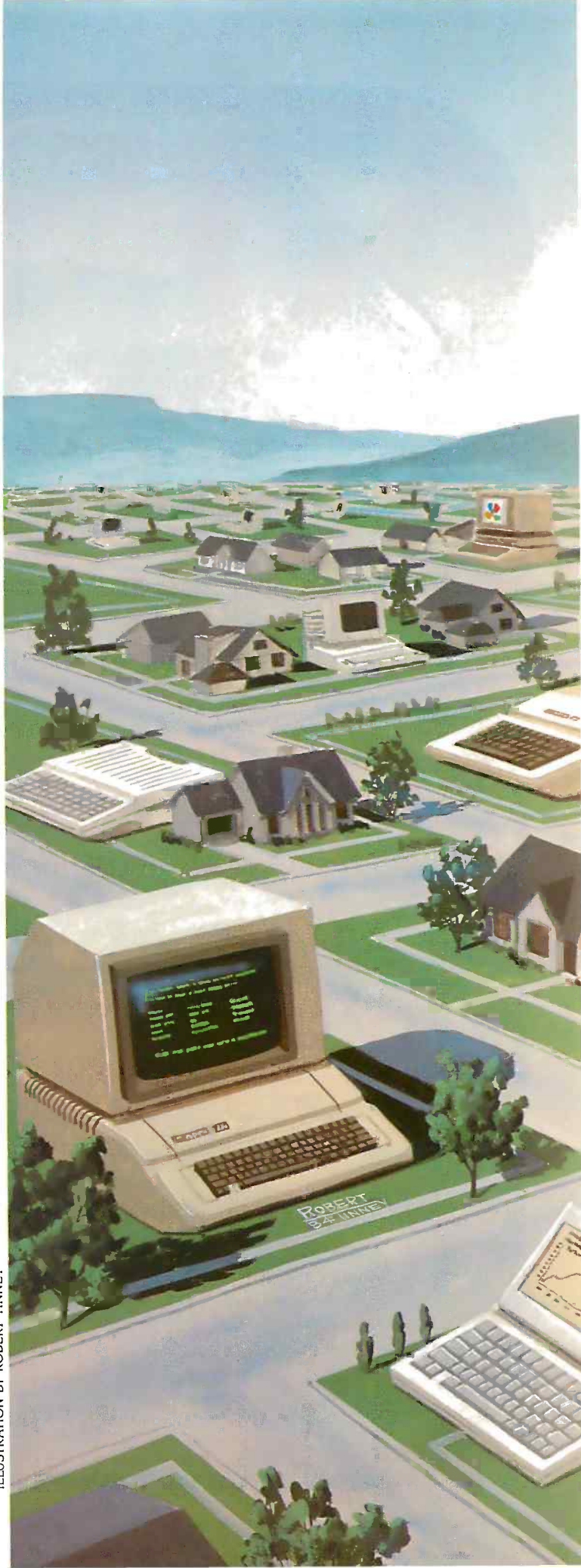
# PART I

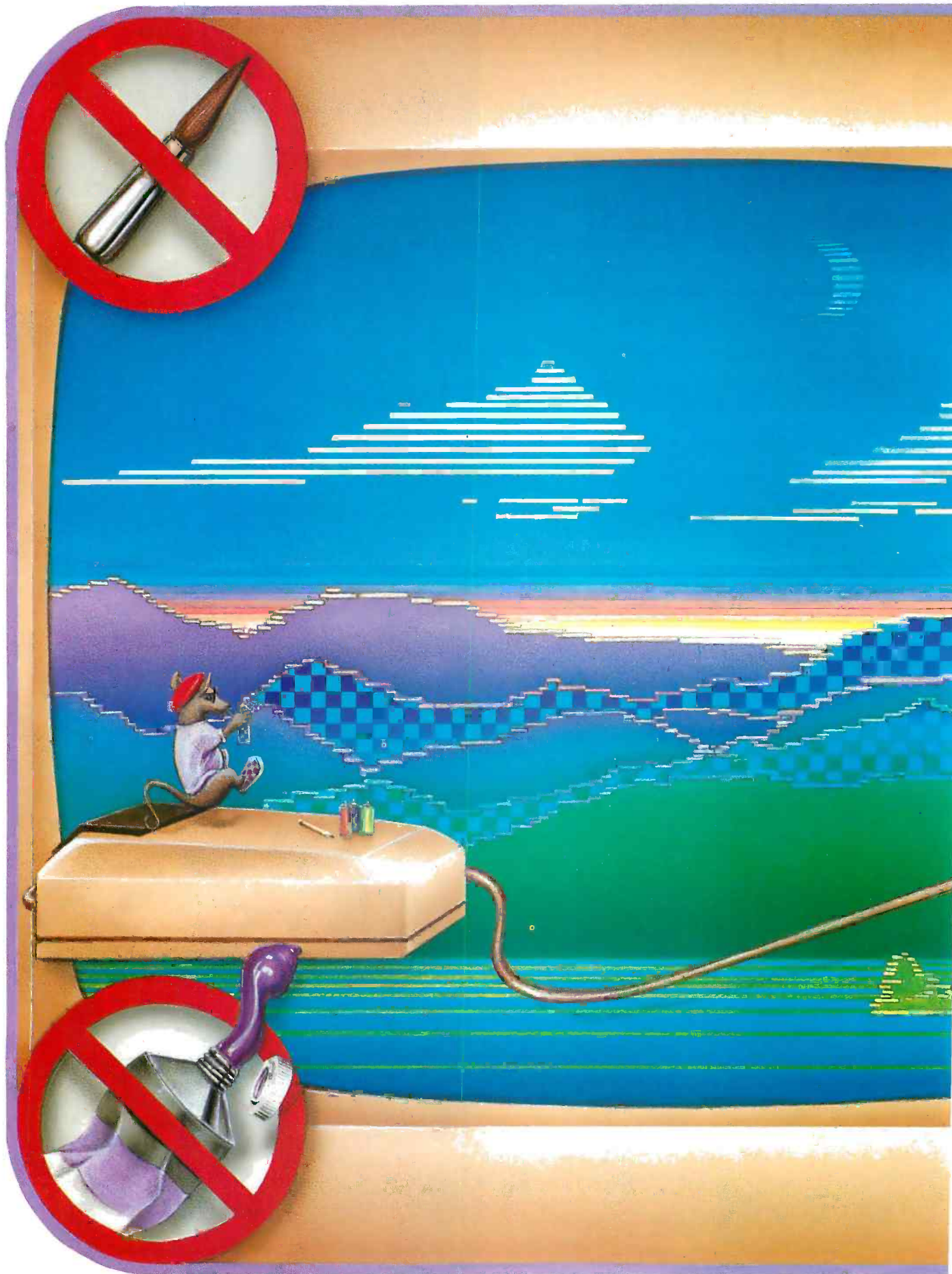
## THE APPLE II, A COMPUTER THAT ENDURES

---

|                                                                                                    |     |
|----------------------------------------------------------------------------------------------------|-----|
| Artistic Tools for the Apple II Family<br>by Eric Eldred .....                                     | A8  |
| Appleworks: An Integrated Office Product<br>by Karen Cmar .....                                    | A18 |
| Preshift-Table Graphics on Your Apple<br>by Bill Budge, with Gregg Williams<br>and Rob Moore ..... | A23 |
| Low-Cost Word Processing on the Apple<br>by Daniel J. Gingras .....                                | A30 |
| Alf's 8088 Coprocessor for Your Apple<br>by David Morganstein .....                                | A38 |
| Expanding Your Apple's Applications<br>by Robert Peck .....                                        | A45 |
| The Search for Speech<br>by Joe Lazzaro .....                                                      | A48 |
| Apple's New Modem and Access II<br>by Henry Brugsch .....                                          | A58 |

ILLUSTRATION BY ROBERT TINNEY





# ARTISTIC TOOLS FOR THE APPLE II FAMILY

*Apple's AppleMouse II and MousePaint  
contrasted to Koala's Gibson Light Pen System*

BY ERIC ELDRED

**Y**ou may not be artistic, but two easy-to-use programs from Apple and Koala could change that. Apple has produced its mouse for the Apple II family and bundled it with a program by Bill Budge of Pinball Construction Set fame. MousePaint 1.0, Budge's adaptation of Bill Atkinson's MacPaint program for the Macintosh, is an incredible feat of 6502 programming.

The AppleMouse II connects directly to the Apple IIc game port or to the Apple II, II+, and IIe through a peripheral board.

The mouse's chief competitor as a drawing tool is the Gibson Light Pen System (formerly called LPS II), first developed in 1982 by Steve Gibson and now marketed by Koala Technologies Corporation.

Both systems surpass other drawing tools by using the full 280- by 192-pixel high-resolution screen in six colors plus shades, patterns, and text. Their fast machine-language programs introduce Apple's "Lisa technology" user interface to the Apple II world.

## APPLEMOUSE II

AppleMouse II has a nice feel inside an adult's palm. The ball is rubber-covered and rolls comfortably. The two tiny plastic feet at the front, which keep the mouse level, do mar shiny desk surfaces, emit a scratchy sound, and will wear out with unusually heavy use.

AppleMouse's button feels much more responsive than the one on the original Lisa mouse. The button does not correspond to any key on the keyboard or the paddle buttons but is read at a screen "hole" memory location, bit 7 of \$778 plus the slot.

Installing the mouse is easy. To use it, you need a flat surface up to about a foot square optimally. From BASIC you can access up to 1024 discrete points, which takes the mouse about 11 inches for full travel. From machine language, you can access the full integer range, which would be more area than most desktops provide unless you "clamped" the range. The resolution is stated to be 0.020 inch (0.5 mm). Cary Lu's *Apple Macintosh Book* (Microsoft Press, 1984) tells you how to add crosshairs to the mouse for such accurate digitizing.

The documentation states that the mouse card fits any Apple II slot, but actually MousePaint emits an error message if it finds the board in slot 3, which is reserved for an 80-column text card or non-ROM card. Slot 4 seems the most compatible with Apple IIc software, but this may be an unlucky choice, as ProDOS expects the second disk-drive controller to be in slot 4. You can secure the Mouse easily in the rear

*(continued)*

*Eric Eldred is currently president of the Southern New Hampshire Apple Core users group (SNAC). He can be reached at RFD 2, English Range Rd., Derry, NH 03038.*

## AT A GLANCE

**Name**

AppleMouse II and Mouse-Paint 1.0

**Type**

High-resolution mouse, interface, graphics software

**Manufacturer**

Apple Computer Inc.  
20525 Mariani Ave.  
Cupertino, CA 95014  
(408) 996-1010

**Price**

\$149 (\$99 for Apple IIc version)

**Author**

Bill Budge

**Format**

One 5¼-inch disk, ProDOS 1.0.1, not copy-protected

**Language**

Applesoft BASIC, listable and modifiable; MousePaint in machine language

**Computers**

64K-byte Apple II, II+, IIe, or IIc; Apple II compatibles with nonsupplied patches; demo program needs Applesoft in ROM

**Documentation**

56-page users manual; interface ROM entry points, no schematic

opening of the II+ or IIe case between a ribbon cable permanently attached to the card and a DB-9S connection from the mouse cable. The AppleMouse II card is the first one I have seen from Apple that is issued without a schematic, and I don't like that. It has a couple of socketed ROMs and a 6821 microprocessor. Two solder jumpers may accommodate a larger ROM in the future.

You can use either a monochrome monitor or a color TV or monitor with the Mouse; though I didn't try one, an RGB (red, green, blue) monitor should also be fine.

**GIBSON HARDWARE**

The Gibson pen runs under Apple DOS 3.3 on a 64K-byte Apple II+ or IIe, but not on an Apple IIc, and needs Applesoft in ROM.

The pen does not take advantage of an 80-column board nor use the double-high-resolution graphics of the Apple IIe. Gibson went to great care to make the pen work with all revisions of the Apple II motherboard, even European 50-Hz Apples, which have slightly different video hardware. Koala has opted to make the new software easy

to use, at the expense of portability to a wide range of machines. I tested it on an Apple IIe.

Installation is relatively easy if you decide to place it in slot 7 in an Apple II+ or IIe with a revision B motherboard. The card needs a video signal present at slot 7 of those machines. In other machines, or if you place the card in another slot, the light pen won't work unless you follow the inadequate instructions in the manual to clip a jumper wire from the card onto a pin of a chip on the motherboard. You may have to adjust the disk-drive cables from the controller in slot 6 if the wide Gibson card in slot 7 fits tightly against them.

The Gibson card is sealed in a heavy plastic case so you cannot see the chips inside, and Gibson does not provide a schematic. The light pen comes with a 90-day warranty, or for a flat \$55 you can have the card or pen repaired thereafter—unless it's been misused.

Since the light cell, recessed inside the tip of the pen, reads the 60-Hz horizontal scan signal from the monitor, the Gibson pen just won't work with certain monitors with long persisting phosphors—the Apple Monitor III. USI

(continued)

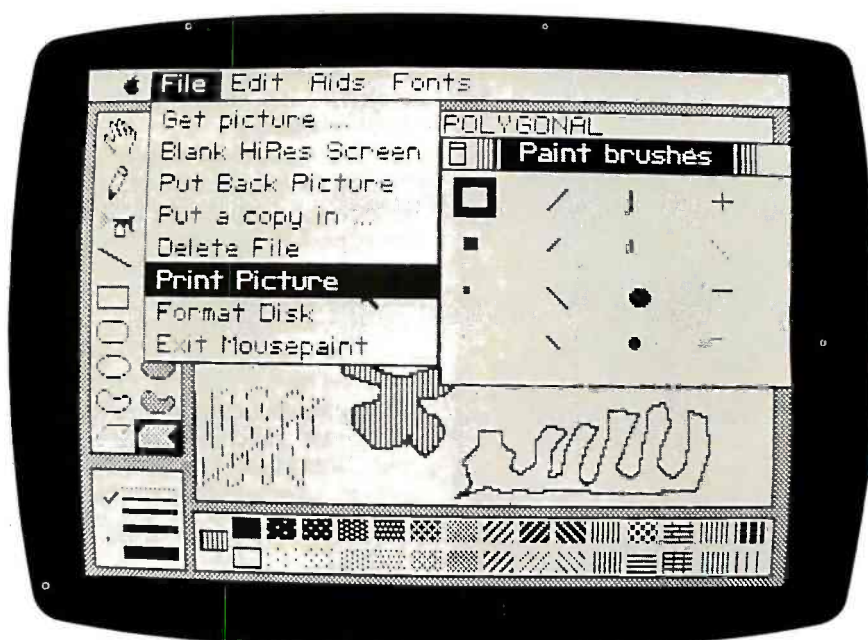


Photo 1: The file menu has most ProDOS functions except catalog. The long diagonal line demonstrates the limit of polygon sides (63 here). Paint-brush-shapes-palette folder can be moved. The program failed to fill the shape at right, evidently because the 63-side limit was reached. You can print only to Apple's Imagewriter and Dot Matrix printers from this menu.

# WHY YOUR MOUSE WILL WANT TO RUN TO 1<sup>st</sup> BASE.

Because the 1<sup>st</sup>BASE™ Database System is RELATIONAL and uses Mac's features to the max!

Yes! 1<sup>st</sup>BASE is just as friendly as your Macintosh. Not only does it use your Mac's mouse, windows and wealth of features to their fullest, but it's relational as well. Meet your data management needs with unprecedented ease and speed. Design and create files.

Enter and edit data. Sort on multiple fields and produce reports from single or joined files—just by pointing and clicking your mouse. Make the most of every byte of your Macintosh with 1<sup>st</sup>BASE, The Relational Database System. It's a piece of cheesecake!

**DeskTop** Software™ Corporation

228 Alexander St. (CN-5287) Princeton, New Jersey 08540. 609-924-7111

Circle 672 on inquiry card.



## AT A GLANCE

### Name

Gibson Light Pen System

### Type

High-resolution light pen, interface, and graphics software

### Manufacturer

Koala Technologies Corp.  
253 Martens Ave.  
Mountain View, CA 94040  
(800) 227-6703

### Price

\$249

### Author

Steve Gibson

### Format

Two 5¼-inch disks, modified Apple DOS 3.3, not copy-protected

### Language

Applesoft BASIC, listable and modifiable; machine-language routines callable from BASIC

### Computers

64K-byte Apple II+ or IIe with Applesoft; hardware works with Apple II compatible or Apple III, but not IIc, and needs at least one disk drive

### Documentation

80-page tutorial with entry points for using Pentrak routines in own programs; no schematic

Pi3, and the Amdek 300, for instance. The problem stems not from the color of the phosphor (in fact, it should work on an RGB monitor) but because a steady dot does not dim enough between refresh signals for the cell to distinguish it. Apple's new Monitor II worked only after I increased the brightness greatly, a point that the manual should stress. In fact, sometimes I had to readjust the brightness level during work within the same program.

Some compensations are available in software. Unlike some other annoying light pens, the display does not flicker off and on to allow the pen to read the dots. In most of the Gibson programs, you can invert the color of the cursor to help the pen locate the dot. Often this tracking cursor will stay in place, as the mouse does, when you remove the pen from the screen, and you can also choose x and y lines to help locate the cursor against some backgrounds. A rough-terrain tracking option can be controlled through software.

Calibrating the pen is simpler and more reliable with Gibson's new software.

Using the pen is easy. Just point it at the screen and move it. Unlike the

mouse, the pen has no switch, so you have to hit a key to turn drawing on and off or to select the color and some other modes. Gibson makes Pendesigner easy for left-handed people to use by assigning the left and right arrow keys, equivalent to the 1 and 2 keys. Some of the new software uses the space bar to select, but I found most of it will also accept the open-apple key on the IIe.

You don't have to hold the pen tightly to the screen, but if you move it away without turning drawing mode off, when you return the pen to the screen it may draw a straight line between the two points where the pen touched the screen. The mouse does not have this problem. The pen does not appear to scratch the screen. You cannot see the exact pixel you are pointing at because the pen tip covers it. The software makes a "booping" sound to signify that it successfully read the point you selected.

You can run the Gibson software with one disk drive, but a second drive would be helpful to save picture files. The DOS 3.3 on the disk supplied has been modified to boot quickly; you cannot initialize another disk unless you reboot with regular DOS, but you can

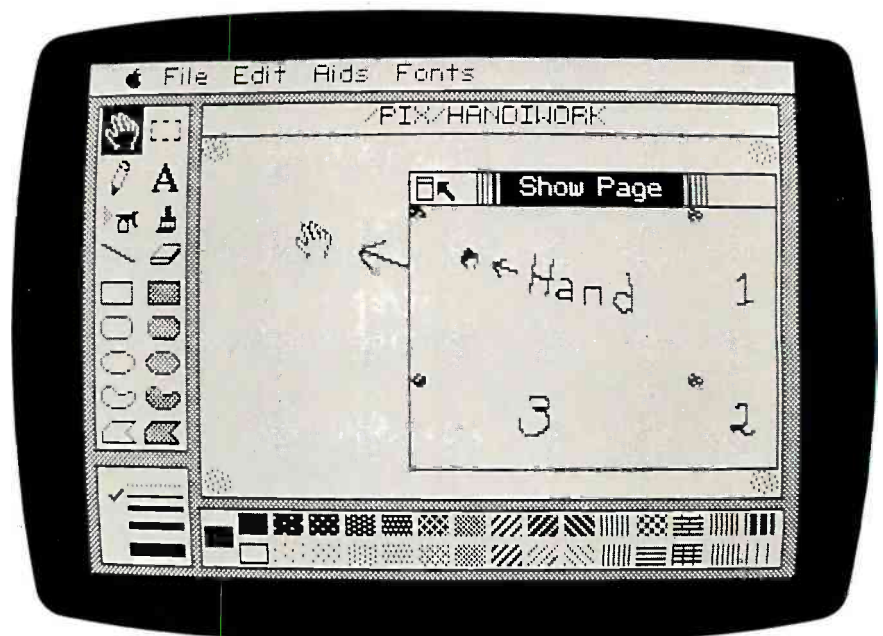


Photo 2: The grabber hand (drawn on sketch pad here) pushes down on paper to move it so you can work on corners marked 1, 2, and 3 on show-page folder, which shows entire screen page. Note the spray-can pattern at corners of the sketch pad. The cursor arrow points to the put-away icon.



*Critically missing from this version of MousePaint is any way to move a part of the picture from one screen to another.*

copy the disks with COPYA and rearrange or modify the programs at will. I was able to use the programs with a disk controller card in slot 4. MousePaint requires you to use slot 6.

The manual doesn't tell you, but the Print function available from the menus is set up to dump the Apple high-resolution screen to a dot-matrix printer through the firmware in just six interface cards: PKASO, Grappler Plus, Microbuffer, Nice Print (Super-MX), Print-It!, and Transtar 315.

As with MousePaint, you can save the picture as a binary file and use another graphics dump program to edit and print it. Adding your own printer driver might be hard because no instructions are provided.

### MOUSEPAINT FEATURES AND QUIRKS

The MousePaint program stores graphics pages and most of the program in memory and uses Apple's new operating system, ProDOS 1.0.1, so it requires an Apple IIe or IIc or a 64K-byte Apple II or II+. (For an overview of ProDOS, see Rob Moore's software review in the February 1984 BYTE, page 252.) ProDOS is packaged with the new Apple II series disk controllers and for older Apples is sold separately by dealers. It includes a users disk and a nontechnical manual.

When you boot the MousePaint disk, you get a choice of MousePaint or a cute introduction to the mouse and some windowing concepts. In this tutorial you learn nothing about MousePaint itself but only things such as how to slide the mouse around. Movement is jerky in either direction, because, unlike MousePaint, the tutorial is writ-

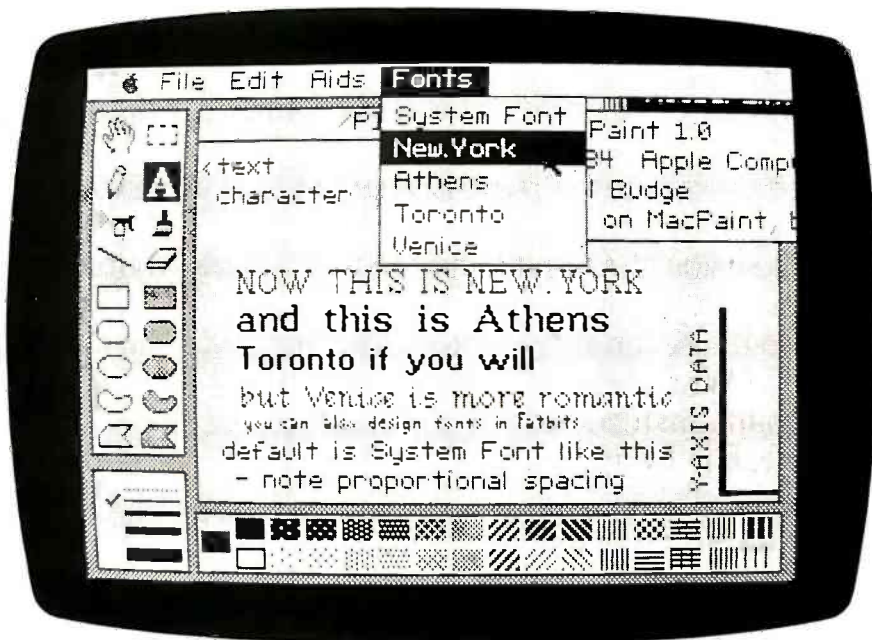


Photo 3: Besides five built-in fonts, you can pencil in others, even vertically, as here. Note the overlapping windows that demonstrate a Macintosh-like interface.

ten in BASIC. Next, you learn the results of clicking the mouse button and how to move objects by "dragging" them—clicking on them and holding down the button while you move them. The program provides a little friendly feedback by making a face smile and adding some windows and a door to a house you build by moving shapes. Finally, you learn about pull-down menu bars and put-away icons.

At this point I should mention a bug in the windowing in MousePaint. There is little point to moving windows around in this program, but, since you can, you might as well be protected against your stupid mistakes. For example, you can grab a window such as the brush-shapes folder and drag it up far under the MousePaint menu bar. Once you let go of the button, you can't move it back because you can't click on its file bar any longer; the window will always reappear in the same place when you select it, and you must reboot to get rid of it. Accurate clipping would have prevented such nasty tricks.

Even if windowing is not perfect in MousePaint, Budge's achievement at transferring some of Lisa's graphics and mouse technology to this 8-bit computer is surely one of the most exciting programming feats I have seen.

When you enter MousePaint, you see

only a sketchpad without "paper" on it. If you want to use a tool, you must first get some paper, either by selecting Blank HiRes Screen (contrary to what the manual states, you are not offered a choice of blank screens), or by Getting an existing file from a disk. Either choice is available by pulling down the file menu and releasing the button when the choice is displayed in inverse.

There is a sample picture on the MousePaint disk, an engineering drawing of an AppleMouse, but since the manual doesn't mention it and you can't get a catalog from the program, you wouldn't find it unless I told you its filename is /MOUSE.PIC. As you become more experienced, you should initially Copy the blank screen to a disk or RAM disk file and during the session frequently Put Back the picture. That way, if you make a mistake you cannot Undo (limited to only a single step), you can Get an earlier version of the picture.

The grabbing hand ("grabber") (photo 2) is necessary because the sketch pad displays only a part of your paper at once, obviously because the icon frame takes up part of the screen. The high-resolution screen is much smaller than a full page of real paper, and there is no way to link screens so they fill a page when printed. You need to push down

(continued)

# Introducing Filevision™ for Macintosh.™

## The fine art of filing by pictures.

Now you can file things the way you see them.

Because Filevision lets you store any kind of information visually. Within pictures you easily create yourself. Even if you can't type or draw.

Filevision. The first software that combines a practical filing system with a simple-to-use, object-oriented drawing system. Which lets you quickly visualize your data. Instead of sorting through tedious line-by-line listings.

In the click of a mouse, you can retrieve the data stored behind each object in your picture. You can even select the objects in your pictures, based on the

data in your files.

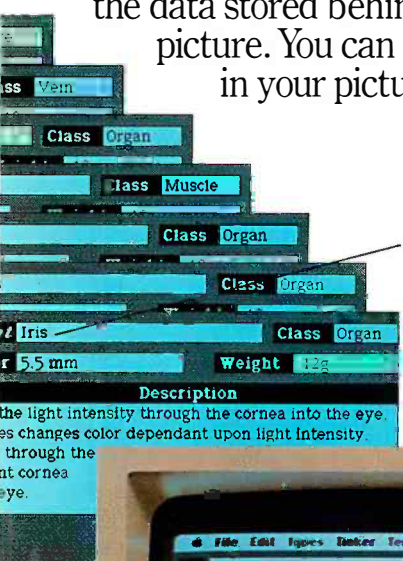
What's more, Filevision lets you link another picture to an object. And lets you group objects together as a common type. So you can create zoom-like effects, step-by-step hierarchies, or overlays. Whatever your mind can picture.

**“Finally. A filing system that sees things my way.”**

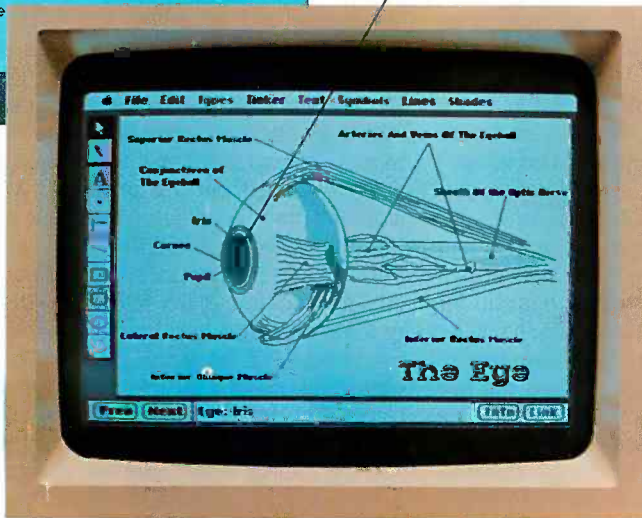
Imagine. A filing system for less than \$200, that lets you look at information the way you look at the world around you.

Utilizing the simplicity of the Macintosh's eye-opening technology, Filevision allows you to create the most spectacular visualizations of whatever you need to file. Or anything you want to see in more detail.

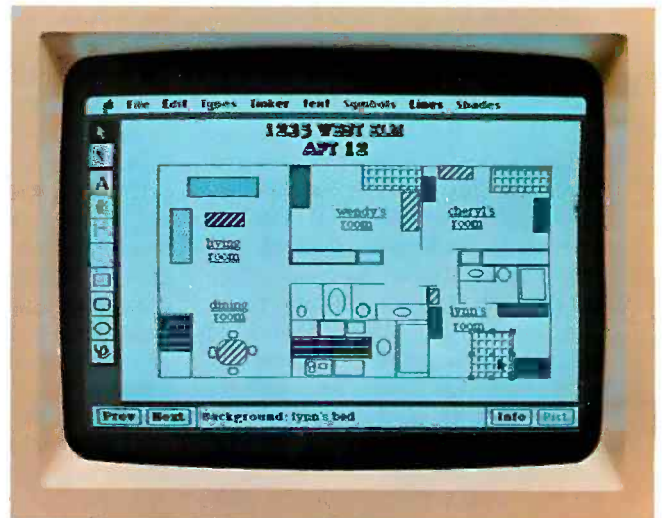
Whether you're an entrepreneur, a businessperson, or someone who collects things at home; if your data relates to



*Each object in your picture is automatically connected to the information about that object.*



*Create technical illustrations or pictures of science class projects, with ease. Whatever you need to remember about your picture, Filevision lets you store on forms connected to it. And retrieve in the click of a mouse.*



*Organize office space by department. Diagram a summer home. Even create a play book for your football team. It's a breeze with Filevision.*

something you can see, you can file it visually with Filevision. And retrieve it visually, too.

You simply place objects in a picture, or select symbols from Filevision's ready-made symbol menu to represent pieces of the information you wish to file.

Then there's Filevision's flexible way of handling alphanumeric data. Each object in your picture is automatically connected to a data form. Which you custom design, quick as a click.

## "For a change, it's simple to modify my files."

Updating your files is just as easy. Whenever the best-laid plans of mouse and man need a little replanning, remember you're just a click or two away from reperfecting your files. Create new symbols and objects, and add them to your picture.

Make a data form for any new object, and all objects of that type will have the same form. Automatically.

Modify a symbol and all matching symbols in your picture will be modified. Automatically.

Change an existing form, and all forms of that type will change. Automatically.

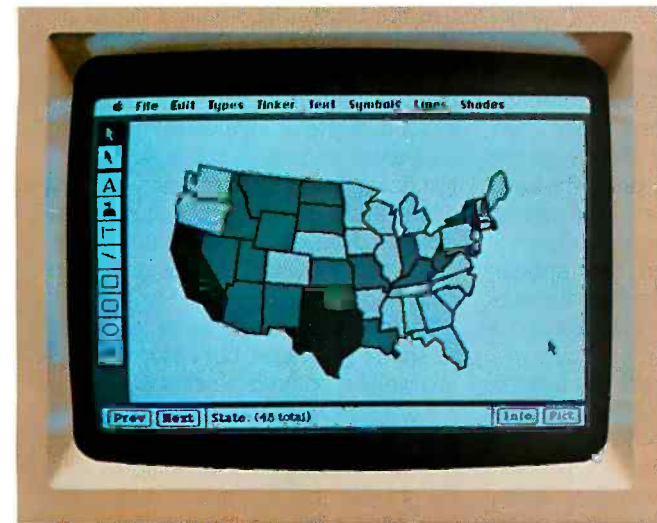
## "Picture the potential."

The possibilities are endless. Filevision can help you quickly make maps, and dawdle over the demographics. Assemble anatomical drawings and look up the names of the ligaments. Separate a plan of Bar Mitzvah guests into those who do and those who don't eat Kosher food and actually see who you seat them next to. Pinpoint places and connect them to faces. Control your inventory by depicting your entire shelf space. And map out geography lessons, sales territories and direct-mail ad targets ad infinitum.

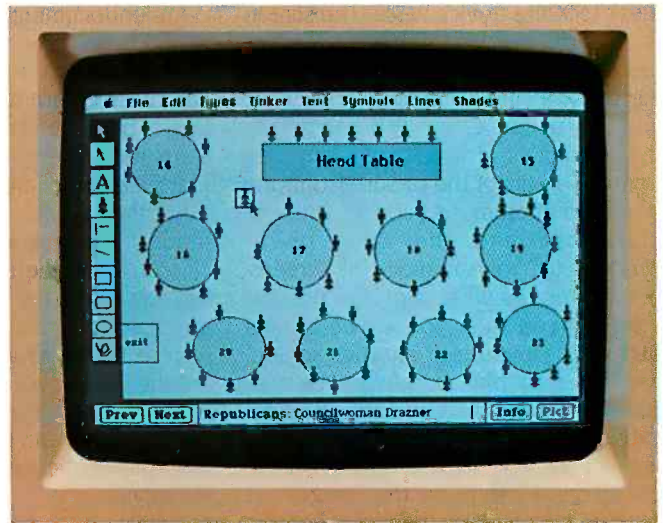
Filevision. The unique filing system for your Macintosh that lets you store and work with information in pictures, as well as numbers and text.

**TELOS**<sup>TM</sup>  
SOFTWARE PRODUCTS  
*Software for the real world.*

Circle 697 on inquiry card.



*Map out sales territories. Sift out subdivisions for direct-mailings. Or search out the states that participated in the French and Indian Wars. Filevision makes your requests pop off the screen. In the click of a mouse.*



*Plan a political fund-raiser with Filevision, and seat the non-smoking Independents away from the smoking Republicans. Or, click to see which blocks of seats have been reserved at your dinner theater.*



Filevision is a trademark of Telos Software Products.  
Telos is a trademark of Telos Corporation.  
Macintosh is a trademark licensed to Apple Computer Inc.

on the hand to slide each of the four corners of the MousePaint page into view, where you can work on them. This can be tiresome in the Fatbits (zoom) mode, since Fatbits (unlike Pendsigner's zoom) always comes up showing the upper left-hand corner of the paper and it takes a dozen full travel slidings of the mouse to reach the opposite corner. There is no shortcut to change icons as in MacPaint or Pendsigner, by simultaneously pushing down a key and the mouse button, so you have to click an icon each time you want another tool such as the hand or pencil.

The editor's box ("marquee") selects an area on which you can operate with any of the procedures in the Edit menu. You can also pick up the outlined area and drag it elsewhere on the visible paper. I would have appreciated a lasso tool like MacPaint's, which, instead of a rectangle, fits tightly around the shape. Likewise, if you frame something and move it or paste it elsewhere and then undo it, MousePaint will leave a hole at the location rather than restore the background.

In the edit mode you have many choices: you can Cut to a buffer, Paste what is in the the buffer, Copy to buffer without cutting, Delete without putting into the buffer, or Invert pixels from black to white or vice versa. The screen is already inverted for your convenience. You can also Flip horizontally or vertically or simply Undo your very last and only action. Critically missing from this version of MousePaint is any way to move a part of the picture from one screen to another, as you can with the Macintosh and the Lisa, or in Pendsigner. You can move full screens, but that erases what is on the present screen. If you know you will be using a part of the picture in another screen, you need to plan carefully. You can erase all but that part and copy it under another name, then start off with it as the new picture. You have to make the background first, move the foreground in, and then touch up the messy corners with Fatbits.

A small note in the manual points out what might be confusing if you run into it in the midst of editing: since the character fonts and screen buffer occupy the same memory area, choosing a font from the pull-down menu right

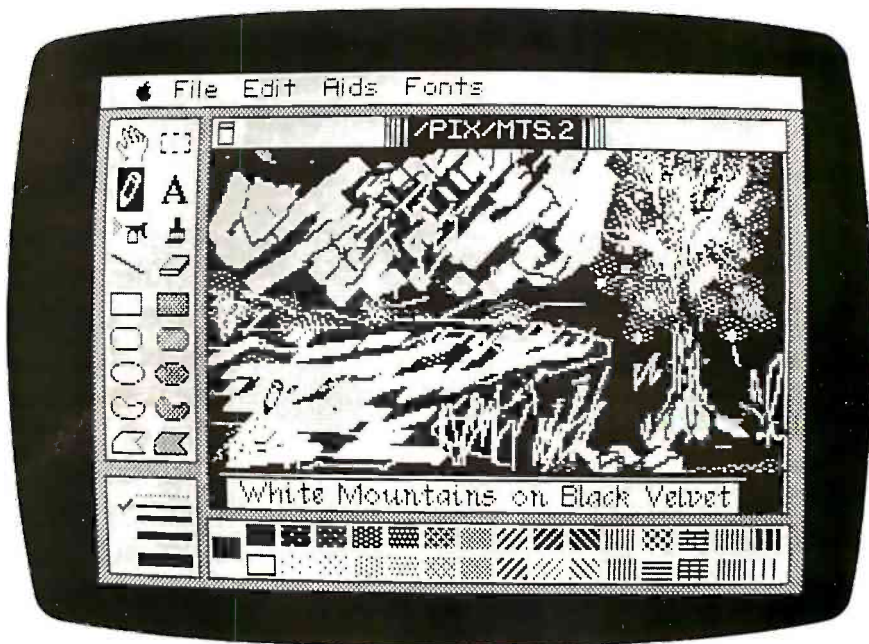


Photo 4: I used the diagonal brush shape for the mountains and reflection, spray can for apple tree, and pencil for snowy crevasses, then inverted the whole sketch pad. Note the pencil in Echo Lake.

after editing will destroy the edit-buffer contents. You won't even get the pointing hand icon if you then select Paste, but must Copy the frame again. The manual says you'll receive a warning before the buffer is destroyed, but I didn't.

An undocumented feature ("quirk" would be more accurate) of edit is that while you are moving the marquee you can press Return to paste its contents. Don't, because the cross cursor then starts moving erratically away from the marquee each time you press the key.

Another quirk occurs in the pencil mode. If you type letters while the pencil icon is on the screen, they appear halfway across the screen from the cursor. Luckily, you can backspace to restore the original.

Budge did a good job with the text letter command. When you move the bracket cursor and press the mouse button, you can type attractive proportionally-spaced characters that erase correctly when you backspace or press the **I** delete key. When you press Return, the text continues on the next line down, but text won't automatically word-wrap and you can't get enough characters on the screen to make MousePaint a word processor. MousePaint has four fonts in different sizes

(their names correspond to Macintosh fonts), but you cannot change styles or sizes as in MacPaint.

The pencil tool is one I tend to use the most in MousePaint. It does not work exactly as you might expect, though. To draw a black line, you should use the brush (the smallest dot brush shape is the same size as the pencil point). The pencil instead inverts the pixel (screen dot) you click on, from black to white or vice versa, then stays that color as long as you hold the button down. For greater accuracy, you can enter Fatbits mode and pencil individual dots, and so construct small or large characters for which there is no font, or clean up messy details.

The spray can is nice for projects such as shading a shape, but it doesn't work too well on colored objects. Ordinarily, it sprays only black, but if the background is colored, the appearance can be odd. Moving the can while holding the mouse button down makes the spray come out every seven dots or so and prevents the background from becoming solid black.

If you are using a color monitor or television, you will probably use the filled and unfilled shape tools much more than I did, because they are the

*(continued on page A62)*

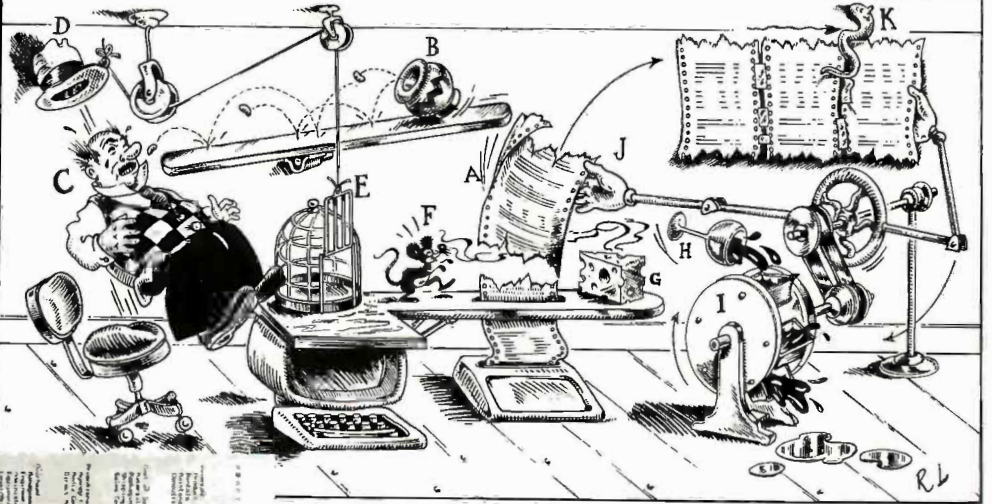
# SIMPLIFIED SPREADSHEET ASSEMBLY

RISING SPREADSHEET (A) KNOCKS MEXICAN JUMPING BEANS (B) INTO MOUTH OF NEUROTIC MAN (C) WHO IS SO DISCOMBOLATED THAT HIS HAIR STANDS ON END, DISLODGING HAT (D) WHICH OPENS CAGE (E) AND RELEASES EPICUREAN MOUSE (F).

MOUSE, INSPIRED BY SCENT OF PERFECTLY AGED CAMEMBERT CHEESE, GNAWS THROUGH SPREADSHEET, ONLY TO DISCOVER HE HAS BEEN FOOLED BY AROMA OF OVER-RIPE GORGONZOLA (G).

IN A FIT OF PIQUE HE SPILLS VINTAGE WINE (H) INTO WATER-WHEEL (I) WHICH TURNS PULLEY THAT CAUSES GLOVE (J) TO GRASP SPREADSHEET AND MOVE IT TO TAPING AREA.

SHEET IS TAPED SECURELY IN PLACE BY TRAINED ADHESIVE TAPE WORM (K).



## MADE SIMPLE.

Now you can save time, aggravation, adhesive tape, and Gorgonzola cheese by following one simple direction—Sideways. It's the unique software program that lets you output all the spreadsheet columns you need, all on one continuous page, all with one print command—and all for only \$60!

With Sideways on your side, no spreadsheet you invent with Lotus 1-2-3™, VisiCalc®, Multiplan™, or SuperCalc™ is too wide! And it's just as powerful an ally when you're creating far-into-the-future schedules and pert charts with your word processor. In fact, for any wide text file, for dozens of uses, the way to go is Sideways.

The experts agree. *PC Magazine*, for example, writes: "If you've got the need, Sideways has the solution." And *PC World* calls Sideways "nifty . . . an easy to use program that does what it claims."

You can go Sideways today with an IBM® PC and an IBM®, Epson, Okidata, Prism™, or Pro-writer™ printer. Ask for Sideways at your local ComputerLand® or other leading computer stores. Or mail a \$60 check to Funk Software, P.O. Box 1290, Cambridge, MA 02238. (617) 497-6339. MC/Visa accepted. Send no Mexican jumping beans, please.

## SIDEWAYS™

FOR EASY-READING HARD COPY

Circle 676 on inquiry card.



BY KAREN A. CMAR

# APPLEWORKS: AN INTEGRATED OFFICE PRODUCT

*Word processing, database management, and spreadsheet analysis  
in one package for the Apple IIe and Apple IIc*

**A**ppleworks is the first package developed for the Apple IIe and IIc that combines the three most popular software applications: word processing, database management, and spreadsheet analysis. Though the software design of the individual modules is not innovative, Apple Computer has produced a package that is easy to learn, genuinely user-friendly, and well documented.

Like the Lisa and the Macintosh, Appleworks uses the kind of everyday language that the inexperienced computer user can understand. The Appleworks "desktop" can handle more than one file at a time. Each file is "added to the desktop" and as many as 12 files can be on the desk at one time. The concepts of "cut and paste" and of a "clipboard" are used to help the user pull information from one file and transfer it to another.

Appleworks requires an 80-column text card (preferably with extended memory), a monitor, and one disk drive. A printer is not necessary, but the system would not be very useful without it. Appleworks is set up to run with any of eight different printers (the Apple daisy-wheel printer, Apple Silentyper, Apple Imagewriter, Epson MX, RX, or FX, and the Qume Sprint 5 or 11) and can be customized to run with any other printer. The user can specify as many as three printers.

Appleworks can also be used with a Profile hard disk.

The Appleworks package comes with

---

*Karen Cmar is a consultant for First Micro Group (1 McKinley Square, Boston, MA 02109). She will be starting Harvard Business School this fall.*

---

*Appleworks will  
automatically calculate  
the page breaks each  
time you print a file.*

---

five single-sided disks, including two training disks, a start-up disk, a program disk, a sample files disk, and a 280-page manual, which includes a written tutorial. The training disks include several quizzes, lots of good graphics, and a few bad jokes. On the whole, the training disks and the tutorial are excellent.

There are two basic modes in the Appleworks program. The highest level, which is the main menu, does the work of controlling the files on the desktop. From the main menu you can choose to add files to the desktop, remove files from the desktop, save files, or quit the program. You can choose the "Other Activities Menu," which includes commands for formatting disks and changing the disk and printer setups, or you can choose to work with one of the files on the desktop.

This part of the program is easy to use, especially the Quit routine. Before you can quit the program, Appleworks reminds you to save each of the files that you have altered during the session. Also, each time you ask for a directory, add files to the desktop, or save files on the disk, Appleworks lists the files on the disk, how much space each occupies, and the space remaining on the disk.

By choosing to work with one of the

files on the desktop, you enter the second level of the program, the review/add/change mode. This is the mode in which all other functions are performed, including setting up file structures, inputting information, and developing report formats.

A Help screen can be called from various other menus. It lists all the commands and command codes that can be called from the current menu. Unfortunately, the Help screen lists only the Appleworks commands and the codes for issuing the commands. Considering the fact that the package is oriented toward the less experienced user, it might have been helpful to put in some additional instructions for some of the more complicated commands.

The screen layout is one of the nicest features of Appleworks. The main menu appears as an index card on the screen. Each selection (except when you are actually working with one of the files) appears as another index card.

Appleworks never leaves you wondering what is happening. There is always a message on the screen to tell you what to do. Even error messages are handled well by the program. Errors are handled within the program in Appleworks terminology, and it is usually easy to recover and get back to what you were doing.

The top and bottom lines of the screen contain basically the same information regardless of whether you are working with a spreadsheet, a database, or a word-processing file. The top of the screen displays the name of the file, the name of the current menu or command mode, and the menu you will go to if you press the Escape key. This is an important feature for the inexperienced user who often gets lost in a maze of

multiple-level menus.

The bottom of the screen shows a prompt that tells you what to do next and, in the lower-right corner, displays a reminder on how to call up the Help screen.

All commands are issued by holding down the Open Apple (OA) key and typing a single letter.

## WORD PROCESSING

The word-processing module is my favorite part of this package. (In fact, I like it so much, I'm using it to write this article.)

To enter the word-processing module, you simply choose to work with an existing word-processing file or create a word-processing file. Then you may begin to type information into the file or use any of the Appleworks word-processing commands. In addition to files created by Appleworks, you can edit text files created by other word processors (provided they are on ProDOS-formatted disks).

Like most other word processors, it has word wraparound, and the Return key indicates the end of the paragraph or a blank line. Unlike some other word processors, Appleworks' word wraparound responds immediately (and quickly) to any changes in a paragraph.

Cursor scrolling speed with Appleworks is excellent (see table I). The commands for moving the cursor around the document are adequate but not designed for serious word processing (i.e., someone who sits at the terminal all day might find both the cursor control and the DELETE commands somewhat inadequate).

The cursor can be moved one space at a time using the four arrow keys (up, down, left, and right). By holding down the Open Apple key with the left or right arrow keys, you can move the cursor one word to the left or right. The Tab key and the OA-Tab key combination can be used to move across a line either forward or backward. (The tabs can be reset using the OA-T command.) These commands for horizontal movement are certainly adequate, but I missed the ability to move from one end of a line to the other with one keystroke.

For vertical movement, there is the "ruler," which allows you to hold down the Open Apple key and type a number between 1 and 9. The number 1 will

bring you to the beginning of the document, the number 9 will bring you to the end, and the numbers in between will move the cursor proportionately within the document.

The OA-D command allows you to use the arrow keys to highlight blocks of text you want to delete. When you press Enter, the text disappears and the paragraph is reformatted. This highlighting feature (reminiscent of Lotus 1-2-3) is excellent in that it really does help prevent mistakes, but like most packages, Appleworks has no prompt to confirm that you want to delete a block of text and (sadly) no buffer that holds deleted text. Once deleted, the text is lost.

The only other delete command, Control-Y, deletes the entire line to the right of the cursor.

The MOVE and COPY commands are similar to the OA-D command. You simply highlight the area you want to move, press Enter, move to the place where you want the text to begin, and press Enter again.

Appleworks has two cursors: an insert cursor, which is a blinking bar, and an overstrike cursor, which is a blinking rectangle. The command OA-E (E is for Edit) switches between the two cursors. To insert text you move one character to the right of where you want the text inserted and type using the insert cursor.

Appleworks' word processor has a Find/Replace feature that can distinguish between upper- and lowercase letters, or it can ignore whether the text is upper- or lowercase. This is an excellent feature that most word processors don't have. The FIND/REPLACE command works from the current cursor location to the end of the text and will not go backwards.

One other helpful feature of Appleworks' word processor, which also works in the other two modules, is the HARDCOPY command (OA-H). This command will print out whatever is currently on the screen. The HARDCOPY command also works in the main menu mode.

## FORMATTING AND PRINTING WORD-PROCESSOR FILES

In addition to the basic formatting features, Appleworks also has some really useful special formatting features. One

of my favorites is the INDENT command, which allows you to set up hanging paragraphs or bulleted items. Others allow you to underline, put text into boldface type, make superscripts and subscripts with just a few keystrokes. These features, as well as the other Appleworks print options, simply require you to move your cursor to wherever you want the print option to begin and type OA-O (O for options). A menu of all the print options appears, and it is simple to follow the prompts to specify the details of a print option. When you are finished, you press the Escape key to return to the text.

The pagination features are also very well thought out. Appleworks will automatically calculate the page breaks each time you print a file. At any time, you can calculate where the page breaks will occur by using the OA-K command (K is for calculate?). The page breaks will appear on the screen as dotted lines with the words "end of page" and the page number in the center. Appleworks has its own rules for setting up pages. (For example, it won't break a paragraph so that only one line is split from the rest of the paragraph—a great idea!) You can override Appleworks page breaks in two different ways. First, you can specify groups of information that must remain together on the same page, and second, you can actually set up some or all of the pages yourself. These are wonderful features, which you'll undoubtedly appreciate if you've ever tried to lay out pages by counting line numbers.

In addition to linking groups of information together on the same page, you can link groups of words or characters together on the same line using "sticky spaces." To insert a "sticky space" in the text, you just type OA-SPACE.

Another useful feature is the ability to specify the number of copies you want printed. You can also have a document stop during printing at a certain point so that you can enter information from the keyboard. These two features together allow you to print out personalized letters.

Things that you might find missing from this package are the ability to set up several files to automatically print sequentially and a spelling checker. It also lacks the ability to do mail-merge. Over-

*(continued)*

**AT A GLANCE**

**Name**

Appleworks

**Manufacturer**

Apple Computer Inc.  
20525 Mariani Ave.  
Cupertino, CA 95014  
(408) 996-1010

**Type**

Integrated software package including word processing, spreadsheet analysis, and database management

**Format**

5¼-inch floppy disk

**Hardware Needed**

Apple IIe or Apple IIc; requires 80-column board

**Operating System**

ProDOS

**Price**

\$250

**Documentation**

280-page manual, tutorial disk, sample file disk

**Audience**

General

all, though, it is an impressive word-processing package, especially for those who have no previous experience with word processing.

**MANAGING DATA**

The Appleworks database module is a very simple system designed to handle mailing lists, schedules, and simple data files, but not suitable for complex business database applications. Its greatest asset is its ability to interface with Appleworks' word-processing and spreadsheet programs.

It is capable of handling text or ASCII (American Standard Code for Information Interchange) files, DIF (Data Interchange Format) files found in VisiCalc, Apple's own Quick File files, and, of course, files created from scratch by the Appleworks' database. It can also create DIF files. According to the documentation, each Appleworks database file can hold approximately 250 records when using an Apple with 64K bytes of RAM (850 with 128K bytes), and each record can contain as many as 30 fields (referred to as categories). The maximum record length is 1024 characters, and the maximum entry length is 76 characters.

Creating and working with a database file are basically easy, but the clarity of the documentation in the manual and in the tutorial is not as good as for the word-processing and spreadsheet modules. The on-screen prompts are sometimes unclear. For example, when you're creating a file, a screen appears called the Change Name/Category screen. The right side of the screen lists some of the options, but the instructions are unclear. The left side of the screen says "Category 1" with the insert cursor blinking at the beginning of the word "Category." In actuality what you must do is type the first category name over the words "Category 1" using the overstrike cursor, then press Return. You continue typing the category names in and pressing Return after each (the words Category 2, Category 3, etc., never appear on the screen). When you have finished with all categories you must press the Escape key to get out of this sequence. It is hard to figure out how to go through these steps from the instructions on the screen. The instructions in the manual are somewhat clearer.

After you have created a file, Appleworks prompts you to input data. There are two screen display formats for data in Appleworks' database: the Single Record Layout, which displays all of the information contained in one record with categories listed vertically, and the Multiple Record Layout, which displays all the records in the file with categories listed horizontally. You can switch back and forth between the two formats using the OA-Z (ZOOM) command. In Multiple Record layout, if all the categories won't fit across the screen, you can specify which categories you wish to have displayed and how wide the columns should appear on the screen using the OA-L (LAYOUT) command. Unfortunately, however, there is no way to scroll over to the right to see the missing categories. This is a serious drawback when you're using the Multiple Record Layout to input or change data.

The editing features and methods of moving the cursor are basically the same as in the other two modules. You can change the file structure by going back into the Change/Add Name screen with the NAME command (OA-N). Using

**Table 1: Benchmark tests for word processing and spreadsheet calculations. All tests run on the Apple IIe with 128K bytes of memory.**

| Test*           | Appleworks' Time (seconds) |
|-----------------|----------------------------|
| Word Processing |                            |
| Document Load   | 14.3                       |
| Document Save   | 19.7                       |
| Search          | 3.5                        |
| Scroll          | 27.7                       |
| Spreadsheet     |                            |
| Save            | 18.7                       |
| Load            | 18.3                       |
| Recalculate     | 18.0                       |

\*Note: Word-processing times are based on Appleworks' loading, saving, searching, and scrolling a 4000-word document. The spreadsheet consists of a 25- by 25-cell matrix. Each cell in the matrix is equal to 1,001 times the cell to the left. The width of each cell is 10 characters. The BYTE database test was too large for Appleworks. The standard database consists of 1000 records, each record consisting of 100 characters.



this screen you can add categories, delete categories, move categories, or change category names. You can insert records in the file by using the INSERT (OA-I) command.

Appleworks' database has some simple sorting functions. You can select records to be displayed on the screen or printed out using the SELECT RECORDS (OA-R) command. The criteria are expressed in an easy-to-learn format, and it is menu-driven so there aren't any problems with syntax. For example, to select from a mailing list, you could specify "State equals Massachusetts and Last Name begins with A through C." Each word in these selection specifications is chosen from a menu except the letters "A" and "C," so it's hard to make a mistake. The reference manual doesn't explain the selection criteria very well, but the on-screen prompts are good.

The SELECT RECORDS command changes the way a file is displayed on the screen (and printed out) but doesn't actually change the contents of the file. You can also use the ARRANGE command (OA-A), which sorts the file and permanently changes the order of the records. You can arrange records in numerical or alphabetical order, either lowest to highest or highest to lowest. You can sort on only one field at a time, so you have to perform multiple sorts if you need the file sorted on more than one criterion.

There is a FIND command (OA-F) in Appleworks' database, but no REPLACE command. I wonder why not, as this is a frequently used feature of most database-management systems.

Appleworks has a built-in report generator, which allows you to generate reports from your data files that can be displayed on the screen, printed out, or "cut and pasted" into a word-processing file.

The report generator provides two basic report layouts: a table-style report and a label-style report. In both formats you have an opportunity to choose which categories you want displayed and how you want them displayed.

You can save your report formats for later use and build more than one report format for a given file. However, if you change the file structure by adding a category, deleting a category, or moving categories, you lose all of your

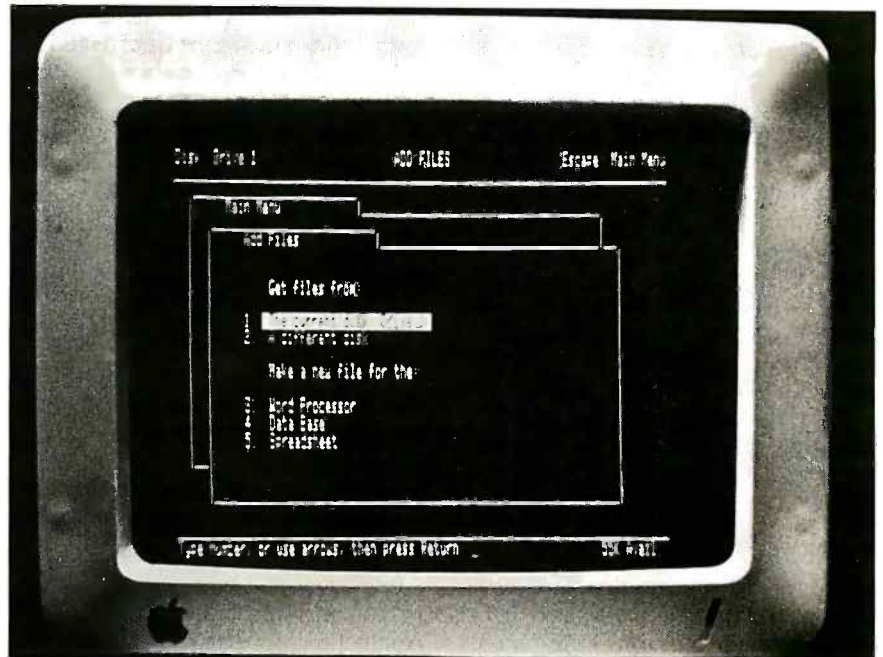


PHOTO COURTESY OF APPLE COMPUTER, INC.

Photo 1: Appleworks offers users screen menus that are on index card images.

report formats. Presumably, this is a necessary safeguard, but it would be nice to be able to amend report formats or handle these changes in a less drastic fashion.

The CALCULATE command (OA-K) allows you to add a maximum of three calculated fields to your file as part of a report format. There are no sophisticated arithmetic, logical, or statistical functions, only addition, subtraction, multiplication, and division. Formulas for calculated fields refer to categories by the letters that appear on the screen at the top of each column. This is an excellent feature, but its usefulness is severely limited by the fact that you cannot sort or select records from files based on calculated fields.

Totals can be set up for all numeric categories, including calculated categories, using the TOTALS command (OA-T). Subtotals can be set up using the GROUP TOTALS command (OA-G). This is perhaps the most poorly documented command in the entire package.

The actual printouts of the reports are rather unattractive and difficult to read. The filename, report title, and report heading appear on successive lines at the top, and the body of the report begins immediately on the next line. This makes it look crowded. Blank lines can be added to a tabular report only

by adding blank fields to the file. Dotted lines and underlines cannot be added at all.

There are very few print options in the database module. You can't use bold-face, condensed type, or many of the other features that are available in the word-processing module. Of course, you can convert any database report into a word-processing file by using the "cut and paste" feature, and then you can use all of the word-processing features to reformat the report. But you can't save the revised format for reuse with different data, and you can't add data to it just by adding to your database file.

Another item I disliked about the Report formats is that the total line and subtotal lines are not labeled. Appleworks does not automatically put the word "Total" on the total line, nor does it give you the opportunity to do so or to choose a label yourself. Also, there is no underline separating the entries in the column from the total. This further contributes to the crowded appearance of the reports. Again, all of this can be fixed by moving the report to a word-processing file, but this is not an ideal solution. These problems make it cumbersome to use Appleworks to create professional-looking business reports.

(continued)

I found several bugs in the database portion of the program. When you are in the process of creating report formats, the OA-Z (ZOOM) command is supposed to allow you to zoom in to the actual records and move around through the file. I was unable to get it to work. The OA-V command supposedly eliminates category names from report formats. Again, I could not make it work. The MOVE command (OA-M) also didn't work properly. I was able to move records anywhere in the file but not to the end of the file. Also, if you right-justify a category in the report format, then set up a total for that category, but later decide to eliminate the total, you lose the right-justification also.

**THE SPREADSHEET**

The spreadsheet module is a well-thought-out package with fairly good documentation. It has all of the features of VisiCalc (except some arithmetic functions) plus useful extras.

The Appleworks spreadsheet is 127 columns by 999 rows. If you use an Apple with 64K bytes of RAM (random-access read/write memory) you should be able to fill about 1800 cells, and with 128K bytes you should be able to fill about 6000 cells (according to the documentation). You can start spreadsheet files from scratch or use the Appleworks spreadsheet module to process VisiCalc's DIF files.

Appleworks' commands for formatting the worksheet display are much like those in other spreadsheet packages. Commands that affect the display format of the entire worksheet are referred to as "Worksheet Standard Values." There are Worksheet Standard Values for value formats, label formats, protection, column widths, and recalculation. Value formats can be set up to display the values on the worksheet as fixed decimals (one to seven places), as dollars (two decimal places and a dollar sign preceding the number), with commas (commas between thousands), or as percents. Label formats can be left-justified, right-justified, or centered. Column widths can be from 2 to 75 characters and can be changed for individual columns or for the whole worksheet. You can recalculate the worksheet manually or automatically, by columns or rows.

The protection feature allows you to

protect label cells, value cells, or all cells so that the entries can't be changed accidentally by you or someone else using your worksheet, an important feature if you use a spreadsheet program to set up templates that are frequently reused.

One really excellent Appleworks feature is the ability to check all of the Worksheet Standard Values currently in effect. By calling up the Help screen and scrolling down to the bottom of the command listing, you see a listing that looks like this:

Current Settings of Standard Values

|                 |              |
|-----------------|--------------|
| Protection is   | On           |
| Label format is | Left-Justify |
| Value format is | Appropriate  |
| Frequency is    | Automatic    |
| Order is        | Columns      |

Individual cell displays can be formatted also. The CELL LAYOUT (OA-L) command can be used to change the display characteristics of a cell or range of cells. The choices are basically the same as for the worksheet formatting, and individual cell layouts override the format of the worksheet.

As in the other modules, using your cursor to highlight the appropriate area, you can insert, move, delete, or copy a cell or range of cells.

As with many spreadsheet programs, the COPY command becomes complicated because formulas that refer to other cells in the worksheet have to be specified as either "relative" to their new positions in the worksheet or "no change."

Other commands let you split the worksheet into two windows (OA-W) with either synchronized or unsynchronized scrolling, set up fixed titles (OA-T), and blank out cells or ranges of cells (OA-B).

The Appleworks spreadsheet module has very few arithmetic, financial, and logical functions. Arithmetic functions are limited to sum, maximum value, minimum value, integer value, absolute value, square root, average, count, and "choose" (chooses one of several values based on the first value in its list of arguments). There is also a Lookup function, which finds a value in a table and returns a second value that corresponds to the first. Appleworks has only one financial function, namely, Net Present Value, and the only logical function is IF. The lack of financial functions and logical functions (like AND, OR, NOT,

ELSE) is a serious hindrance to using Appleworks for complex business models.

The spreadsheet module, like the database module, has very limited print options. Of course (as mentioned in relation to the database printouts), you can transfer your spreadsheet to a word-processing file and use any of the word-processing features.

The Appleworks spreadsheet has a sort function that is basically the same as the sort function in the database module. The ARRANGE command (OA-A) lets you sort your worksheet according to the value of entries in a particular column or row. Sorting can be alphabetical from A to Z or from Z to A, or numerical from lowest to highest or from highest to lowest. You can also search for a specific piece of information using the FIND command (OA-F). The FIND command will search for any combination of up to 25 characters. In the spreadsheet module, the FIND command is not case-sensitive, and you cannot search for numeric values. The FIND command can also be used to move the cursor to a specific cell address.

One unusual feature of the Appleworks spreadsheet is that after you use a command, the spreadsheet reprints on the screen, one line at a time from the top. I found this distracting and time consuming. Another feature that I did like, however, is that while the worksheet is recalculating, the screen tells you which column or row is currently being calculated.

The spreadsheet module on the whole is well documented and simple to learn. It doesn't have some of the functions and features that can be found in the latest generation of spreadsheet programs, but it does have most of the features that users demand and a command structure and documentation package that is easy to use.

**OVERVIEW**

Appleworks is a well-integrated package. The spreadsheet and database are good but certainly not standouts in the marketplace. The word processor is well above average but still has room for some improvement. As a package, however, especially for those new to computing or those whose needs are personal rather than professional, Appleworks is excellent. ■

---

# PRESHIFT-TABLE GRAPHICS ON YOUR APPLE

*This fast assembly-language routine allows you to move rectangular images quickly to any point on the Apple high-resolution graphics screen*

---

BY BILL BUDGE,  
WITH GREGG WILLIAMS  
AND ROB MOORE

[Editor's note: This article was a collaborative effort. Bill Budge shared his implementation of preshift-table graphics with us and helped Rob Moore and me with the article itself. Rob wrote the assembly-language subroutine, and I wrote the article text and BASIC program. . . .G.W.]

**I**n microcomputer graphics, speed is always of the essence—we are always trying to get the same processor to do more work than it's done before. In creating Mousepaint (a drawing program that uses icons, windows, and Apple's new mouse), Bill Budge devised a technique that simplifies moving rectangular blocks of pixels on the Apple II high-resolution graphics screen. The cost is a slight loss in speed and an overhead of about 3K bytes of memory, but the versatility of this routine certainly justifies the expense.

Expressed simply, Budge's method (called *preshift-table lookup*) uses a short assembly-language routine to access a large table that lists all the possible shifted results for all possible byte values. This saves time by exchanging a certain amount of calculation, looping, and shifting with a single table lookup, a logical OR operation, and some occasional set-up instructions.

## APPLE II HI-RES GRAPHICS

The Apple high-resolution graphics page is organized as 192 lines of 280 dots each; you will have this resolution available to you if you view the page on a monochrome display. If you use a color display, certain two-dot patterns will appear as a single color dot: this means that your effective resolution for color

graphics is 140 by 192 dots. The high-resolution page can display six colors: black, white, violet, green, orange, and blue. Each line of graphics occupies 40 bytes in memory; given 280 dots per line, this means that each byte converts to 280/40 (or 7) dots per byte.

The fact that each byte of memory translates to 7 (not 8) dots— $3\frac{1}{2}$  if you're talking about high-resolution color—is one of the many subtleties that characterize Apple graphics. Speaking in terms of the color display of dots within a byte, you can display black, white, and one of two sets of two colors each—green/violet or orange/blue. The computer interprets the most significant bit of a byte (the only one that doesn't translate to a dot) as a color bit; when this bit is off, you can get green/violet, and when it is on, you can get orange/blue. Two adjacent bits on—anywhere in the byte—make a white dot appear. Two adjacent bits off make a black dot. A

*(continued)*

---

Bill Budge is well-known for his graphics work on the Apple II; his best-known products are Raster Blaster (the first pinball game of its caliber), Pinball Construction Kit, and MousePaint (supplied with the Apple II mouse). Gregg Williams is a senior technical editor at BYTE. Rob Moore is a hardware designer and a frequent contributor to BYTE. They can be reached at POB 372, Hancock, NH 03449.

single even bit on (with both adjacent bits off) makes a violet or blue dot, depending on the color bit. Similarly, a single odd bit on makes a green or orange dot. See figure 1 for details. (Because the even/odd position of a bit within a byte determines its color, images to be viewed on a color display must move an even number of bits at a time. If they don't, they will alternate between the two color sets every move.)

One final detail: if you consider the byte as a binary number, you must strip

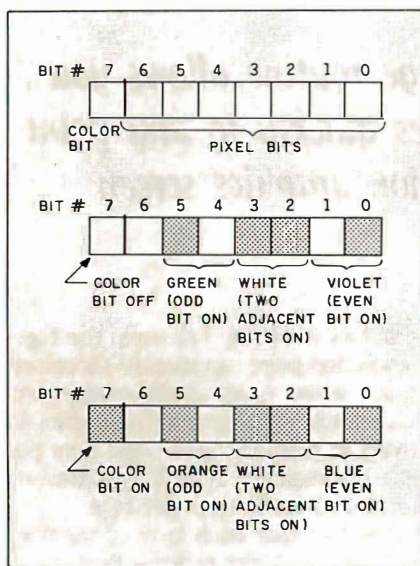


Figure 1: Translating memory bits to graphics on the Apple high-resolution graphics page. Only 7 of the 8 bits in a byte become dots on the high-resolution screen. Bit 7 determines what colors can appear in that byte.

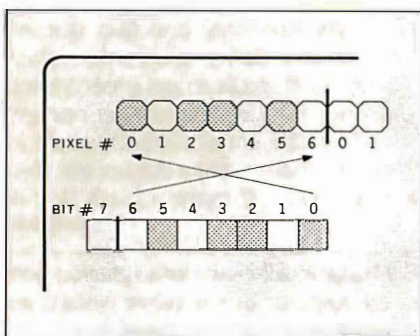


Figure 2: The relationship between bits and pixels. The Apple II reverses the seven low-order bits of a byte before displaying them on the high-resolution screen—that is, it displays the bits right to left.

off the most significant bit and reverse the order of the remaining bits before you put them on the high-resolution screen—in other words, the rightmost bit in the byte becomes the leftmost dot on screen, and vice versa. Figure 2 shows this relationship. In this article, we will be shifting rectangular blocks of dots to the right. Because of the above relationship, this means we will be shifting bits to the left. Keep the following sentence in mind: *to shift dots right, shift bits left.*

Finally, we get to the overall makeup of the high-resolution screen. With seven dots per byte, 40 consecutive bytes become 140 color dots (or 280 monochrome dots). But do the next 40 bytes make up the next row of dots? Unfortunately, no—they are the 65th row. As you can see from figure 3, consecutive rows of dots are not 40 bytes apart. The scheme is much more complex than figure 3 shows, but that is of little interest to most programmers. Because speed is of the essence in graphics work, most graphics routines look up the address of the first byte in a row from a table of 192 values instead of having the computer calculate it while it is doing the graphics. Once we create that table, as the program in listing 1 does, the complexity of the

high-resolution screen layout becomes irrelevant.

**PRESHIFTABLE LOOKUP VS. PRESHIFTED SHAPES**

Most people who do high-performance work with Apple II graphics know about *preshifted shapes*, a graphics method that stores seven versions of a given image and quickly looks up the appropriate one. (For more details, see the text box "What Are Preshifted Shapes?" on page A26.) Preshifted shapes have one main use: to allow rapid animation of small shapes that move only several dots at a time. Budge's needs were different: he had several windows that he had to be able to move quickly. Such windows are too large to have seven versions of (or modify seven versions of). In addition, their expected movements were large jumps across the screen, not continuous movement.

Shifting an image does not change it visibly, but it does change how that image is represented in byte-sized pieces. For example, the simple two-byte image in figure 4a changes significantly when shifted right three dots—what's more, we now need another byte to store it in! Notice that some dots stay in the same seven-dot group (these are called "shiftstay" dots) and that others move

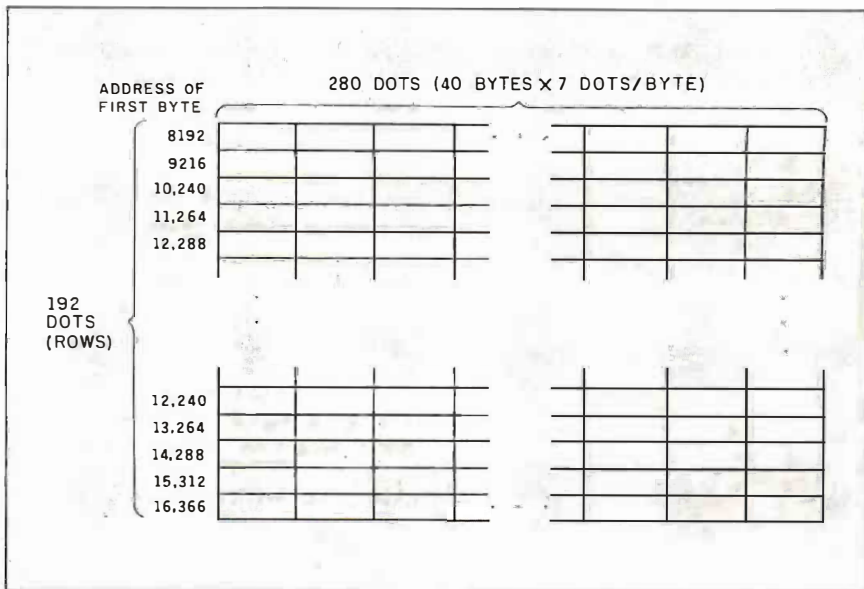


Figure 3: The Apple II high-resolution graphics page. Each line of dots is given by a contiguous 40-byte area in memory. Successive lines are usually separated by 1024 bytes; every eighth line (lines 8, 16, and so on) has an address 7040 bytes less than the start of the previous line.

to the next seven-dot group to the right (these are the "shiftout" dots). If you understand this figure and remember that the *bits* corresponding to these dots are stored in reverse within each seven-dot group (byte), then you will understand the essence of this algorithm: to move a single-line image to the right, we split each byte and combine the shiftstay bits of one byte with the shiftout bits of the previous byte. Figure 4a shows how simple it is to shift an image three dots to the right. Unfortunately, when we start looking at manipulating the bits themselves (which, within a byte, are reversed from the way they are displayed on the screen), things get more complicated (see figure 4b). Here is one recipe for manually making the shift (notice that we start with the rightmost byte and work our way left):

1. Shift the second source byte left three bits and put the three overflow bits into the *lower half* of the third destination byte. Hold the right four bits (which have been shifted left three bits) somewhere.
2. Shift the first source byte left three bits. The three overflow bits and the four leftover bits from step 1 join like two adjacent pieces of a jigsaw puzzle. "Fit" them together (using a logical OR instruction) and save them in the second destination byte.
3. Place the remaining bits of the first source byte in the first destination byte.

The 6502 microprocessor inside the Apple can shift only one bit at a time. Therefore, we would have to write a loop of assembly-language code every time we wanted to shift *n* bits. Such a routine would be very slow and would be slower as *n* gets larger.

**ENTER THE PRESHIFT TABLES**

Bit shifts take too long to calculate, so why don't we precalculate everything and do a simple table lookup instead? We'll need two tables: one for the bits that are shifted out of the byte (which I'll call the *shiftout* value) and another for the bits that remain in the byte, but in their new, shifted position (the *shiftstay* value). A byte has 256 possible values, so each table will take up 256 bytes, for a total of 512 bytes for both tables. We will need these tables for shifts of one

through six bits; this takes up a total of 3K bytes of table space, and this overhead is constant whether you have one image to move or a hundred.

(For this article, we've added shiftout and shiftstay tables for a shift of zero bits. This adds an extra 0.5K bytes of tables but greatly simplifies the assembly-language routine needed.)

Figure 5 shows how the shiftout and shiftstay values are created for a given byte, and listings 1 and 2 create the re-

quired preshift tables. The tables deal with shifting dots *right*, so the bits in a byte are shifted *left* (remember that bits reverse their positions when they become dots on the high-resolution screen—see figure 2).

The middle line shows the same byte, binary value 11101010, as it is shifted two, three, and four dots (bits). The line above it shows the bits that go into the shiftout byte and the line below it, the

(continued)

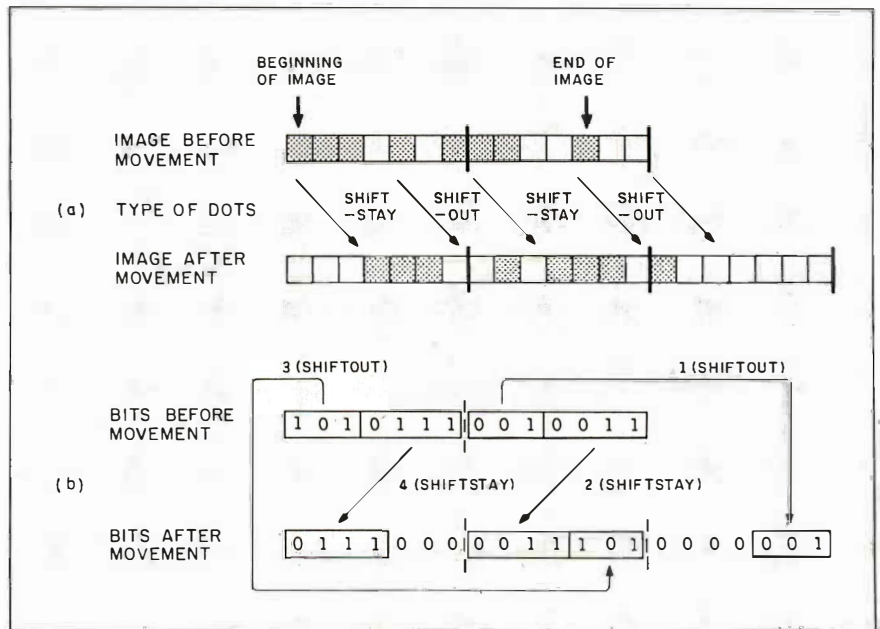


Figure 4: Moving an image. When a two-byte image is moved three dots to the right (figure 4a), it occupies an extra byte, and the values of the bytes all change in a complex way. Figure 4b shows the bit patterns underlying the original and shifted images (for simplicity, we are ignoring the color bits in each byte). To shift the image right 3 bits, we shift each byte to the left 3 bits and rearrange the pieces in the order shown.

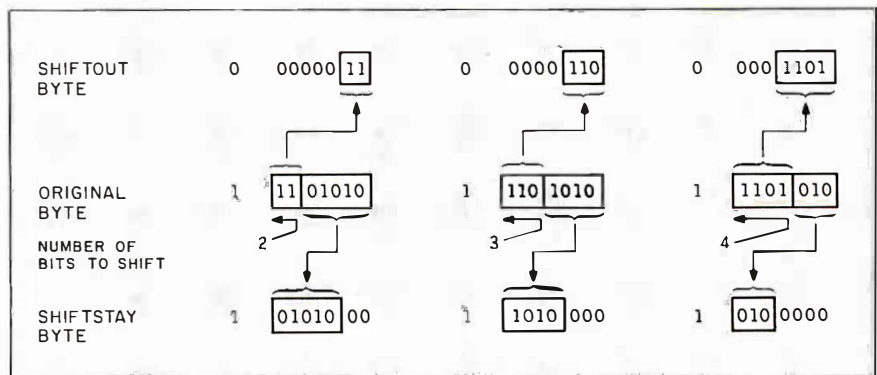


Figure 5: Creating *shiftout* bytes (top) and *shiftstay* bytes (bottom) from an arbitrary byte (center). This figure shows the same byte being shifted two, three, and four bits. Note that the color bit (the leftmost one, outside the boxes) remains with the *shiftstay* byte.

shiftstay byte. Notice that the most significant (color) bit, which is not included in the shift, stays with the shiftstay byte. The program in listing 2

makes tables of the shiftout and shiftstay value for each byte (values from 0 to 255) and for each possible value for number of bits shifted (zero to six).

## What Are Preshifted Shapes?

The preshifted-shape method is at the root of the most common forms of graphics animation for the Apple II. It is yet another application of the maxim that says, "To make graphics faster, calculate as much as possible in advance, store the results in tables, and do table lookups instead of calculation during the animation process." To shift a shape several dots right or left during the animation (or "on-the-fly," as we call it) would involve lots of byte splitting and recombining and would significantly slow the animation. Instead, we keep seven versions of the shape in memory and select the appropriate one to be "pasted onto" the graphics screen in real time. (We want to deal with whole bytes only, and we need seven versions to take care of all the possible positions of the shape within byte boundaries.)

In addition, by making slight changes to each of the seven shapes, we can achieve "internal animation"—animation of the shape itself as it moves horizontally—at no extra cost. Figure 1 shows a monochrome shape with internal animation in its seven preshifted versions.

Preshifted shapes are the latest word in fast animation. Unfortunately, they take up a lot of room, and it is often inconvenient to maintain a large inventory of such shapes, especially when they are subject to periodic revisions. (Utility packages like Penguin Software's Graphics Magician can help with such tasks.) For example, an image 10 dots square (which is actually 5 dots square in color) must be shifted within an image area 10 lines high by 3 bytes wide (a 10-dot image that begins on the last dot in a byte ends in the second dot of the third byte.) This is 30 bytes per version, or 210 bytes for the entire preshifted shape table—all for an image about the size of a fingernail! In some situations, of course, the method described in this article is a space-saving alternative.

—Gregg Williams

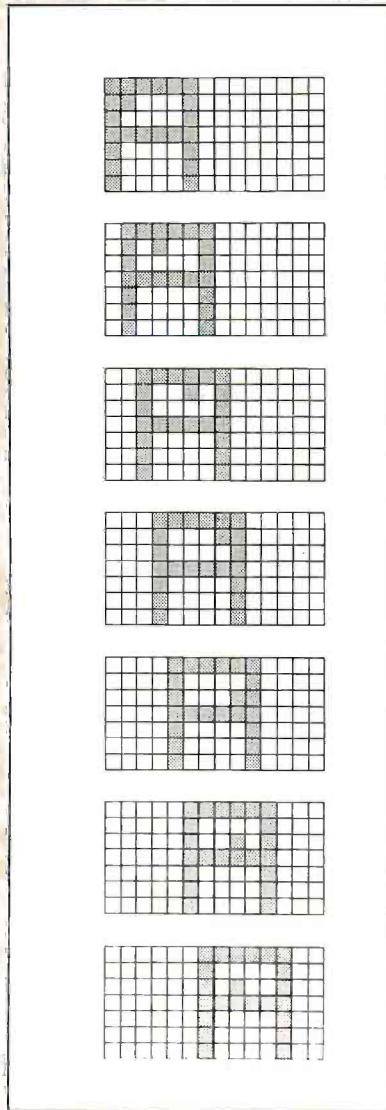


Figure 1: Apple II preshifted shapes. Depending on the location of the shape within a 2-byte-wide area, a program can "paste" one of the above seven images into that area. In addition, when the seven shapes are drawn into the same area in order, the "A" appears to move to the right, and a little dot rolls around the interior cavity of the "A." This effect is called internal animation.

The problem of moving a rectangular image is reduced to that of moving a single line of the image, which in turn is reduced to that of moving a single byte of the image between one and six dots (a move of, say, three dots and a move of ten are essentially the same because the extra seven dots—one byte—can be taken care of by adding one to the destination-byte pointer).

### PRESHIFTING AN IMAGE LINE

You may have noticed that the shiftout values are right-justified and the shiftstay values are left-justified within the low 7 bits of the byte. This allows the computer to combine the two image fragments correctly. Figure 6 shows how the core routine (only 23 bytes) accomplishes the task. In particular, figure 6 shows how the shiftstay bits from one byte and the shiftout bits from the byte before it create a new destination byte.

Bill Budge did not get this code density without pulling some tricks. In line 1, the address \$mmmm is the first byte of the one video line of image that this routine manipulates. The address \$mm00 is the first byte of the shiftout table being used, and \$pp00 is the first byte of the shiftstay table. (Remember that the tables must begin on page boundaries—this explains the double zeros in both addresses.) A driver program (discussed below) must change the first address for each new line of image to be processed and must change the last two addresses only at the beginning of a new shift-rectangular-image operation. Yes, this is self-modifying code. It works, and it is necessary to get the speed Budge wanted out of this routine.

The calling program must supply this routine with two other values: the y register must contain the width of the image in bytes, and the accumulator (A) must contain zero since there is no previous byte that has left shiftstay bits behind.

### PRESHIFTING A RECTANGULAR IMAGE

Given the appropriate shiftout and shiftstay tables (which allow you to split an arbitrary byte by doing two table lookups instead of *n* shift operations), the routine in figure 6 will shift one line of dots and put the result in a buffer area. To make this routine useful, you must surround it with a driver routine that

shifts each line of the rectangular image and does the necessary housekeeping. Many such routines are possible depending on the implementation needed. To illustrate this routine, let's assume that the program has access to an area of memory with image data as specified in table 1. For each line of the image, the driver routine will modify the addresses within the inner loop to point to the right areas, shift a line of the image to the buffer, then transfer the buffer to the correct screen position one byte at a time (see figure 7).

Listing 3 is the final assembly-language subroutine for shifting a block image via the preshift tables and moving it to the screen as described above. The equate statements at the top of the listing show the positions of needed tables and variables. Two tables not yet discussed are the XDIV7 and XMOD7 tables. Because the Apple stores 7 dots per byte, the algorithm needs to divide single-byte numbers by 7 and use either the quotient or remainder. At the expense of 512 bytes (256 bytes per table), we can calculate either quantity as quickly as an indexed load instruction: the *n*th bytes of the XDIV7 and XMOD7 tables are the integer quotient and remainder, respectively, of *n*/7. Listing 4 creates these tables for later use and saves them under the name DIV7 TABLE.

The BASIC program of listing 5 loads the preshift, DIV7, and HIRES1 tables, along with the table for the image to be moved into a single binary file called TABLPAK. The image that the demonstration program is going to move, an arrow pointing diagonally up, takes the form given in table 1 and can be any size. You can change it to any image you wish, as long as the table starts at address 20864 (5180 hexadecimal). When translating a picture of the image to hexadecimal values, remember that the bottom 7 bits of a byte are displayed reversed from the way they are stored; for example, to illuminate the rightmost dot of a seven-dot byte, the byte needed is a 64 (binary 01000000) or a 192 (binary 11000000), not 1 (binary 00000001).

### THE DEMO PROGRAM

The BASIC program of listing 6 loads in the TABLPAK package of tables and the  
(text continued on page A132)

Listing 1: The HIRES1 program creates the binary file HIRES1 TABLE. The first 192 bytes of the file contain the low bytes of the starting addresses of line *n* of high-resolution page 1; the second 192 bytes of the file contain the high bytes of the same addresses.

```

JLIST
100 REM
110 REM HIRES1 PROGRAM
120 REM
130 REM CREATES TABLE OF ADDRESSES
140 REM OF FIRST BYTE IN EACH LINE
150 REM OF HI-RES PAGE 1
160 REM
170 REM BY GREGG WILLIAMS
180 REM 22 APR 84
190 REM
195 REM -----
197 REM
200 T2BLBGN = 16384
210 REM --BEGINNING OF TABLE AS
220 REM --STORED IN MEMORY
230 REM
235 TBLWIDTH = 192
236 REM --WIDTH OF EACH TABLE
237 REM
240 HI1BGN = 8192
250 REM --ADDRESS OF BEGINNING
260 REM --OF HIRES PAGE 1
263 REM
266 ADDR = T2BLBGN
269 REM --THIS PGM CALCULATES
272 REM --ADDRESSES IN ASCENDING
275 REM --ORDER; ADDR HOLDS THE
277 REM --ADDRESS OF THE NEXT
278 REM --TABLE ELEMENT TO BE
279 REM --FILLED
280 REM -----
290 REM
300 REM MAIN LOOP OF PGM
310 REM
313 HOME : PRINT "CREATING HIRES1 TABLE";
320 FOR I = 0 TO 2
325 : FOR J = 0 TO 7
330 :: FOR K = 0 TO 7
340 :::VL = HI1BGN + 40 * I + 128 * J + 1024 * K
353 :::VHI = INT (VL / 256)
356 :::V2LOW = VL - 256 * VHI
359 ::: POKE ADDR,V2LOW
362 ::: POKE ADDR + TBLWIDTH,VHI
366 :::ADDR = ADDR + 1
370 :: NEXT K
375 :: PRINT ".,.";
380 : NEXT J
384 NEXT I
385 PRINT
386 REM
388 REM --ABOVE ALGORITHM
390 REM --DERIVED FROM TABLES
392 REM --IN APPLE REFERENCE
393 REM --MANUAL
394 REM
400 REM -----
410 REM
420 REM --SAVE FILE TO DISK
430 REM
440 PRINT CHR$(4);"BSAVE HIRES1 TABLE,A;"T2BLBGN;"L384"
450 REM
455 PRINT : PRINT "TABLE SAVED TO DISK"
460 END

```

(listings continued on page A28)

## PRESHIFT-TABLE GRAPHICS

Listing 2: The Preshift program creates fourteen 256-byte tables, which are saved as the binary file PRESHIFT TABLE. The first seven are the shiftout tables for 0 through 6 dots, while the last seven are the corresponding shiftstay tables.

LIST

```

100 REM
110 REM CREATE-PRESHIFT-
120 REM TABLES PROGRAM
125 REM
130 REM CREATES SHIFTOUT AND
135 REM SHIFSTAY TABLES FOR
140 REM 0 THROUGH 6 DOTS
145 REM
150 REM BY GREGG WILLIAMS,
155 REM 17 APR 84
157 REM
160 REM -----
170 REM
180 REM INITIALIZATION OF
190 REM CONSTANTS
200 REM
210 BGNTBL = 30720
220 REM --ADDRESS OF START OF
230 REM --TABLE; MUST BE EVENLY
240 REM --DIVISIBLE BY 256
250 REM
260 BININCR = 7 * 256
270 REM --DISTANCE FROM BEGINNING
280 REM --OF SHIFTOUT (SOUT)
283 REM --TO SHIFSTAY(SSTAY)
286 REM --TABLES
290 REM
300 TBLWIDTH = 256
305 REM --DISTANCE BETWEEN
310 REM --ANY TWO TABLES
315 REM
320 C1ZMAXSHF = 6
340 C2MAXBYTEVL = 255
360 REM
380 REM -----
400 REM
420 REM MAIN LOOP
440 REM
450 HOME : PRINT "CREATING PRESHIFT TABLE (THIS WILL TAKE
 SEVERAL MINUTES) ";
460 FOR SHF = 0 TO C1MAXSHF
480 :CURRTBL = BGNTBL + SHF * TBLWIDTH
500 : FOR BYTE = 0 TO C2MAXBYTEVL
520 :: GOSUB 1000
540 REM --CALCULATE SHIFTOUT
560 REM --& SHIFSTAY VALUES
580 REM --FROM SHF AND BYTE
620 REM
640 :: POKE CURRTBL + BYTE,SSTAY
660 :: POKE CURRTBL + BYTE + BIGINCR,SOUT
680 REM --STORE VALUES IN
700 REM --TABLES
720 REM
725 :: PRINT " ";
740 : NEXT BYTE
760 NEXT SHF
770 PRINT
775 REM
780 REM -----
800 REM
820 REM SAVE TABLES AS ONE
840 REM LARGE DISK FILE
860 REM
880 PRINT CHR$(4);"BSAVE PRESHIFT TABLE,A";BGNTBL;"L3584"
890 PRINT : PRINT "TABLE SAVED TO DISK"
900 REM
910 REM END OF PROGRAM
915 REM
920 END
960 REM -----
980 REM
985 REM --SUBROUTINE TO SPLIT
987 REM --AN ARBITRARY 8-BIT
989 REM --VALUE INTO ITS
991 REM --COMPONENTS; SEE
993 REM --TEXT FOR DETAILS
995 REM
1000 IF SHF = 0 THEN SOUT = 0:SSTAY = BYTE: GOTO 1380

1005 REM
1010 REM --THE FOLLOWING CODE IS
1012 REM --DONE IFF SHF>0
1015 C3SCALEOUT = 2 ^ (7 - SHF)
1020 C4SCALNW = 2 ^ SHF
1030 BSVE = BYTE
1040 REM
1060 IF BYTE >= 128 THEN SIGNBIT = 1:BYTE = BYTE - 128: GOTO
 1140
1080 REM (ELSE IF BYTE < 128)
1100 SIGNBIT = 0
1110 REM (AND BYTE UNCHANGED
1120 REM
1140 SOUT = INT (BYTE / C3SCALEOUT)
1160 REM --FIND SHIF-OUT BITS
1180 REM --BY CUTTING OFF RIGHT
1200 REM --MOST (7-SHF) BITS
1210 REM
1220 SSTAY = 128 * SIGNBIT + (BYTE - SOUT * C3SCALEOUT) *
 C4SCALNW
1240 REM
1260 BYTE = BSVE
1280 REM --RESTORE ORIGINAL
1300 REM --VALUE OF BYTE
1320 REM
1340 REM END SUBROUTINE
1360 REM
1380 RETURN

```



## PRESHIFT-TABLE GRAPHICS

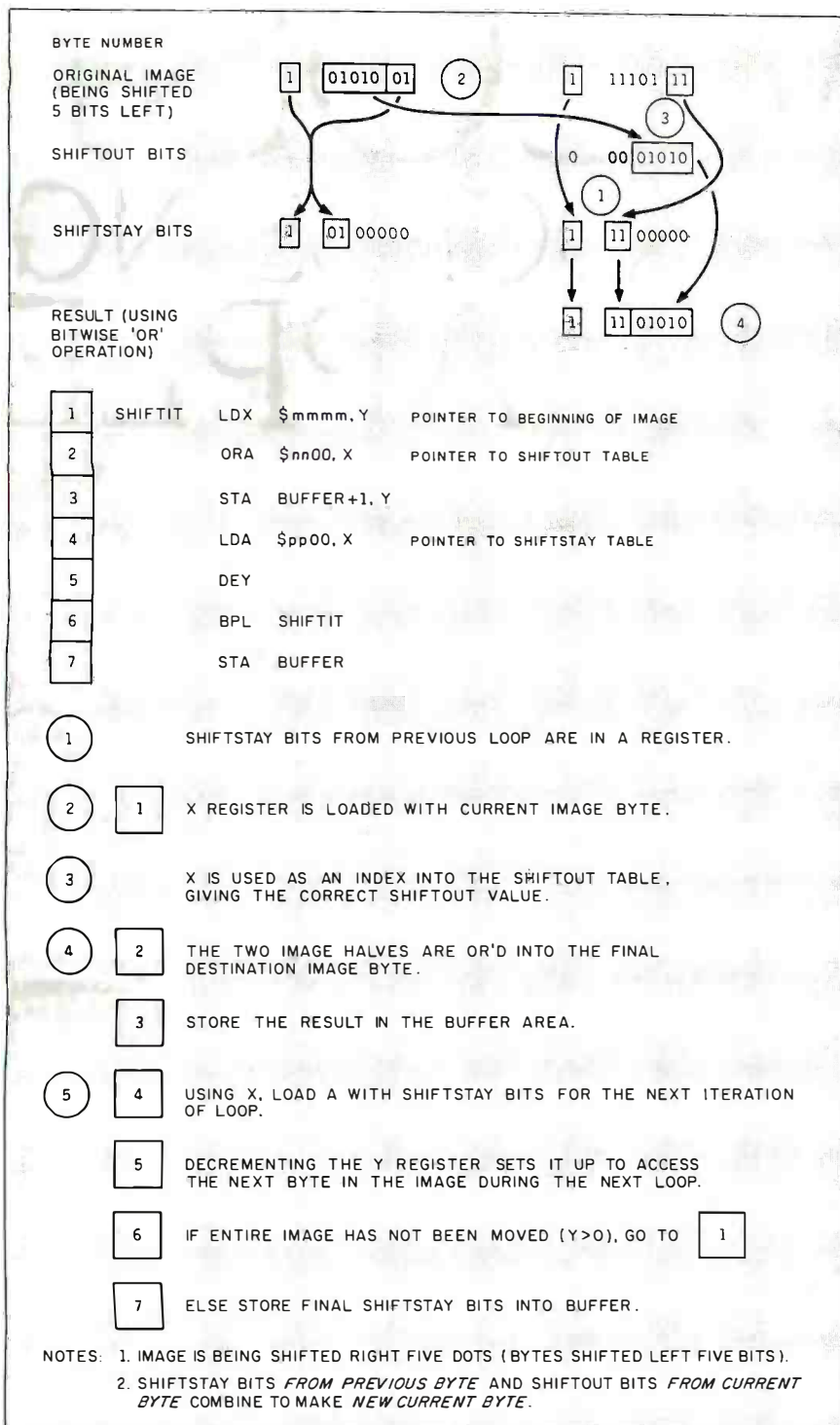


Figure 6: The basic preshift-table lookup routine. The top area shows how the code creates a single result byte, the middle area is the actual code, and the bottom area is a commentary. The numbers in the circles and squares relate events to lines of code. Hexadecimal mmmm points to the first byte of the image. The hexadecimal addresses nn00 and pp00 point to the proper shiftout and shiftstay tables, respectively. At the beginning of the routine, the accumulator contains zero and the y register contains the number of bytes in the line.

(listings continued on page A127)

# Love Apples?



## Join the club.

We're the Apple PugetSound Program Library Exchange, and we're the largest, oldest, and most knowledgeable user group in the world. We support all the Apples, and all user levels, from the beginner to the seasoned program author. A membership in A.P.P.L.E. will provide you with vital support, like our international hotline service for immediate technical evaluation of your problem... our international magazine, **Call—A.P.P.L.E.**, and significant discounts on our world famous software, plus great hardware prices.

Write today for a sample copy of our publication, product catalog, and membership application, or fill out the enrollment coupon below.

**A.P.P.L.E.**  
pioneering Apple computing

since 1978.

Mail to:  
 A.P.P.L.E.  
 21246 - 68th Ave. S.  
 Kent, WA 98032  
 (206) 872-2245  
 or call our toll-free number  
 1-800-426-3667  
 (24 Hrs. Orders Only)

MEMBERSHIP \$26 one-time application fee + \$25 first year dues. \$51

FREE INFO + Call—A.P.P.L.E.  
 Please send free information

Name \_\_\_\_\_  
 Address \_\_\_\_\_  
 City \_\_\_\_\_  
 State \_\_\_\_\_ Zip \_\_\_\_\_  
 Phone # \_\_\_\_\_

M/C VISA # \_\_\_\_\_  
 Exp. Date \_\_\_\_\_

Additional foreign postage required for membership outside the U.S.

**Join Now and Receive  
10 FREE Diskettes!**

Apple II, II+, IIe, IIc, III, Lisa, and Macintosh are all registered trademarks of Apple Computer Inc.

BY DANIEL J. GINGRAS

# LOW-COST WORD PROCESSING ON THE APPLE

*A number of efficient word processors  
are available for every budget*

**C**ited as the major reason that most people are purchasing microcomputers, word-processing packages have multiplied to the point of confusion in the past several years. Among the recent additions to the word-processing fray are a number of entry-level programs that offer the novice microcomputer user a chance to experience many sophisticated word-processing functions at a price that should not tax even the tightest budget.

When buying a word processor, you should double-check the machine requirements before walking out of the store. Pay specific attention to memory requirements and your Apple's ability to generate lowercase letters. (An entire industry has grown up around supplying lowercase add-on boards to the Apple.) Older Apples can generate lowercase letters with the addition of a Shift-key wire modification. If the word processor you buy does not generate lowercase from software, you will need to add a special piece of hardware to your Apple II+. Both the Apple II+ and the IIe will require an additional board if you want to display text 80 columns

---

Daniel J. Gingras (31 North Adams St., Manchester, NH 03104), a former magazine and newspaper editor, is currently a publishing consultant. He can be reached through *The Source* at CPA 062 or CompuServe 72426,254.

across.

Check to see if your printer is supported by the word-processing program before you buy it, particularly if you do not have one of the popular printers. It may be that the word processor you choose will not be able to access all of the features of your printer such as proportional spacing, boldfacing, and underlining.

When shopping for a word processor, devise a sample paragraph that represents the kind of typing you generally do. Take it to the software store and try to enter it, or at least ask the salesman to enter it for you.

The current genre of inexpensive word processors has recognized the inherent difficulty of trying to make the transition from the typewriter to the word processor, and most manufacturers have taken steps to make the programs as easy to use as possible. Remember, however, even learning to use a typewriter requires practice, so you should expect to spend some time with your processor before you become fully productive.

Let's look at several word-processing programs available for the Apple. See table 1 for a comparison of features of the programs reviewed.

## THE PERSONAL SECRETARY

The Personal Secretary from Sof/Sys Inc. is a tailored version of the excellent Executive Secretary for the Apple II series

(see photo 1). It is an exceptional value in low-cost word processors and is full of features. First, it's not only a word processor but also a small database, which is described by John Riskin, the author of the program, as a "card file" that allows you to create a mailing list that can be merged with your text to create form letters. This is the only word processor of those reviewed to offer such a feature. Not content with simple merging, Personal Secretary also allows specific merging of selected documents, or conditional merging depending on a true/false condition.

One of the most welcome features to be found on any word processor is envelope addressing. This feature allows you to mark the beginning and the end of an address on your letter by typing AD, and when the letter is finished printing, the computer will prompt you to insert an envelope and will print the address. I have not found any other package with such a feature.

Personal Secretary asks several questions about your equipment when you first call it up. Once answered, these questions need never be answered again. In subsequent sessions the program will present a main menu with six entries:

1. Create/Edit Documents
2. Print Documents
3. Edit a Card File
4. Delete/Transfer/Restore

5. Set up a document disk
6. Change system features

When you create a document you are prompted "CREATE WHAT DOCUMENT:" and you specify the name. You toggle between the text-entry mode and the editing mode by using the Escape key, and you can scroll the document back and forth using the number keys while in the edit mode. The program allows for scrolling by line, by 10 lines, and by screen and jumps to the beginning or end of the document. The cursor can be moved using the cursor-control keys, or by using the Return key and the slash key on the II+. You can move the cursor on a line a letter at a time or a word at a time, or to the right or left margin immediately.

Personal Secretary lets you create a "shorthand" of printer control codes using "dot" commands. This same feature can be used to create shorthand for frequently used words or phrases. Suppose you have a printer and you want to be able to use its boldface capabilities. Your printer needs to get an Escape 9 to begin boldface. You tell Personal Secretary to define .BF as Escape 9 by typing .BF #27,57, which indicates the ASCII (American Standard Code for Information Interchange) characters for Escape and 9. Now, any time you want to use boldface, simply type .BF. In the same way, you could have defined BYTE magazine as .BT, and every time you typed .BT, BYTE magazine would appear in your text.

You can make a draft print directly from the editor, and the draft printer will ask you if you want the lines numbered or if you want the draft double-spaced. Final copies of a document are "fancy printed" (the final formatted output, as opposed to "draft printed," which prints formatting commands), and you can specify page length, spacing, and other options from the print menu. You can also embed print commands in the document itself, such as indents, right-justified copy, or centered copy.

Documentation for Personal Secretary is excellent, and the manual is organized in the form of a tutorial that takes you through each feature offered by the package. The index is thorough and well organized.

Personal Secretary can also merge other documents such as VisiCalc files

into your files, or you can create "boilerplate" text that can be merged with your document by simply typing XT FILENAME.

Sof/Sys also has Executive Speller available separately, which works with Personal Secretary (or any other word processor), and Executive Footnoter,

which supports footnotes on complex documents. Executive Footnoter will work with other word processors as well.

Personal Secretary is the best bargain in low-cost word processors. It is more difficult to learn than the easiest of the

(continued)

Table 1: Comparative features on some low-cost word processors for the Apple.

| Feature                   | Personal Secretary | The Writer | Bank Street Writer | Home Word      | Cut and Paste  |
|---------------------------|--------------------|------------|--------------------|----------------|----------------|
| Move block                | Y                  | Y          | Y                  | Y              | Y              |
| Delete block              | Y                  | Y          | Y                  | Y              | Y              |
| Copy block                | Y                  | Y          | Y                  | Y              | Y              |
| Search                    | Y                  | Y          | Y                  | Y              | Y              |
| Search/replace            | Y                  | Y          | Y                  | Y              | N              |
| Overstrike/insert         | Y                  | Y          | N                  | Y              | N              |
| Multiple inserts          | Y                  | Y          | N                  | Y              | Y              |
| Mark envelope address     | Y                  | N          | N                  | N              | N              |
| Link another file         | N                  | Y          | N                  | Y              | N              |
| Boilerplate text          | Y                  | Y          | N                  | Y              | N              |
| Shorthand text            | Y                  | N          | N                  | N              | N              |
| Preset tab stops          | Y                  | Y          | Y                  | Y              | Y              |
| Draft printing            | Y <sup>1</sup>     | Y          | Y                  | N              | N              |
| Scroll by lines           | Y                  | Y          | Y                  | Y              | Y              |
| Scroll by screen          | Y                  | Y          | Y                  | N              | Y              |
| Jump to beginning/end     | Y                  | Y          | Y                  | N              | Y              |
| Lines shown               | 24                 | 23         | 14                 | 14             | 40             |
| Line width (columns)      | 40/80              | 80/128     | 38                 | 38             | 21             |
| Merge printing            | Y                  | Y          | N                  | N              | N              |
| Internal database         | Y                  | N          | N                  | N              | N              |
| Conditional printing      | Y                  | Y          | N                  | N              | N              |
| Merge keyboard input      | Y                  | N          | N                  | N              | N              |
| Specify line spacing      | Y                  | Y          | Y                  | Y              | Y              |
| Justified printing        | Y                  | Y          | N                  | Y              | N              |
| Centered printing         | Y                  | Y          | Y                  | Y              | Y              |
| Printer control codes     | Y                  | Y          | N <sup>3</sup>     | N <sup>3</sup> | N <sup>3</sup> |
| Force new page            | Y                  | Y          | N                  | Y              | Y              |
| Specify page numbers      | Y                  | Y          | N                  | Y              | N              |
| Page headers              | Y                  | Y          | Y                  | Y              | Y              |
| Page footers              | N                  | Y          | N                  | Y              | N              |
| Link documents together   | Y                  | Y          | N                  | Y              | N              |
| Help screens              | Y                  | Y          | N                  | Y              | N              |
| Tutorial                  | Y <sup>2</sup>     | Y          | Y <sup>5</sup>     | Y <sup>4</sup> | N              |
| Manual pages              | 48                 | 128        | 35                 | 35             | 14             |
| Screen preview            | Y                  | Y          | N                  | Y              | N              |
| Auto backup               | N                  | semi       | N                  | Y              | N              |
| Change default parameters | Y                  | Y          | Y                  | Y              | Y              |

Hardware supported:

|                        |   |   |   |   |   |
|------------------------|---|---|---|---|---|
| Keyboard enhancer      | Y | Y | N | N | N |
| 80-column boards       | Y | Y | N | N | Y |
| Shift-key modification | Y | Y | Y | N | N |

Memory required                    64            48/64            48/64            48            64

Notes: 1) soft preview only; 2) manual; 3) one set-up code only; 4) cassette tape; and 5) on disk.

**AT A GLANCE**

**Name**  
The Personal Secretary, version 4.1

**Manufacturer**  
Sof/Sys Inc.  
4306 Upton Ave. South  
Minneapolis, MN 55410  
(612) 929-7104

**Price**  
\$69.95

**Computer Needed**  
Designed for the Apple IIe, but will work with the Apple II+ with shift-key wire modification; works in 40-column mode with Apple II+ or in 80-column mode with Apple, Full View 80, Smarterm, Superterm, Ultraterm, or Videoterm

**Documentation**  
48-page manual in padded cover

**Audience**  
Any Apple II user who is looking for a low-cost, feature-packed word processor and small database

other packages, but it supports many more features.

**THE WRITER**

One of the first things that you notice about The Writer is that it is not copy-protected—the only package reviewed for this article that is not. This is an important fact if you plan to use your word processor in a business, since a crash might delay your productivity.

The Writer is easy to use. I selected the 80-column mode and left the Help menu on the screen. This gives you 15 lines of 80-column text to work with. If you turn the Help menu off, you have 23 lines of text on the screen.

The Help menu is exceptional, and multiple Help screens are available simply by typing Control-Q. The cursor-control movements are "full-screen-editing" type, which means you hit Control-E to move up a line and Control-C to move down a line. Many of the control keys are the same as in WordStar. The Writer uses dot commands to control print formatting, some of which are the same as WordStar's.

The documentation is indicative of the complexity and completeness of this program: it's spiral-bound and 127 pages long, and the manufacturer supplies a reference card to jog your mem-

ory. The manual is set up in the form of a tutorial. Lessons teach you the basics of the editor first and the text formatter later. The manual is well indexed and very complete.

Editing with The Writer is a joy. Not having to toggle between modes can speed the editing process tremendously, and cursor movements are lightning fast. You can jump the cursor to the top or bottom of the screen using Control-D and then can scroll a screen forward or back using Control-R/Control-V. Cursor movements within the window are made using a diamond of Control-E-S-F-C.

As in WordStar, many of the control keys are not mnemonic, and alternate key caps or stickers for the keys would be helpful. Although The Writer does appear to act like WordStar in many respects, the documents that are created by The Writer are not compatible with WordStar.

Scrolling with The Writer is particularly fast, and you can jump from the beginning to the end of a line and back again using Control-B or to the top of the document using Control-T. The status of the editor and the line you are currently typing appear below the editing window. The Help screen, if selected, appears above.

Once you begin a document, it remains in memory until you clear it. You can return to the Command menu by typing Control-Shift-P and there will find a number of options (see photo 2).

The commands are self-explanatory, and with The Writer you can save files in text or binary format. You can also edit both types of files; binary files take less space on the disk and load and save faster than text files, but text files allow you to use other programs such as spelling checkers and communications programs with the document you have created. The Writer is one of the few programs to give you both options.

Typing FILENAME allows you to append another file to your text. The Writer also lets you back up your current document by using a two-letter command—a nice touch if you are working on a complex document that should be saved back to the disk frequently. Typing %W gives you the word count in the document, which is important if you write newspaper or magazine articles and need to keep the text to a

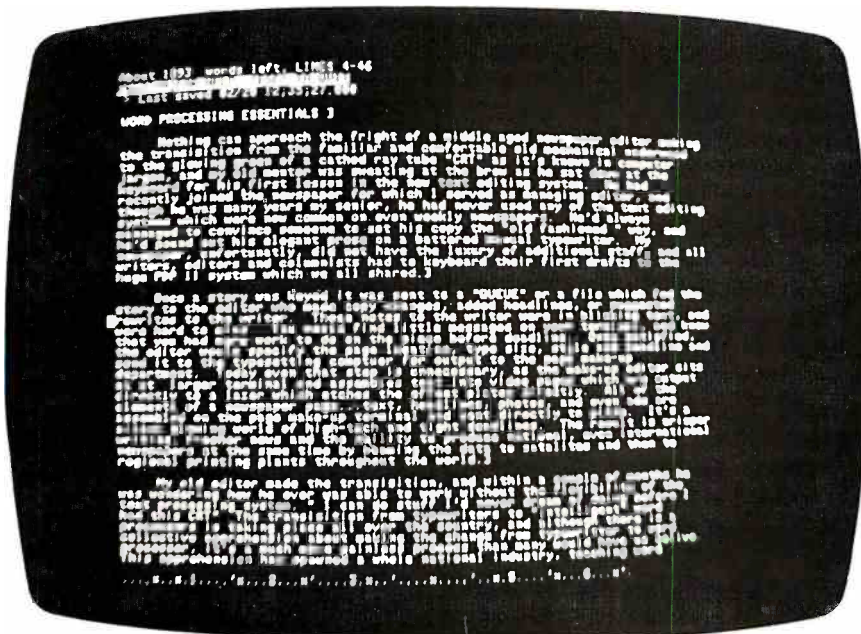


Photo 1: Personal Secretary used with an 80-column text board on the Apple II+.

certain word length. You can also embed special printer control codes within the text either by using the "dot" commands that have been previously defined or by actually embedding control codes (or escape sequences) within the text using Control-Shift-M followed by the code. You can also insert unpaddable (mandatory) spaces in the text, such as between words that you do not want split on different lines.

A great strength of The Writer is the flexibility its dot commands add to its output formatter. Some of these controls include:

|       |                            |
|-------|----------------------------|
| .PP   | Begin paragraph            |
| .NP   | Begin NO fill Paragraph    |
| .FI   | Fill (Justify)             |
| .SP N | Space down N lines         |
| .BP   | Begin page                 |
| .in N | Indent N                   |
| .he   | Header text                |
| .fo   | Footer text                |
| *     | Comment line, do not print |
| .ce   | Center                     |
| .bf   | Boldface                   |
| .ul   | Underline                  |
| .NX   | Chain to another file      |

These and other format controls let you merge material from a data file and print form letters, and output your text exactly the way you want. You can also preview the output to the screen before you send it to the printer.

I can recommend The Writer. If you are looking for a low-cost yet full-featured word processor, then this is one of the two packages that you should examine.

### BANK STREET WRITER

Bank Street Writer (see photo 3) is a good word processor, but it has limited uses. It's ideal for those of you who are still afraid of being lost in the computer revolution. Although it contains most of the major features of a standard word processor, it is limited by its small display—only 38 characters across—too small for business correspondence. Broderbund has recognized this problem and has recently announced a new version of Bank Street Writer for the Apple IIc that will display either 40 or 80 columns. This version will also work on the Apple IIe with an extended 80-column card.

Broderbund advertises Bank Street

Writer as "the first truly home-oriented word-processing system." Although I'm not sure what the difference is between a "home-oriented" word processor and any other, it would be difficult to beat Bank Street Writer in terms of its ease of use. The disk comes with a tutorial on the reverse side, which takes you through the steps to enter text, move the cursor, correct initial mistakes, erase letters, erase blocks of text (and reinstate them), move blocks of text, etc. The tutorial is so clear even an 8-year-old could begin entering text and correcting elementary errors.

At the top of Bank Street Writer's screen is the menu area. Tapping the Escape key puts you in the Editing menu and allows the cursor to move within the text file. You toggle between the text-entry mode and the menu by using the Escape key. You move the cursor with the I-M-J-K keys, and the cursor movements are displayed as an icon at the top of the screen to remind you.

Once in the Editing menu, you have the choice to perform additional functions such as ERASE, which allows you to specify a segment of your document that is to be eliminated. The program prompts you to move the cursor to the beginning of the block to be erased.

(continued)

## AT A GLANCE

### Name

The Writer, Apple IIe version (II+ version available)

### Manufacturer

Hayden Software  
600 Suffolk St.  
Lowell, MA  
(800) 343-1218

### Price

\$49.95

### Computer Needed

Apple II+ or IIe, with 48K or 64K bytes; the 64K models will allow both editor and formatter to be loaded at the same time; optional 80-column boards supported; shift-key wire modification or keyboard enhancer required

### Documentation

128-page spiral-bound manual, reference cards

### Audience

Anyone looking for a full-featured word processor at a low price

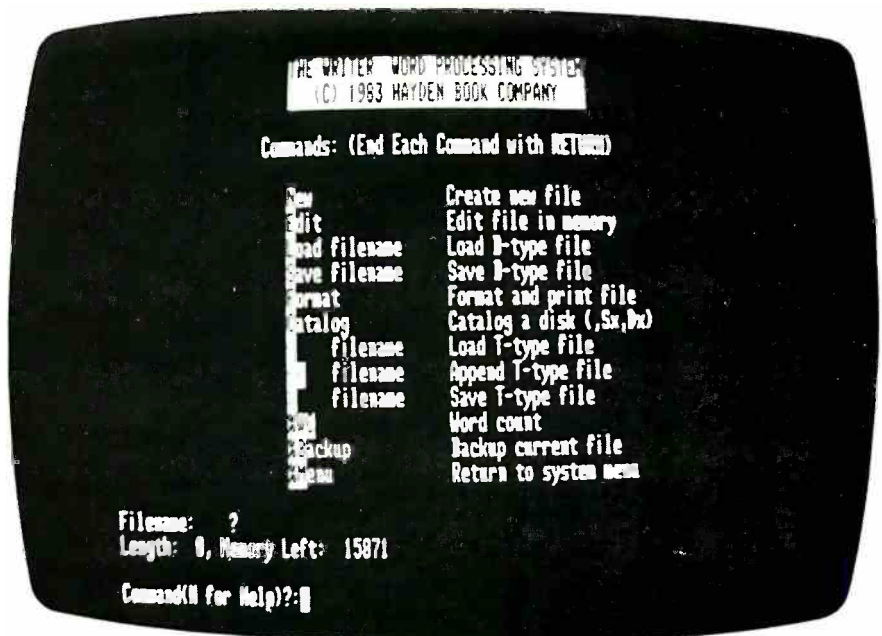


Photo 2: The command menu for The Writer, the only program reviewed that allows you to make backup copies.

## AT A GLANCE

### Name

Bank Street Writer, Apple II version

### Manufacturer

Broderbund Software  
17 Paul Dr.  
San Rafael, CA 94903  
(415) 479-1170

### Price

\$69.95

### Computer Needed

Apple II+ with 48K bytes of RAM (version available for IIc and IIe requires 128K bytes and the Extended 80-Column Card on IIe)

### Documentation

35-page manual, indexed

### Audience

New word-processing users, children, anyone who wants a simple and limited word processor

You then hit Return, and the prompt area at the top of the text screen will ask you to move the cursor to the end of the block to be erased. Hitting the Return key again will cause the area selected to be displayed in inverse video (black on white), and the prompt area will ask you to confirm that the area highlighted is the area to be deleted. If you have made a mistake, there is no problem because Bank Street Writer features an UNERASE command that allows you to replace the text.

The Move function works much the same way, using the same prompts to select an area to be moved and an additional instruction to place the cursor where you want to "paste" the moved copy. Like the ERASE command, the MOVE command also has an UNMOVE option.

The last menu entry is the Transfer menu, which moves you to a submenu that enables you to file, retrieve, and print documents. The Transfer menu allows you to initialize a disk, save a document with a filename of as many as eight characters, and specify a password on the file.

The Transfer menu also lets you retrieve a document from the disk and, if you've forgotten the name of your

document, will ask if you need a catalog. You can also save the document from this menu, but saving the document does not erase the current draft from memory, so a Clear function allows you to wipe the memory clean and begin a new document.

Two print options are found on the Transfer menu: Print-Draft and Print-Final. Print-Draft prints the document exactly the way it appears on the screen, limited to 38 characters. It does ask if you want to pause between pages and allows you to add a page heading, but that's about all. Print-Final, on the other hand, will ask you how many characters you want per line (between 40 and 126) and what the space between lines should be. It also asks if this is a continuation of a previous file (in case you want to join documents), and, if so, if the pages are to be numbered. You can print the entire file or just a portion of it. A nifty option of Print-Final will show the top and bottom of a page and allow you to adjust where the page will break, a nice touch that lets you keep paragraph headings and their associated paragraphs together.

A utility program, accessed by pressing Escape twice while the program is loading, allows you to customize Bank Street Writer. Oddly enough, the utility menu lists the filenames on the data disk with their passwords, which makes Bank Street's protection scheme somewhat less than secure. The utility specifies your drive slots and provides a key-clock toggle, a cursor-type (block or underline) toggle, a toggle to allow for a shift-wire modification on the Apple II+ or a keyboard enhancer, and a format converter. The format converter transforms the binary files created by Bank Street Writer to standard text files, and vice versa.

A format converter is essential since Bank Street cannot read standard text files. Also, Bank Street files are binary and on a special disk format that is unreadable by most other programs. Converting files and formats is essential if you want to transfer your files to another word processor or use a data communications program. Unfortunately, the format converter is very slow. It took 8 minutes and 15 seconds to convert a 1500-word draft.

Bank Street Writer is a good program for people who, traditionally, have not



Photo 3: Bank Street Writer can be used with a spelling checker.

used their Apples as word processors, particularly owners of older II+ computers who have not modified their machine to display lowercase letters.

The single greatest flaw is the 38-character by 18-line typing screen, which is simply too small to display any but the simplest documents.

**HOMWORD**

Homeword is a good choice if you are looking for a simple yet friendly word processor for light work. Sierra On-Line designed its word processor using an Icon menu. When you want to change functions, you toggle from the text-entry mode to the editing mode by hitting the Escape key. A series of icons will appear on the bottom of the screen. Moving the icon frame, you select the function you want. The first array of icons shows a printer, a document with an X through part of it to indicate editing functions, a file cabinet, two documents indicating format options, a pointer indicating customize options, and a floppy disk indicating disk utilities.

When you are in the edit mode, the screen is divided into two windows, a top section for text entry (40 columns by 14 lines) and another window below showing the page you are typing on and two bar graphs indicating free memory and free disk. (A really nice touch in the lower-right corner is a graphic representation of what the full page will look like.)

With Homeword you can customize your documents from the Icon menu (see photo 4). By hitting the Escape key in the editing mode, you are brought to the file icon; by hitting Return, you will bring up the save document mode with the current document title selected. This is particularly helpful if you like to continuously save your document on the disk to ensure against losing it because of a power problem.

Editing with Homeword is quite slow. On the Apple II+ the lack of a Delete key makes correcting the last misstruck character somewhat difficult; the arrow key simply moves the cursor, instead of erasing the last entry.

With Homeword you can erase text by painting areas in inverse video. Homeword also allows you to recover the last erased text. You can move text, copy text, and find and replace words. All the functions are intuitive and surprisingly

easy to use.

The print menu offers either continuous or single-sheet paper. From the menu you can indicate the starting page number and preview the document on the screen prior to printing it. You select your printer card from the Customize menu.

The Layout menu enables you to set line spacing, force the start of a new page, and select flush left, flush right, centered, or aligned (justified right/left), print style (bold, normal, or underlined), headings and footings, and indented points.

The Customize menu enables you to select several important options not available on other low-price word processors. You can automatically create a backup of your document. The program can save the last version of your document as a new copy, and the previous version becomes the backup. This feature, standard on many expensive programs, is rare at this price. You can also preset the margins from this menu and specify what type of printer card you are using. You specify the indent points here, as well as the number of disk drives in the system.

Homeword is a very good program for the casual word-processing user. It's

*(continued)*

**AT A GLANCE**

**Name**

Homeword, version for the Apple II+

**Manufacturer**

Sierra On-Line  
Sierra On-Line Building  
Coarsegold, CA 93614  
(209) 683-6858

**Price**

\$49.95

**Computer Needed**

Apple II+, IIe

**Documentation**

35-page manual, tutorial cassette tape designed to teach basics of program features

**Audience**

Anyone who is looking for an easy-to-learn word processor

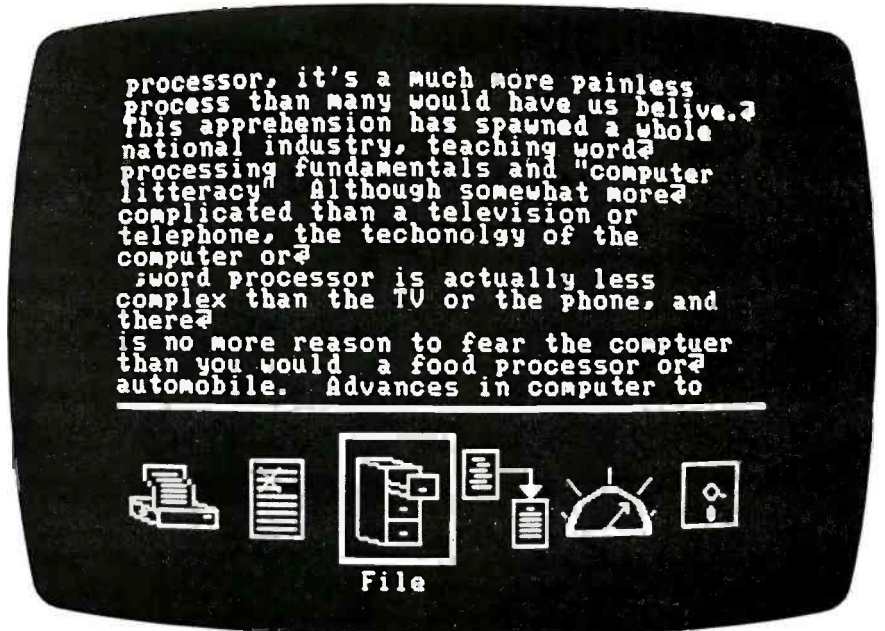


Photo 4: Homeword is limited but has some interesting features, such as the icon menu above.

**AT A GLANCE**

**Name**

Cut and Paste, version Apple IIe

**Manufacturer**

Electronics Arts  
2755 Campus Dr.  
San Mateo, CA 94403  
(415) 571-7171

**Price**

\$49.95

**Computer Needed**

Apple IIe

**Documentation**

14-page manual, reference card

**Audience**

Students, children, or anyone looking for a simple-to-use but limited word processor

simply too slow for the serious user, and the screen display too limited. It does have, however, good documentation, including on-screen help, a cassette-tape presentation to take you through the basics, and a manual to explain the options.

Sierra On-Line should provide a reference card for the control keys. Most are not mnemonic (Control-O for page up, for example). The manual does have an index, but none of the control functions are included in the manual, and you have to stumble on them almost by accident. If you are having problems that simply can't be solved by looking at the manual, you can call a California number listed here to get help.

Homeword is supplied on a copy-protected disk. Sierra On-Line will sell you a backup for \$10 more, a profitable, but unfortunate, practice that prohibits me making an unqualified recommendation.

**CUT AND PASTE**

Cut and Paste (see photo 5) is a very simple word processor with some unfortunate limitations. You know that Cut and Paste is simple when you look at the documentation, a scant 14 pages, most of which is white space. The Cut and Paste packaging is impressive, with

vivid four-color photographs of the programmers seated at a Linotype machine—the implication being that this program will have the impact on history that Ottmar Mergenthaler's typesetting machine did. Hardly.

Cut and Paste is really simple to use. Boot the program, and you are presented with a blank screen. You toggle between the text-entry mode and the Command menu using the Escape key. The Command menu is presented as an inverse block of text at the bottom of the screen, and you select commands by moving a noninverse block to "unhighlight" the command you want. The initial menu presents you with a number of choices including Save, Print, Cut, Paste, Catalog, and Buffer.

To create a document, you select the Catalog command, and then by loading a blank screen, you can enter your copy. Should you want to correct an entry as you type, simply hit the Delete key on the Apple IIe to backspace and erase the last entry. Cut and Paste is always in the insert mode, but should you want to change some text, you will first have to erase the old text, then insert new text. Most serious word-processing users would prefer to have an overstrike mode.

You can also delete a block of copy



Photo 5: Cut and Paste is an easy introductory program for young people.



by choosing Cut on the menu, then marking the text with the left or right arrow key. You cannot move down the text using the down or up arrows, which makes marking a block of copy for deletion a slow process.

You don't have to use the Escape key to toggle the menu. You can select the major commands by typing Control with the appropriate key. The control commands are:

- Control-N Indents five spaces to the right
- Control-R Indents five spaces to the left
- Control-A Followed by arrow keys selects text to be moved or cut
- Control-C Cuts the text into the buffer
- Control-P Pastes down the marked copy
- Control-S Moves cursor to the beginning of the

- Control-E Moves cursor to the end of document
- Control-F Pages forward
- Control-B Pages back

As you become more familiar with the program, you can select these commands directly from the keyboard for faster operation.

The Catalog Menu also allows you to print; delete a document; catalog the disk; copy a disk, which will back up your disk; format a disk, which allows you to create a new data disk; indicate a second drive; and set up a display, allowing you to select 40 or 80 columns and matching the program to your particular printer.

The setup allows you only to specify the pitch that your printer uses, the number of characters on a line, and whether your printer needs a carriage return with a line feed. You have no way of entering printer control strings to in-

itialize your printer or using any of its special features such as underlining or boldfacing.

Cut and Paste has some interesting features, including the ability of the program to "take care" of "widows" and "orphans," which might make the program seem philanthropic, but what it actually does is make sure that there are no last lines from paragraphs that start a new sheet of paper, or first lines of paragraphs that end sheets of paper. A nice touch. The program also assumes that a single-line paragraph is actually a paragraph heading and will ensure that it is kept with the next paragraph. You can also force the start of a new page by typing—on a new line.

Cut and Paste is simple to use, but unfortunately it's much too limited to be of great value as a serious word processor (see table I). It would make an excellent choice for your school-aged children who are learning to use a computer. ■

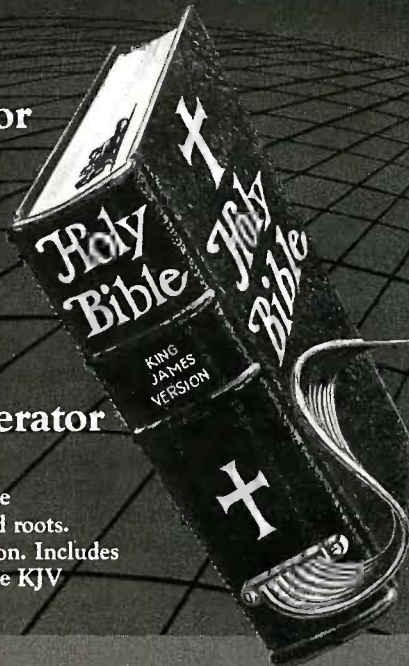
## New dimensions in Bible study.

### THE WORD processor \$199.95

The KJV Bible on disks. Search for any word or phrase, create personal indexes, print any verse. Build your own library of Scripture references.

### THE GREEK transliterator \$199.95

Start with any English word and find the original Greek, with definition and word roots. For any Greek word find every translation. Includes STRONG'S CONCORDANCE and the KJV New Testament. (Apple and IBM only.)



### TOPICS \$49.95

An index to over 200 Scripture subjects.

### PEOPLE \$49.95

An index to over 140 Biblical people.

For Apple, IBM PC, Commodore 64, TRS80, Kaypro, CPM 2.2, MS-DOS.

## Bible Research Systems

9415 Burnet Road #208 • Austin, TX 78758 • (512) 835-7981

Include \$3 postage/handling plus sales tax in Texas.

"Software for personal Bible study"

---

# ALF'S 8088 COPROCESSOR FOR YOUR APPLE

*Adding MS-DOS with this board is easy;  
dealing with the restrictions is the hard part*

---

BY DAVID MORGANSTEIN

**D**oes ALF's new 8088 coprocessor turn your Apple 6502 into an IBM PC? Not quite. Along with some interesting features come a number of drawbacks.

The Alf offerings come as various options. First, you can obtain support software to use the board under Apple DOS 3.3 or Apple Pascal. Second, you can purchase either the MS-DOS oper-

ating system or the CP/M-86 operating system, both of which run on the IBM PC. Third, you can buy the add-on memory board with either 64K or 128K bytes of memory. You can use this board as a RAMdisk under DOS 3.3 or as added memory under MS-DOS or CP/M-86. Finally, you can add an 8087 numeric processor to the RAM (random-access read/write memory) board for further speed improvements when performing number-crunching operations. Let's begin by looking at the hardware.

Both boards are well laid out and of quality construction. The AD8088 contains the 8088 chip, up to 4K bytes of PROM (programmable read-only memory), and as much as 8K bytes of RAM. A plug for a ribbon cable could connect two or more of the 8088 cards. The memory card is available with either 64K or 128K bytes of RAM. It can also be equipped with an 8087 numeric data-processor chip for additional speed when running programs that perform extensive computations.

Software support is provided in several ways. DOS 3.3 programmers can choose from several valuable utilities, including the Formula Transfer Link (FTL), the Multiple Event Timer (MET), and RAMdisk emulation (Memdisk). Pascal programmers can install a Pascal Patch, which hooks several of the p-code commands into the 8088 card for faster execution. In addition, a Transcend Unit permits faster execution of

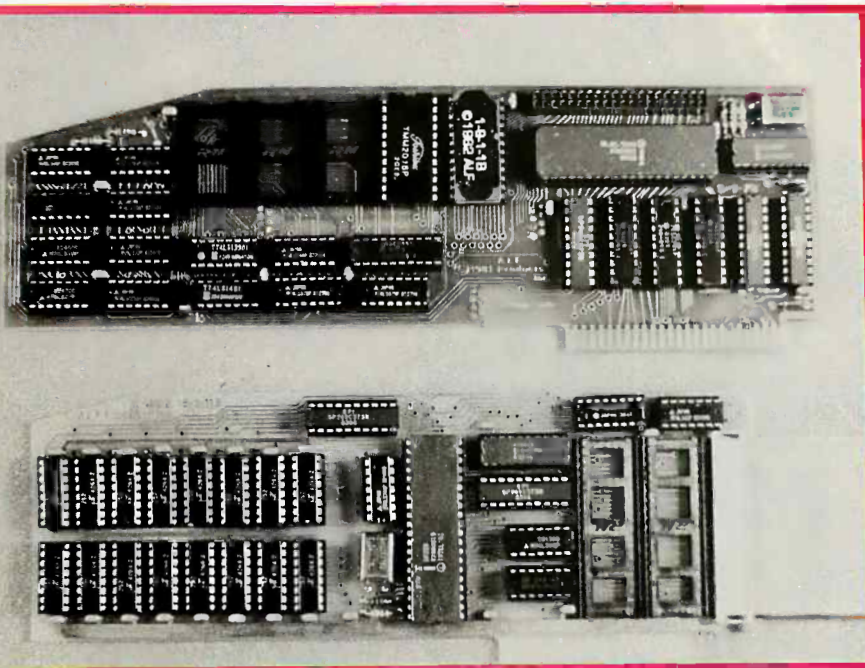


Photo 1: *The Alf coprocessor.*

transcendental functions such as sines and exponentials. For those wanting to run IBM PC software, Alf sells the MS-DOS 1.1 operating system and the newer CP/M-86 operating system in an Apple drive-compatible format.

## INSTALLATION AND USE

The AD8088 card installs easily in any slot, 0 through 7. I have used it only in slot 2 because you must initially install it there to emulate the IBM PC. You can then run a utility to change the default slot. Unfortunately for many Apple owners, this might require removing a modem or serial interface card until the software is reconfigured.

Installing the RAM board is more difficult. Unlike other RAM boards, this one must be connected to the 8088 card via a two-inch ribbon cable. A novice can do this, but routing the cable requires care. Even more challenging is removing the 8088 microprocessor from the AD8088 card and installing it in a socket provided on the RAM board. Removing a 40-pin chip can be a hair-raising, pin-bending experience, especially if you do not have a tool designed for this purpose. The Alf documentation suggests you use a screwdriver. The package does not (but should) include a chip puller, which would have simplified the operation and reduced the chances of damaging the pins on the 8088 chip. Fortunately, the optional 8087 processor easily plugs into the RAM board. When using both boards, you should install them within one slot of each other. Again, both operating systems require that the AD8088 be installed in slot 2 initially, although you can relocate it later.

Once installed, the boards are very easy to use. The documentation and software provided take care of just about everything.

## DOS 3.3 SUPPORT

If you write Applesoft programs that contain a lot of computations, particularly those with transcendental functions, Alf's Formula Transfer Link (FTL) will speed things up. This machine-language routine automatically routes function calls to the Applesoft ROMs through the 8088 (and, optionally, the 8087). Unfortunately, you must convert the FTL routine from DOS 3.2 to DOS

3.3 before you can use it. This is simple to do with the system utility program, Muffin. ProDOS users will find, however, that FTL does not work at all in their operating systems.

FTL is fairly short, requiring only about 1K byte of RAM. Since most Apple owners have 64K bytes of RAM, this requirement is inconsequential.

How well does FTL perform? The Alf advertisement suggests a factor of three or greater increase in speed. I found a factor of two to be a more realistic assessment. The relative speeds with and without FTL are shown in table 1. The greatest improvement was in the computation of a square root. Note that the speed improvements will result only when function calls, such as transcendentials, are made. There is no speed improvement for most BASIC operations. To test this, I tried one of the BYTE speed-comparison programs, the Sieve of Eratosthenes. As expected, the execution time using FTL was no different. If you purchase the optional 8087 chip, Alf provides a slightly modified version of FTL (FTL87), which reportedly does computations even faster.

Another interesting use of the 8088 card is the ability to time events that occur as quickly as several hundred microseconds or as "slowly" as several hundred milliseconds. The on-board clock has a selectable resolution of 50, 100, or 500 microseconds or 1, 5, 10, 50, or 100 milliseconds. The events you time may have a duration of three seconds at the highest resolution of 50 microseconds or slightly under two hours at the slowest clock speed of 100 milliseconds. The Multiple Event Timer (MET) program allows you to time from 457 to 2505 separate events, depending on the amount of RAM on the 8088 card. MET includes a routine, called MET Read, for accessing the timed

results and either displaying them on the screen as values, seeing them in a high-resolution plot, or saving them on disk for later processing. While MET is most valuable for those working with laboratory equipment or software optimization, it will not work while FTL is installed unless you have two 8088 cards.

The Alf memory card is supported by software that permits you to add a "fast disk drive" for speedier processing of disk-based files. Alf provides two programs, Memdisk, which sets up the memory card as a RAMdisk, and Memcopy, which allows you to exchange data between a real disk drive and the RAM drive. Unfortunately, you cannot use the memory card as added RAM or as a language card for the Apple's 6502. Only the 8088 processor can access the memory, so you cannot use the memory card to expand a spreadsheet work space.

Alf does not provide software to permit RAMdisk emulation under the UCSD Pascal or CP/M operating systems.

A handy utility included on the Alf DOS 3.2 disk is a program for increasing the load time of files. Fast Load modifies DOS to permit quicker disk-drive access.

## PASCAL 1.1 SUPPORT

For Pascal users, Alf offers two routines that increase computational speed in Apple Pascal.

Pascal Patch modifies Pascal's P-machine so that certain time-consuming p-code operations are passed to the 8088 card for quicker processing. The patch replaces the MPR (multiply real), DVR (divide real), and MOV (block memory move) p-codes with calls to the 8088. After you make the patch, all calls to the affected op codes should be redirected and speeded up. No changes in existing programs are needed.

A special Transcend Unit is available for additional speed improvements. A USES statement is required at the

*(continued)*

Table 1: Time (in seconds) for 300 computations.

|             | w/o FTL | with FTL |
|-------------|---------|----------|
| Sine        | 20      | 12       |
| Square (^)  | 26      | 11       |
| Log         | 19      | 13       |
| Square root | 26      | 14       |

David Morganstein is vice-president of Westat and president of Washington Apple Pi, a 5000-member users group. He can be reached at 13424 Walnutwood Lane, Germantown, MD 20874.

**AT A GLANCE**

**Name**

AD8088 processor card and AD 128K-byte memory card

**Type**

Coprocessor board, memory board, and support software

**Manufacturer**

Alf Products Inc.  
1315F Nelson St.  
Denver, CO 80215  
(303) 234-0871

**Components**

Coprocessor board—5-MHz 8088, 4K-byte PROM, 2K-byte RAM; RAM memory board—64 or 128K-byte RAM

**Software**

For DOS 3.3—Formula Transfer Link, Multiple Event Timer, and RAMdisk Emulator; for Pascal 1.1—Pascal Patch and Transcend Unit, MS-DOS 1.1, CP/M-86

**Optional Hardware**

5-MHz 8087 math processor

**Documentation**

26-page manual for AD 8088 board, includes schematic; 18-page manual for 128K-byte memory board, includes schematic; IBM MS-DOS 1.1 manual with 26-page *Clone Software Guide to AD 8088 Applications*; Digital Research CP/M manual with 36-page *Clone Software Guide to AD 8088 Applications*

**Price**

|                                            |       |
|--------------------------------------------|-------|
| AD8088 coprocessor board                   | \$345 |
| Memory Card w/o memory                     | \$295 |
| Each 64K bytes of RAM<br>(max. 128K bytes) | \$ 75 |
| MS-DOS 1.1                                 | \$100 |
| CP/M-86                                    | \$100 |

beginning of the Pascal code to establish a link to this library unit. No program changes should be necessary. You need only replace the Apple-supplied library unit with the Alf unit to gain access to the 8088 card routines.

**THE IBM CONNECTION**

While 6502 support is of interest, the really intriguing feature of the 8088 card is the possibility of running IBM PC software on your Apple. As the old joke goes, I have good news and bad news. The good news is that you can run 8088 code with the Alf card. This means that many programs written for the IBM PC will run on the Apple. Alf supplied me with the PC's two most frequently used operating systems, CP/M-86 and MS-DOS (version 1.1). The bad news is that this software has to be in Apple disk format because Apple drives are not capable of reading disks formatted on PC drives. Although Alf did not provide any commercial applications programs for me to test under either of these systems, I did receive a list of about 70 programs running under CP/M-86 in Apple disk format that are available from another supplier.

CP/M-86 is an upgraded version of

Digital Research's widely used CP/M package, which runs on Z80 boards. Most of its features are similar to those found in the 8-bit version. If you purchase this operating system, you will get the extensive Digital Research manual documenting CP/M-86, a brief addenda written by Clone Software describing certain utilities needed to operate the package on the Apple, three IBM PC-compatible disks containing the Digital software, and three Apple-compatible disks to drive the 8088 card and load the system. One of the three disks is a copy of the operating system in 13-sector format, one is a copy in 16-sector format, and the last is a utility disk in 16-sector format. (Note that two of the IBM-compatible disks contain GSX-86, the Digital graphics extension package. This software is not provided in Apple disk format, however, and probably would not work on the Apple anyway because of hardware differences.)

Once you have installed the 8088 board in slot 2 and have inserted the system disk, booting CP/M-86 is simple. When the computer comes up, you will see the standard Digital Research greeting, in 40-column format. To obtain the

Table 2: CP/M-86 commands.

| Built-in Command          | Function                                                             |
|---------------------------|----------------------------------------------------------------------|
| DIR                       | Displays filenames in disk directory                                 |
| DIRS                      | Displays names of SYS files                                          |
| ERA                       | Erases a filename from a disk directory                              |
| REN                       | Lets you rename a file                                               |
| TYPE                      | Writes the content of a character file to your console output device |
| USER                      | Lets you change user number                                          |
| Transient Utility Command | Function                                                             |
| ASM86                     | Translates 8086 assembly-language programs into machine-code form    |
| ASSIGN                    | Directs I/O to peripheral devices                                    |
| CONFIG                    | Programs serial-port operation                                       |
| DDT86                     | Program debugger                                                     |
| DSKMAINT                  | Copies, verifies, and formats your disks                             |
| ED                        | Line editor                                                          |
| FUNCTION                  | Programs the function keys                                           |
| GENCMD                    | Produces executable commands files                                   |
| HELP                      | Displays information on commands                                     |
| PIP                       | Combines and copies files                                            |
| STAT                      | Allows you to examine and alter file status                          |
| SUBMIT                    | Executes a command file                                              |
| TOD                       | Sets the data and time display                                       |

benefits of an 80-column board or the Alf memory card, you must run a utility program called Adapt. This program allows you to establish various system defaults.

Table 2 lists the standard built-in commands and programs. Users of Z80 CP/M will find familiar programs such as ED for line editing, ASM-86 for assembling 8088 and 8086 code, and DD1:86, the dynamic debugger program for examining memory and disk contents. CP/M-86 does contain a few new commands such as HELP, DSKMAINT, and TOD. The HELP command lists the available options. DSKMAINT performs several useful disk-maintenance functions on IBM drives, including copying disks, formatting blank disks, checking drive speed, and verifying programs. Since Apple drives function differently, four utility programs are provided to supply DSKMAINT's useful services. TOD is used to set and read the date and time.

The most important utility is the Adapt program. As I mentioned earlier, it is used to establish important parameters such as the 8088 card slot number, special device drivers, memory availability, and screen and keyboard function definitions. Unfortunately, I have not been able to install the 80-column driver that should support my Videx board.

The people at Clone Software, who wrote the Apple-compatible utilities, also include a valuable pair of programs for transferring text information between CP/M-86 and Apple DOS disks. Another useful pair of programs is the Upload/Download routine for communicating between Apple CP/M-86 and another version running on different hardware. This routine permits you to convert software you have purchased on IBM-formatted disks into Apple format if you can connect the two computers with an RS-232C umbilical.

Among the CP/M-86 programs available in Apple format are dBASE II, MAG/base, Milestone, SuperCalc 2, T/Maker III, a C compiler, CBASIC-86, Pascal/MT+86, and WordStar. The price list indicates that these products are sold at list prices, rather than the discounted prices found in mail-order ads for IBM PC software. Unfortunately, I cannot tell whether all these programs will run in the Apple environment,

Table 3: MS-DOS commands.

| DOS Command      | Function                                                                                                        |
|------------------|-----------------------------------------------------------------------------------------------------------------|
| CHKDSK           | Checks disk and memory status                                                                                   |
| COMP             | Compares two files                                                                                              |
| COPY             | Copies files to another disk                                                                                    |
| DATE             | Sets system date                                                                                                |
| DEL or ERASE     | Erases a filename from directory                                                                                |
| DIR              | Displays filenames in disk directory                                                                            |
| DISKCOMP         | Compares two disks                                                                                              |
| DISKCOPY         | Copies one disk to another                                                                                      |
| EXE2BIN          | Converts .EXE files to .COM files                                                                               |
| FORMAT           | Formats blank disk, checks for defects                                                                          |
| MODE             | Sets mode of operations                                                                                         |
| PAUSE            | Suspends operations                                                                                             |
| REM              | Displays remarks from within batch file                                                                         |
| RENAME           | Lets you rename a file                                                                                          |
| SYS              | Copies operating-system files to another disk                                                                   |
| TIME             | Lets you enter or change system time                                                                            |
| TYPE             | Outputs character file to another device                                                                        |
| Utility Programs | Function                                                                                                        |
| EDLIN            | Line editor                                                                                                     |
| LINKER           | Combines object modules, searches library for external references, produces listing and relocatable load module |
| DEBUG            | Loads, alters, or displays files, executes object files                                                         |

because memory limitation and keyboard hardware could present insurmountable difficulties.

**MS-DOS**

The MS-DOS provided is version 1.1, which lacks the hierarchical directory structure provided by the more recent version 2.0. It includes Edline for editing text files, Link for linking compiled modules, and Debug for examining and changing memory. Table 3 summarizes the MS-DOS commands and available programs. A comparison of tables 2 and 3 suggests that the MS-DOS software takes up more memory but might be more convenient to run because it has many more built-in commands. Utility programs that must be read in from disk perform fewer functions.

As with CP/M-86, the most important utility provided is the Adapt program. The MS-DOS version works like the CP/M version. Again, I was not able to install the 80-column driver for my Videx board.

The MS-DOS utility disk has the same useful routines supplied with the CP/M-86 system, including text transfer and Upload/Download.

No software for writing a program under MS-DOS is included. The standard package does not contain BASIC or even an assembler. You must buy this package if you are going to run any commercial program, but as such, it is of little value. Alf was not able to send me a list of commercial programs available in Apple format that run under MS-DOS. For now, you might be limited to software originally written for an IBM clone that just happens to work under the hardware restrictions you will encounter.

**DOCUMENTATION**

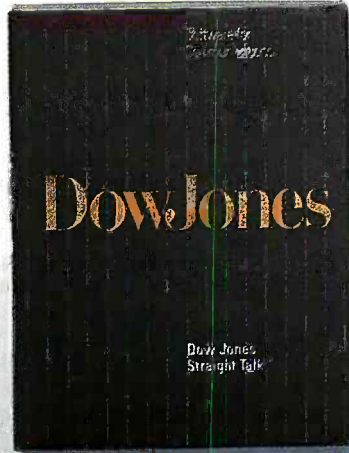
Each card comes with a manual describing the hardware and software accompanying it. The manuals clearly explain how to install the cards and include pictures of each step. They also include circuit diagrams and card layouts, permitting technically sophisticated users to troubleshoot problems. The manuals, though brief (25 pages for the 8088 card and 17 pages for the memory card), are complete and contain a table of contents and an index.

The manual for the 8088 card  
*(continued)*

## Introducing Dow Jones Straight Talk™

# Now there's smart software™ for the Macintosh.

Think of it. Now there's software as smart as the Apple® Macintosh™ computer. Dow Jones Straight Talk™ offers you all the facts in Dow Jones News/Retrieval® and the other leading information services. With Straight Talk, you get the exact information you need when you need it.



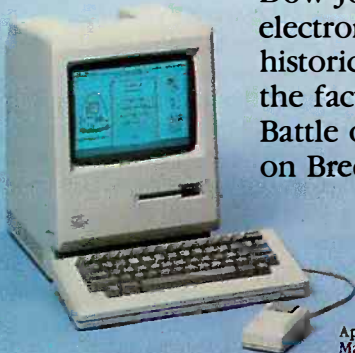
Dow Jones Straight Talk is a trademark of Dow Jones & Company, Inc. Dow Jones News/Retrieval is a registered trademark of Dow Jones & Company, Inc. Smart software is a trademark of Dow Jones & Company, Inc. The Information Game is a trademark of Dow Jones & Company, Inc. Apple is a registered trademark of Apple Computer, Inc. Macintosh is a trademark licensed to Apple Computer, Inc. Copyright © 1984 Dow Jones & Company, Inc. All Rights Reserved.

## Get an "A" on your Paper.

It's one o'clock in the morning. Your term paper on the American Revolution is due at 8 a.m. Where was the misnamed Battle of Bunker Hill *really* fought? It could be the difference between an "A" and a "B".

### Now there's smart software™ for the Macintosh™ computer.

With Straight Talk, the smart software from Dow Jones, you can use an electronic encyclopedia to find the historical fact you need. Even if it's the fact that on June 17, 1776 the Battle of Bunker Hill was fought on Breed's Hill.



### Dow Jones Straight Talk™

Apple is a registered trademark of Apple Computer, Inc. Macintosh is a trademark licensed to Apple Computer, Inc.

## ALF COPROCESSOR BOARD

---

*Unfortunately,  
no software for writing  
a program under  
MS-DOS is included.  
The standard package  
does not contain  
BASIC or even  
an assembler.*

---

describes the FTL and MET programs for Applesoft programmers. A six-page section for assembly-language programmers discusses the on-board PROM routines.

You can use the routines to generate a random number, multiply or divide, and manipulate 5-byte floating-point numbers. Also included are routines to perform the basic four math functions on floating-point numbers and to compute several transcendental functions, such as log and antilog, exponentiation, sine, cosine, and arctangent. The material is clearly presented and very understandable.

The documentation accompanying the CP/M and MS-DOS packages consists of the extensive manuals provided by Digital Research and IBM (written by Microsoft) and a 30-page addenda written by Clone Software regarding its adaptations for the Apple. The Digital and IBM manuals are lengthy, well organized, and thorough. The Clone addenda describe how to boot-up each system on the Apple and how to adapt the systems for various options, such as 80-column displays. The addenda contain some technical material for machine-language programmers who might be interested in developing software for the 8088 chip within each operating system.

### PROS AND CONS

The Alf 8088 card allows Apple owners to write 8088 or 8086 code using an assembler provided with CP/M-86. Apple-

soft or Pascal programmers who require special mathematical functions (such as square root, logarithms, and sines) can increase program execution speed with special routines and patches to the standard operating systems. Those who would like to try programs advertised for the IBM PC might be able to purchase them from a firm that is converting some IBM PC software to Apple-compatible disks.

Potential buyers should be aware of the following limitations, however. In DOS 3.3, the Alf RAM card can be used only as a disk emulator and not as added memory with programs such as spreadsheets. (Expansion of spreadsheet size is a typical rationale for adding a RAM board to an Apple.) Currently, it cannot even be used as a disk emulator within the Pascal or CP/M operating systems. Software developers who want to use the FTL routines in commercial packages will have to obtain a license from Alf.

The biggest problem is that the Apple disk drive is not compatible with the IBM PC disk format. Thus, your Apple drive will not be able to read disks written with an IBM PC or any of its clones.

(The reverse is not true, however. There is a card and accompanying support software for the IBM PC that permit the reading of Apple-formatted disks. This incompatibility is due in great part to the fact that Apple drives can write only 35 tracks, while IBM disks have 70 tracks.)

The drive problem is not insurmountable. Rana has announced an 8086 board with disk drives and a controller for the Apple that can emulate the IBM PC. The Rana system reportedly permits you to read Apple- or IBM-formatted disks.

The key to the system is a drive that can read the higher data densities of the IBM PC disk. Thus, if you are going to run IBM software with the Alf card, you will be restricted to packages that have been converted to the Apple format.

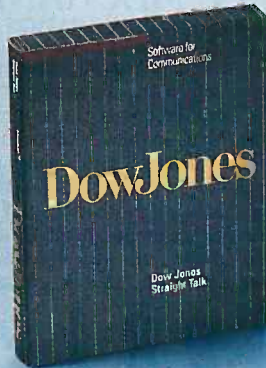
Make sure, however, that any Apple-formatted programs you buy do not call upon special-function keys that are found in IBM hardware but cannot be simulated on the Apple. In addition, be aware of the package's memory requirements. Many IBM PC packages require 256K bytes or more of memory. ■

# Get that Big Promotion.

In half an hour, your boss is due to finalize a merger with a company you have doubts about. His career rides on this deal. How can you change his mind before it's too late?

**Now there's smart software™  
for the Macintosh™ computer.**

With Straight Talk, the smart software from



Dow Jones, you can get the lowdown on a company without ever leaving your office. You might even discover a revealing fact that saves your boss's job and earns you a new one.

**Dow Jones  
Straight Talk™**

Apple is a registered trademark of Apple Computer, Inc. Macintosh is a trademark licensed to Apple Computer, Inc.

## Play it Smart.

**Play the Information Game™  
and get \$60 off Dow Jones  
Straight Talk™ and Apple® Modem 1200.**

Play the Information Game at your authorized Apple® dealer. Answer five questions on the Macintosh™ computer using Straight Talk. Show us how smart *you* are.

Play the Information Game and buy Straight Talk and we'll give you \$10 off Straight Talk and \$50 off Apple Modem 1200\*. It's a deal smart people can appreciate. One that will make you a winner — whatever your information game.



**Dow Jones  
Straight Talk™**

For a free brochure on Dow Jones Straight Talk, call: **1-800-345-8500 ext. 272** (Alaska, Hawaii and foreign, call 1-215-789-7008)

\*Rebated from Dow Jones and Apple with proof of purchase while supplies last.

Apple is a registered trademark of Apple Computer, Inc. Macintosh is a trademark licensed to Apple Computer, Inc.

# Beagle Bros Apple® Software Report

"All the News That Fits"

Fall/Winter 1984

Ad Number 181



1 A=21: SPEED-A: PRINT CHR\$(A)  
TEXT: HOME: PRINT "RUQWLUPR273"  
2 COLOR-12: HLIN 0,10 AT 1: POKE 1030,  
160 COLOR-13: PLOT 8,1: PLOT 10,1

NEW!

## BEAGLE GRAPHICS™

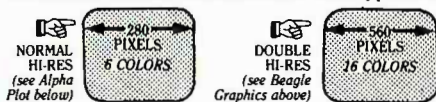
16-COLOR DOUBLE HI-RES GRAPHICS  
\$59.95 (DOS 3.3 and ProDOS™, requires Apple IIc or 128K IIe)

16 colors and 560x192 resolution on your IIc or 128K IIe! Beagle Graphics is packed with features:

As an Artist, you can draw, FILL and label double hi-res pictures using the AppleMouse™, joystick, Koala Pad™, graphics tablet or keyboard. Icon-assisted "Cut & Paste" features make graphics manipulation easy. Any section of a picture can be stored, moved, inverted or flopped.

As a Programmer, you get 33 new commands for drawing, filling and manipulating double-res images. New utilities let you convert normal programs & pictures to double-res, save and load any image section, compress picture data to 1/3 disk space, produce double-res "slide shows" and more.

Label your double hi-res pictures with a variety of editable normal-size and double-wide typefaces.



## ALPHA PLOT™

STANDARD HI-RES GRAPHICS UTILITY

\$39.50 (DOS 3.3, compatible with any version of Apple II)

Alpha Plot lets you draw in hi-res on both pages using easy keyboard commands. Pre-view lines before plotting. One-keystroke circles, boxes and ellipses, filled (solid/mixed) or not. All pictures are Save-able to disk for access by your programs.

Compress hi-res data to 1/3 disk space, allowing 3 times the number of hi-res pictures per disk.

Superimpose pictures or relocate sections of images anywhere on either hi-res page.

Add variable-size color text to pictures. Type anywhere on the screen, even sideways for graphs.

## PRONTO-DOS™

TRIPLE-SPEED DOS 3.3 UTILITY

\$29.50 (DOS 3.3, compatible with any version of Apple II)

ProntoDOS triples the speed of loading and saving pictures and programs. Compare speeds:

| Function               | Normal  | Pronto |
|------------------------|---------|--------|
| BLOAD HI-RES IMAGE     | 10 sec. | 3 sec. |
| LOAD 60-SECTOR PROGRAM | 16 sec. | 4 sec. |
| SAVE 60-SECTOR PROGRAM | 24 sec. | 9 sec. |

(Text files no change)

MOVE DOS 3.3 above main memory to free 10,000 bytes of memory (64K required to move DOS). Get 15 extra free sectors per initialized disk too.

New TYPE command ("TYPE filename") immediately displays your Apple text file contents.

## NEW! FATCAT™

DISK LIBRARY ORGANIZER

\$34.95 (compatible with any version of Apple II)

Fatcat reads all of your DOS 3.3 and ProDOS disk catalogs into one or more "Master Catalogs" that can be searched, sorted and printed. Update at any time by simply reading in new or altered disks.

Fatcat also lets you quickly compare any two files and alphabetize file names in your catalogs.

## "How can I make my Apple® do that?"

You know, you can make your Apple do almost anything you can think of, with just a little help—Beagle Bros software helps make your Apple a more powerful computer, and you a better programmer.

**BEAGLE BROS, THE UTILITY LEADERS:** Beagle Bros' low-priced unprotected disks dominate the Apple Utility bestseller lists. And Beagle disks were recently voted to FOUR of the TOP-24 spots in *Softalk's* "Most Popular" poll—that's against all Apple software publishers in all categories.

**APPLE'S SECRETS REVEALED:** Our authors are always on the lookout for techniques and tips that can be shared with our customers. From our inspectable programs to our informative instructions and Apple Tip Books, you will learn from the experts. And you don't have to be an expert to start. For example, type in this little program, and then type "RUN" 10 HGR: POKE 228,99: HPL0T 0,99 TO 279,99 A-ha! You just drew a dotted line on the hi-res screen. A secret technique? Not any more.

## APPLE MECHANIC™

HI-RES SHAPE ANIMATION

\$29.50 (DOS 3.3, compatible with any version of Apple II)

Apple Mechanic lets you draw shapes on the screen which are converted into "shape tables" so your programs can perform animation with Apple's built-in Draw & Xdraw commands.

Easy-to-follow "List & Learn" demos on the disk teach how to program in Hi-Res.

Fancy typefaces are another big part of Apple Mechanic. Six proportionally-spaced fonts are included on the disk, with 26 more on our Apple Mechanic TYPEFACES disk, sold separately.



10 AS="JACKZIP": FOR  
H=1 TO 7: CALL-198:  
FOR S=1 TO 16 \*  
(ASC(MIDS(A\$,H))  
-64): NEXT S,H

NEW!

## TRIPLE-DUMP™

"PRINT-ANYTHING" PRINTER UTILITY

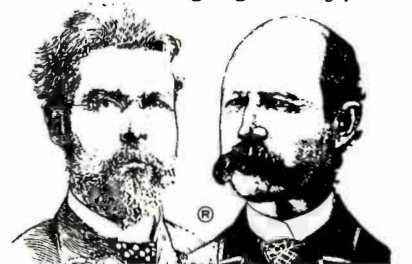
\$39.95 (DOS 3.3 and ProDOS™, compatible with any version of Apple II)

Triple-Dump lets you print any kind of image on your dot matrix (graphics-capable) printer:

1 Hi-Res & Double Hi-Res graphics. 2 Lo-Res & Double Lo-Res graphics. 3 40 & 80-Column text.

Triple-Dump's print routines can be run directly from the disk, or included in your programs.

Also included is a bonus GIANT BANNER program that makes 8 1/2" high signs on any printer.



The Apple Programmer's Best Friend

BEAGLE BROS, INC.

3990 OLD TOWN AVENUE, SUITE 102C  
SAN DIEGO, CALIFORNIA 92110 619-296-6400

## The Beagle Bros Catalog

### GRAPHICS

- ALPHA PLOT (described in this ad) . . . . . \$39.50
- APPLE MECHANIC (described in this ad) . . . . . 29.50
- APPLE MECHANIC TYPEFACES . . . . . 20.00
- BEAGLE GRAPHICS (described in this ad) . . . . . 59.95
- FLEX TYPE (II+, IIe, IIc, DOS 3.3) . . . . . 29.50
- Variable-width text (wide/normal/condensed) controllable with normal Applesoft commands. No 80-column card read.
- FRAME-UP (II+, IIe, IIc, DOS 3.3) . . . . . 29.50
- Make Apple "slide shows". Keyboard controlled or unattended, using your existing hi-res, lo-res and text screens.
- TRIPLE-DUMP (described in this ad) . . . . . 39.95

### ALL-PURPOSE

- DISKQUIK (IIc or 128K IIe, DOS 3.3) . . . . . 29.50
- Acts like half a disk drive in slot 3. Silent and fast as a hard disk. Load/save files in memory with normal commands.
- FATCAT (described in this ad) . . . . . 34.95
- PRONTO-DOS (described in this ad) . . . . . 29.50

### PROGRAMMING

- BEAGLE BASIC (IIc or 64K II+, DOS 3.3) . . . . . 34.95
- Puts Applesoft in RAM so you can change it and add enhancements—new commands like if-then-ELSE, SWAP variables, GOTO/GOSUB-a-variable, TONE, HSCRN, etc.
- DOS BOSS (II+, IIe, IIc, DOS 3.3) . . . . . 24.00
- Reword DOS 3.3 commands. Change "Catalog" to "Cat". "Syntax Error" to "Oops" or anything. Includes many meaty tips for altering DOS, including program "save-protection".
- DOUBLE-TAKE (II+, IIe, IIc, 3.3/Pro) . . . . . 34.95
- 2-way scroll for Listings & Catalogs. Better List-format, fast variable+line number display, better renumber/append, auto line-numbering, instant hex/dec converter and more.
- GPLE (II+, IIe, IIc, 3.3/Pro) . . . . . 49.95
- Edit Applesoft without cursor-tracing. Features insert & delete and fast search & replace. Make all keys be "function keys" to type anything you like (ESC-1 catalogs disk, etc.). Move DOS 3.3 out of main memory to add 10K of space.
- SILICON SALAD (II+, IIe, IIc, DOS 3.3) . . . . . 24.95
- Over 100 utilities and tricks—hi-res program splitter, DOS killer, disk scanner, hi-res text imprinter, 2-track catalog...
- TIP DISK #1 (II+, IIe, IIc, DOS 3.3) . . . . . 20.00
- 100 tips on disk from Tip Books 1-4. Fascinating Apple programming techniques. Includes Apple Command Chart.
- UTILITY CITY (II+, IIe, IIc, DOS 3.3) . . . . . 29.50
- 21 utilities—List-formatter puts each statement on a new line, multi-column catalogs, invisible/trick file names, etc.

### GAMES

- BEAGLE BAG (II+, IIe, IIc) . . . . . 29.50
- 12 games on one disk. Voted to 1983's MOST POPULAR list in *Softalk* poll. The best Apple game bargain on the market.

**GOTO** your favorite software store. If they are out of a particular Beagle Bros disk, get on their case; they can get it for you immediately from any software distributor.

**OR** buy directly from Beagle Bros by phone or mail. **PHONE:** Visa/MasterCard/COD orders, phone toll free. **MAIL:** Send check or Visa/MC numbers to Beagle Bros. Add \$1.50 shipping +6% if Calif. We ship immediately.



Toll Free: **1-800-227-3800 ext.1607**  
(MasterCard/Visa/COD orders only please.)  
For product information, phone 619-296-6400.)



# EXPANDING YOUR APPLE'S APPLICATIONS

*Adding CP/M to your Apple II system now means just choosing which board best suits your needs*

BY ROBERT A. PECK

**T**oday, not only can you choose from thousands of programs written for the Apple, but, thanks to a number of manufacturers, you can choose from thousands more CP/M programs. The hardware and software packages range from the very simple Z80 add-on board with little documentation to the very complex multifunction board with multiple memory banks and literally pounds of documentation.

Each of them, regardless of complexity, offers access to the wide range of applications currently available under CP/M, giving you many more choices in the ways you can use your Apple.

## CP/M

For those of you not familiar with the term, CP/M stands for control program for microcomputers. When you add a CP/M card to your Apple, you are adding the Z80 processor to the system, which is necessary to execute the instructions for CP/M programs. Your Apple essentially becomes a terminal for communicating with the Z80; the 6502 main processor in the Apple becomes a slave to the Z80's requests for input and output.

Manufacturers have used two basic ways to add the Z80 to the system: by sharing the bus and by coprocessor communication.

## BUS SHARING

Sharing the bus means that the 6502 and the Z80 processors must take turns

using the memory and the I/O (input/output) facilities of the system. Each, in turn, becomes the only master processor of the system at the time it is in control. Each time one processor wants the other to perform some action, it must set up a sequence of instructions for the other processor. It then activates the other processor and immediately "goes to sleep." When the other processor has finished its work, it follows the same kind of actions, dropping off to sleep so that the opposite processor can again take over the system.

Examples of Z80 cards that perform bus sharing are the Microsoft Softcard and the ALS Z-Card II (now known as the Z-engine).

The advantage of bus sharing is that programs for the Z80 can use the Apple memory and peripherals directly, for example, to read the keyboard or joystick, or to write directly to the screen.

The primary disadvantage is that the Z80 must be held to the same speed as the Apple's memory in order to synchronize correctly with it. The standard operating speed of most Z80 systems, such as Osborne, Morrow, and Altos, is 4 MHz. This synchronization forces the Z80 to run at about a 2-MHz effective rate, making the Apple run about half as fast as other systems designed to run CP/M directly.

The speed limitation is not present when you use one of the other CP/M cards surveyed because each of these cards has its own separate memory—no sharing. Each has its own clock, and

neither the 6502 in your Apple nor the Z80 on your CP/M card has to shut itself off so that the other can run.

A clever programmer can often take advantage of this by having each processor perform its own separate task. When the processors want to communicate with each other, they do so through a small, fixed set of memory locations, handshaking along the way. (Handshaking refers to message passing in which one processor says, "Here is something for you," and the other says, "Thanks, I've got it.")

Each CP/M board includes a minimum of 64K bytes of high-speed memory, exclusively accessed by the Z80. This memory includes the CP/M operating system and is where CP/M programs reside. The Apple memory for the 6502 processor, as far as CP/M is concerned, contains only the instructions for communicating with the outside world, such as drivers for the 5¼-inch disk units, the 80-column cards, and any other accessory that is to be treated as part of the system.

The boards in the coprocessor category are the Digital Research Gold Card, the Microsoft Premium Softcard IIe, the Advanced Logic System CP/M Card, and

*(continued)*

*Robert A. Peck works for Amiga Computer Inc. He is the author of the Atari BASIC Tutorial and the Advanced Atari BASIC Tutorial, both from Howard W. Sams & Co. He can be reached at POB 2231, Sunnyvale, CA 94087.*

## AT A GLANCE

### Name

Z-engine (formerly called Z-Card II)

### Version of CP/M

2.2

### Manufacturer

Advanced Logic Systems  
1195 East Arques Ave.  
Sunnyvale, CA 94086  
(408) 730-0306

### Price

\$169

### Documentation

A 40-page installation booklet, also describing briefly some of the supplied programs

### Features

Effective clock rate of approximately 2 MHz; comes with one disk containing a "standard set" of CP/M 2.2 programs (PIP, ASM, LOAD, DUMP, DDT, ED, STAT, SUBMIT, XSUB) and some ALS-supplied utilities; does not include 80-column capability; does not have on-board RAM but uses Apple on-board memory

the Personal Computer Products' Appli-card (Apple II line).

### COMMON ELEMENTS

All of these systems have several things in common:

1. The operating system of all of these is Digital Research CP/M, versions 2.2 or 3.0. When you purchase any one of these systems, you become a licensee of Digital Research.
2. All of them have at least 56K bytes of TPA, or transient program area. This is an important point because most standard CP/M programs, such as popular word processors, database managers, and CP/M-based programming languages, can usually run in 56K bytes.
3. All of these cards will work with the standard 35-track Apple disks. This means that if you can purchase or download such programs to Apple-format disks, you will most likely be able to run them under Apple CP/M.
4. Each of the cards can write to a printer interface installed in slot 1. If you have what might be termed a standard Apple system, consisting of the computer, an extended RAM (random-access read/write memory) card (or a IIe), a monitor, two disk units, and a printer, you will be able to run CP/M applications regardless of which card you choose. The only time you may have difficulty is if you have some form of favorite accessory other than what is part of the term "standard Apple system" mentioned above.

### STANDARD SYSTEMS VS. STANDARD SOFTWARE

Not only is there a distinction between standard and special systems, but there is a distinction between what might be termed standard CP/M and Apple CP/M because of the way the Apple computer is constructed. Sometimes a manufacturer will take advantage of the way in which the Apple is constructed, such as by using the Apple high-resolution graphics mode directly. In this case, a special Apple-only version of a program will be offered. It is designated as an Apple-CP/M program rather than simply a CP/M program.

While I was trying to perform the benchmark testing for this article, an in-

teresting thing happened that truly points out how certain programs, though designated CP/M, are very Apple-specific. For the past few months I have used an Apple that contains a rather odd assortment of cards. In slot 7, there is a StarCard from MicroPro, which I purchased with a WordStar package. (The StarCard is actually an Appli-card from Personal Computer Products.) In slot 4 is a Softcard. Slot 6 has the normal Disk II controller card, and slot 5 has an 8-inch disk controller.

This meant, for example, before I received the 8-inch-controller driver software for the Appli-card, when I wanted a 6-MHz clock speed I would boot the StarCard version of CP/M. When I wanted to put things on the 8-inch disks, I used the 8-inch modification of the Microsoft CP/M. Of course, to transfer data between the two, I used the 5¼-inch disks. Because the Softcard is a bus-sharer and the Appli-card is a coprocessor, neither knew about the other, and neither created any interference in the system. Only the processor whose operating system was loaded talked to the Apple.

During the benchmark testing, I had decided to try to use the GBASIC program on the Microsoft Premium SoftCard IIe disk. All of the testing was to be done on an Apple IIe, and I felt that this would make things more consistent and easier to keep straight.

Since I had had no problems with alternative operating systems in the past, when it came time to benchmark the ALS Z-engine, I neglected to remove the Microsoft Premium Softcard from the auxiliary slot in the Apple IIe. When I booted the ALS version of CP/M, the screen came up normally because the Microsoft card includes the 80-column capability for the IIe. I did not notice any difference at first.

I gave the command to load GBASIC, then to load and run the benchmark program. I was amazed to find that the ALS card, running at effectively 2 MHz, had seemed to have completed the benchmark in *exactly the same time* as the 6-MHz Microsoft Premium Softcard! Well, I was wrong. The GBASIC program supplied with the Premium Softcard is smart enough to load and run with the Softcard instead of the ALS card, even though the ALS CP/M had been booted in the first place.

As a result of this experience, I switched over to the MBASIC program from the Microsoft Softcard disk for the benchmarks. Even this produced some rather unexpected results.

Now let me share some observations about the individual boards.

### ALS Z-ENGINE

This is the more recent implementation by Advanced Logic Systems (ALS) of a Z80 card for the Apple. The former version was known as a Z-Card II. According to sources at ALS, this version "should work well both with the Apple IIe and Apple clones due to a change in the way the board synchronizes with the system bus." Other than the slowdown noticed in the benchmark testing (which seems to be about 20 percent), I experienced no difficulties with this card. It is, among those tested, the least expensive way to begin using CP/M.

The ALS Z-engine doesn't have much documentation with it. However, since most users are applications-oriented, only a very small percentage will be inclined to make changes at the system level. Several introductory books on CP/M are available that can help make up for any lack of documentation in this system, since it is "standard CP/M."

### SOFTCARD

This board from Microsoft was the first of the CP/M cards available for the Apple II. As such, it has perhaps the largest amount of outside-vendor support. Microsoft provides an introduction to all of the CP/M commands in the manual set, along with a Microsoft BASIC manual. The version of MBASIC and GBASIC included with both of Microsoft's offerings is for "Microsoft (Apple) CP/M."

### PREMIUM SOFTCARD IIE

This board from Microsoft includes the Apple IIe 80-column card. The speed of the display update is second only to that of the Gold Card. Additionally, the memory on the Softcard IIE extends the IIe's memory to 128K bytes for those programs that can use it. Likewise, the card supports the new double-density (560 pixels across) color mode.

### GOLD CARD

I received the 192K-byte version of the Gold Card for evaluation, along with

both sets of boot software (nonbanked 64K-byte and banked 192K-byte CP/M 3.0). Considering the amount of memory, it was surprising that the figures reported by MBASIC showing the percentage of free memory available after the BYTE standard spreadsheet was loaded were so small for the Gold Card as compared to, for example, the ALS CP/M Card (see table 4).

Two other features are worth noting. First, a type-ahead buffer of 256 characters allows you to keep going even when your word processor is doing a disk access (I paid \$45 for this feature about two years ago as an add-on board). Second, the resident CCP, or console command processor, is helpful. This is a feature of CP/M 3.0 itself, so it is not unique to the Gold Card. Most applications require that you type Control-C to reset the system (warm start) or to escape to the operating system. In most CP/M 2.2 systems, this means the CCP will be reloaded from the "default disk" (usually drive A). However, if there is a formatted disk in drive A, but no "system" on it, then the system hangs, and you have to do a full Control-Reset to solve the problem. If you change a disk while you are working, the CP/M 2.2 system treats the new disk as read-only until you reset with Control-C.

CP/M 3.0, on the other hand, keeps the CCP resident in memory. The Control-C still resets the system correctly but requires no disk access to get the CCP and, therefore, does not require the system to be resident on the disk in drive A. This was especially handy when, during the benchmark testing, I was loading programs from other CP/M systems from disks whose tracks 0 through 2 did not necessarily contain Gold Card boot information.

The Gold Card's use of memory differs from that of PCPI's Appli-card. Instead of the RAM being specifically defined as a RAMdisk, it is defined under CP/M Plus as a "disk cache." CP/M Plus senses repeated disk accesses no matter which disk they are from. The next time the same sector is requested, it will be read from the cache rather than from the disk.

The disk cache improves the speed of disk operations. However, it does not match the speed of a true RAMdisk.

*(continued on page A122)*

## AT A GLANCE

**Name**  
Softcard

**Version of CP/M**  
2.2

**Manufacturer**  
Microsoft Corporation  
Microsoft Building  
10700 Northup Way  
Bellevue, WA 98004  
(206) 828-8080

**Price**  
\$345; also available with an 80-column card and a 16K-byte card for an Apple II or II+ as the Softcard Premium Pack for \$695

**Documentation**  
A two-volume set, totaling about 370 pages; contains hardware and software details about the system, including the Digital Research CP/M manuals and a manual covering Microsoft BASIC

**Features**  
Effective clock rate of approximately 2 MHz; comes with a "standard set" of CP/M 2.2 utilities, plus MBASIC, GBASIC (MBASIC plus Apple graphics extension), APDOS (to transfer files from Apple DOS to CP/M), CONFIGIO (aids in customizing this CP/M), and DOWNLOAD/UPLOAD (to transfer programs to or from other computers); does not include 80-column capability; does not have on-board RAM but uses Apple on-board memory

# THE SEARCH FOR SPEECH

*A programmer reviews five speech synthesizers  
and separates the toys from the tools*

BY JOE LAZZARO

I cannot read a normal video screen because of poor vision. I can see my video screen when the other lights in the room are off, but I can't read it. When I got my Apple IIe computer, it was important for me to find a way to use it fully, so I began my search for the perfect speech synthesizer. Such a device should be able to do more than just talk. It should be able to replace the screen.

In this review, I will examine five speech synthesizers—Echo Cricket, Echo II, Intex Talker, Votrax Personal Speech System, and Mockingboard. Table I gives a rundown of my assessments.

I have rated these voice synthesizers according to their hardware, software, documentation, speech quality, and flexibility. I ran them on a 128K-byte (though most synthesizers use only 64K bytes) Apple IIe with two disk drives through Apple's Super Serial Card. Three of the synthesizers are self-contained peripherals. Two are Apple-dependent plug-in circuit cards. All of them have different and useful features.

In my evaluation of these five synthesizers, I was looking for a unit that could provide as much information as the screen and speak every keystroke. It should have blind-user commands, high-quality speech, and provisions for a wide range of software.

## ECHO CRICKET

Echo Cricket is a 6801 microprocessor-based speech and music synthesizer. The heart of the system is the Texas Instruments TMS5220 speech-

processor chip and two General Instruments 8913 sound-effects chips.

I found the voice and music effects of this compact unit very impressive. You can easily create exotic stereo music and sound effects over a range of seven octaves with Cricket's user-friendly sound editor. Cricket is a speech-by-rule system with more than 400 rules and exceptions. ASCII (American Standard Code for Information Interchange) is converted into phonemes under the direction of the rule table. The phonemes are then fed into the 5220 voice chip. This extensive text-to-speech rule table gives Cricket an unlimited male vocabulary.

Cricket also has a female voice with a vocabulary limited to 700 words. The words were selected from lists of the most commonly used English words and computer terms. Unlike the male voice, the female voice sounds almost human. It is a painstakingly encoded set of preselected speech patterns.

Cricket can be driven by either an Apple IIe or Apple IIc computer. You will need an Apple Extended 80-Column Card and the Street Alphabits serial card if you have an Apple IIe. Cricket's text-to-speech and music drivers reside in the 80-column card, leaving 64K bytes of memory free for BASIC programs.

Cricket has no character buffer, so the speech cannot fall behind what is being displayed on the screen. This allows the screen and speech to operate in sync.

Cricket is clean and compact, measuring 10 by 9.5 by 3.5 centimeters. It is the

most space-efficient external unit I tested. Cricket comes with a 110-V, 50/60-Hz power supply, full documentation, and a ProDOS-based disk containing music and text-to-speech software. The front panel contains a pilot lamp and volume control, while the back panel (photo 1) has connectors for power and miniplug stereo headphones. Cricket operates at 9600 bps (bits per second). Its data format is preset at 1 start bit, 8 data bits, 1 stop bit, and no parity. I had no trouble interfacing Cricket to my Apple IIe. I only had to install the Alphabits serial card in slot 2 to emulate the Apple IIc.

Cricket makes writing talking-BASIC programs easy. When you use normal Applesoft BASIC PRINT commands, Cricket automatically intercepts everything that goes to the screen and sends it to the 5220.

The SCREEN TALK command forces Cricket's software to intercept all characters sent to the screen. This is known as straight text to speech. It is the easiest way to add a voice to your existing BASIC programs. Text to speech will mispronounce a small percentage of English words. (The English language is so full of exceptions that no rule table can cover all the bases.) If you want to avoid mispronunciation, you must construct phonetic strings to send to Cricket. An appendix of phonemes in-

*(continued)*

---

Joe Lazzaro (70 Highland St., Revere, MA 02151) is currently attending the University of Massachusetts at Boston, where he is a physics major.

*Great Performance.  
You might have to pay thousands.*



*You might not.*



**LIS'NER 1000**  
Voice Recognition & Synthesis Board

Face it, if money were no object, you'd be using speech recognition right now. So would a lot of other folks. Well, cost is not an obstacle anymore.

Micromint's LIS'NER 1000<sup>TM</sup> Speech Recognition and Synthesis system puts long-awaited features in a price category that's realistic — so realistic that we're proud to put it in print.

**LIS'NER 1000**  
**COSTS ONLY \$189.00\***

Extremely flexible, LIS'NER 1000 is a speaker dependent, unconnected speech system and can ultimately be upgraded to dependent speaker, connected speech applications. The LIS'NER 1000 basic hardware/software package recognizes thousands of words, 64 at a time. Once you've trained a list of words, you need never retrain.

LIS'NER 1000 speaks as well as it listens. Two types of speech synthesis, LPC and phonetic, are designed into the LIS'NER 1000 Apple\*\* version (LPC only on the Commodore 64\*\*\* version), and a text to speech algorithm makes it say anything you want.

95-98% correct matching coupled with adjustable rejection threshold means extraordinary price/performance. With LIS'NER 1000, the system designer controls the system's ultimate capacity. With LIS'NER 1000, experimentation, design-ins or applications don't have to wait one more day.

Each unit comes with a professional, headset-style electret microphone, recognition software and LPC speech demo on diskette and a user's manual.

Look, you might spend ten times as much for speech recognition, but you probably won't and certainly shouldn't. LIS'NER 1000. It makes sense in a lot of ways.

*\*Apple II LIS'NER 1000 for SP1000 recognition and LPC synthesis . . . \$189.00*

*Apple II LIS'NER 1000 for SP1000 recognition and LPC synthesis plus SSI263 phoneme synthesizer chip with text to speech algorithm . . . . . \$259.00*

*Commodore 64 LIS'NER 1000 for SP1000 recognition and LPC synthesis . . . \$149.00*

Add \$4.00 for shipping & handling

\*\* Apple is a trademark of Apple Computer, Inc.  
\*\*\* Commodore 64 is a trademark of Commodore Business Machines, Inc.



MICROMINT, INC. 25 Terrace Drive, Vernon, Connecticut 06066

Circle 696 on inquiry card.

To Order CALL 1-800-635-3355

**AT A GLANCE**

**Name**  
Echo Cricket

**Type**  
Speech and music synthesizer

**Manufacturer**  
Street Electronics Corp.  
1140 Mark Ave.  
Carpinteria, CA 93103  
(805) 684-4593

**Price**  
\$179.95

**Size**  
10 by 13 by 3.5 cm

**Processor**  
6801

**Features**  
Unlimited male vocabulary, limited female vocabulary, built-in clock, music and sound effects

**Hardware Required**  
128K-byte Apple with 80-column card and Alphabits serial card or Apple IIc

**Software Provided**  
Disk-based text-to-speech generator with music and sound-effects editors

**Documentation**  
80-page booklet with quick-reference card

**Options**  
Music Construction Set, Peachtree/EduWare educational packages

**Voice Chip**  
Texas Instruments TMS5220

**Audience**  
Users who want a friendly speech system, classroom uses

**Comments**  
Will run on any Apple II or IIc

cluded with Cricket will help you customize Cricket's speech.

Cricket has a single built-in speaker. This provides monophonic voice and music. But you can plug in a Y adapter and separate speakers or stereo headphones.

Cricket has a floppy-disk-based text-to-speech program. Because this software is disk based, Cricket uses about 8K bytes of your computer's on-board memory. Cricket's software adds 45 commands to Applesoft BASIC.

I found Cricket's command structure easy to use. All the commands are in plain English, so they are easy to recognize. They might, however, be time consuming for an advanced user.

Cricket has a built-in clock and alarm. You can use it as an old-fashioned time-piece or to interact with ProDOS. The only other synthesizer to have a clock is Votrax, but you cannot use its clock to time-stamp ProDOS files.

The 80-page Cricket manual is clearly written and well organized. An inexperienced user will find this manual

helpful because it painlessly explains how to operate. Cricket's extensive musical-effects generators. It has phoneme and musical-note tables for programmers interested in constructing elaborate music and sound effects. The manual includes many examples for inexperienced users but also attends to the needs of advanced programmers.

Because Cricket has a disk-based text-to-speech generator (like Echo II and Mockingboard), making protected software talk is not easy. To add speech to protected software, you will either have to transfer the Cricket text-to-speech program to the protected disk or alter the protected software to revolve around speech output. This will challenge all but the most skilled programmers. Most protected software locks up the host system, so you do not have the opportunity to run Cricket's text-to-speech generators. The problem of getting protected software to talk is not confined to Cricket, however. None of the speech synthesizers on the market have yet reached a level of flexibility

Table 1: Comparisons of the speech synthesizers tested. Words-per-minute tests were done with a standard 1K-byte text file. Boot times are in seconds, and all values refer to the synthesizer's default (boot) mode.

|                  | Echo Cricket | Echo II | Intex           | Votrax          | Mockingboard |
|------------------|--------------|---------|-----------------|-----------------|--------------|
| Speech quality   | good         | good    | fair            | fair            | good         |
| Words per minute | 80           | 80      | 100             | 76              | 81           |
| Programmability  | no           | no      | yes             | no              | no           |
| Buffer size      | 0            | 0       | 2700            | 3500            | 0            |
| Music            | yes          | no      | yes             | yes             | yes          |
| Boot times       | 15           | 15      | 0               | 0               | 20           |
| I/O              | serial       | slot    | serial/parallel | serial/parallel | slot         |



Photo 1: The Cricket's rear panel has a five-pin DIN I/O cable and room for an external speaker.

that will allow them to make most protected software speak.

All in all, I found Cricket to be of exceptionally high quality. The documentation makes the system easy to learn, and the quality of its stereo music and speech is excellent.

## ECHO II

The Echo II voice synthesizer card (photo 2) incorporates the Texas Instruments TMS5220NL chip, the same one used in Cricket. The entire board plugs into any Apple expansion slot. I like this plug-in speech card because it allows real-time interaction with the host computer. That means Echo II has no buffer lag time, unlike Intex Talker and Votrax. When a line of text is sent to the screen, Echo II speaks that line before moving to the next one.

I found Echo II very responsive. It is the only synthesizer you can stop instantly in any mode by using the Control-X sequence. Hitting any key restores speech. This is important, especially when you are reading large blocks of text. Echo II and Cricket are the only synthesizers tested to have this useful feature. A talking program can take a lot of time to run, and this feature allows you to skip over menus with which you are familiar.

The Echo II speech-generator disk provides four binary programs for turning text into speech—Textalker, Textalker.RAM, Textalker.Blind, and Speakeasy. They automatically intercept all characters intended for the screen and route them to the 5220 chip. The text is still displayed on the screen in the normal manner, but after a text line ap-

pears, it is spoken. Textalker consumes 8K bytes of memory. Textalker.RAM loads its 8K bytes into the RAM card, giving you extra memory for BASIC programs. Textalker.Blind has a screen-review feature for blind programmers, while Speakeasy uses only phonemes and consumes 3K bytes of memory.

When you load any of these speech generators (except Speakeasy), you can continue to write Applesoft programs in the usual way. BASIC will still be BASIC. Making Echo II speak requires no complex routines. Characters enclosed within quotes will be spoken as they are sent to the screen.

In addition to the speech generators, the Textalker disk contains useful, listable BASIC programs and demos that show how to interact with Echo II. There is one drawback to the Textalker speech-generator disk: DOS 3.3 Textalker works only with BASIC or 6502 assembly-language programs. If you want to use C or Pascal, you must purchase a separate language-support disk from Street.

Echo II will occasionally mispronounce certain words. As with the other synthesizers I reviewed, you can use phonemes to customize speech.

The 50-page manual is clearly written and organized. Aimed at the beginner, it also contains phoneme tables and program listings for advanced users. Thanks to the manual, I had Echo II up and talking in less than five minutes.

The drawback of Echo II is that it will not make all programs talk. Any protected software disk that must be cold-booted will not talk because you can-

*(continued)*

## AT A GLANCE

**Name**

Echo II

**Type**

Text-to-speech synthesizer

**Manufacturer**

Street Electronics Corp.  
1140 Mark Ave.  
Carpinteria, CA 93103  
(805) 684-4593

**Price**

\$129.95

**Size**

7.5 by 12.5 cm

**Processor**

Dependent on Apple 6502

**Features**

Unlimited male vocabulary, optional 700-word female vocabulary, screen-review mode for blind programmers

**Hardware Required**

Apple II, II+, or IIe with 48K

**Software Provided**

Textalker text-to-speech utility disk

**Documentation**

56-page booklet with quick-reference card

**Options**

Echo Words natural-sounding female voice, C and Pascal support disk

**Voice Chip**

Texas Instruments TMS5220

**Audience**

Users who want a friendly speech system, handicapped users

**Comments**

Turns Apple into a true talking computer



Photo 2: The Echo II circuit card includes the speech chip from Texas Instruments.

## AT A GLANCE

**Name**

Intex Talker

**Type**

Text-to-speech synthesizer

**Manufacturer**

Intex Micro Systems  
725 S. Adams Rd., Suite L8  
Birmingham, MI 48011  
(313) 540-7601

**Price**

\$295

**Size**

20 by 15.75 by 6 cm

**Processor**

Internal 6502

**Features**

Music and sound effects

**Hardware Required**

Apple II with serial or parallel card

**Software Provided**

ROM-based text-to-speech firmware

**Documentation**

33-page manual

**Voice Chip**

Votrax SC-01

**Options**

2.7K buffer; user programmable memory;  
8-ohm speaker

**Audience**

Advanced users and programmers

**Comments**

Will run on any computer with serial or  
parallel port

not load Textalker into memory.

Another Echo II drawback is its volume control, which is on the card. Every time you want to reset the volume, you have to open your computer. It is possible to reset the volume using Control sequences from the keyboard, but this does not lower the volume as a normal volume control does. Instead, it makes Echo II speak in a lower and lower whisper.

All in all, Echo II is a well constructed hardware/software combination that is easy to use and produces excellent speech. When you plug one into your Apple, it turns your computer into a talking machine, not just a computer that can make limited attempts at speech.

**INTEX TALKER**

Intex Talker is a 6502 microprocessor-based text-to-speech synthesizer that measures 20 by 15.75 by 6 centimeters. You can interface Intex Talker with any computer that has either a serial or parallel output port (photo 2). The serial input is RS-232C, using a standard DB-25S 25-pin connector. The parallel interface is 8 bits with strobe and acknowledge handshaking, configured with a Centronics-compatible 34-pin edge connector. Intex Talker uses the SC-01 voice-processor chip, the same one used in Votrax. The SC-01 is an older-generation voice processor that has rougher speech than the TI5220 used in the Echo products or the SC-02 used in the Mockingboard. I was not pleased with Intex Talker's speech.

Intex Talker has a 2.7K-byte buffer and 6K bytes of programmable memory. This is useful for the advanced machine-language programmer who wants to add subroutines to the text-to-speech firmware. Intex Talker has a programmable text-to-speech rule-exception table. You can change the pronunciation of any word and store a long list of words on disk. The user-programmable exception table is easy to use.

Intex Talker's data rate adjusts from 75 to 9600 bps (bits per second) and supports XON/XOFF handshaking. The amplifier delivers 1 W (watt) of power into an optional 8-ohm speaker. The standard power supply is hard-wired to the Intex Talker. If anything happens to it, you will have to ship the whole sys-

tem back for repair.

Intex Talker has a ROM-based text-to-speech algorithm that occupies 6K bytes of memory. I discovered that Intex Talker's firmware makes more pronunciation mistakes than any of the synthesizers tested.

Intex Talker uses none of the host computer's memory. Intex Talker's firmware can make the SC-01 voice chip speak letter by letter, word by word, or line by line. You can adjust Intex Talker's inflection, volume, and speech rate through the firmware. The text-to-speech firmware recognizes any printable ASCII character and performs a synthesis-by-rule analysis, determining which characters are silent or spoken.

When it comes to writing a talking BASIC program, Intex Talker works just like Votrax and Echo II. You can use PRINT commands, declared variables, or data statements.

Intex Talker can echo print every keystroke. You can turn on this feature by sending the string "!"DN" (where N is in the range from one to eight). The larger the number N, the longer the delay.

You can adjust Intex Talker's speech rate and pitch through software.

Intex Talker's 33-page manual is oriented toward the advanced user. It contains a lot of technical information but very few examples. It tells you how Intex Talker is constructed but not how to install and operate it easily. The manual would be improved by some extra tutorials and a "getting started" section.

Intex Talker is limited by its older speech processor and its smaller text-to-speech firmware. The firmware lacks fine pronunciation in straight text-to-speech mode. Its straight text-to-speech quality cannot compete with Votrax, Cricket, Echo II, or Mockingboard. To get good speech out of Intex Talker, you must utilize its phonetic programming code fully.

**VOTRAX SPEECH SYSTEM**

Votrax is a Z80 microprocessor-based text-to-speech synthesizer. You can interface it with almost any computer that has either a serial or parallel output port. Votrax incorporates the SC-01 phoneme synthesizer chip, the same one used in Intex Talker. All text-to-speech operations are performed inside





Photo 3: The Intex Talker rear panel features a serial and parallel port, as well as an external speaker jack.

Votrax, using none of the host computer's memory.

Votrax's audio center is composed of the SC-01 speech chip, the musical-tone generator (MTG), the filter-control generator (FCG), and a 1-W amplifier. These four devices are controlled by the execution buffer's firmware. The SC-01 and the MTG generate all voice and music effects. The SC-01 is fed directly into the amplifier. The MTG is switched in or out using software control. The MTG can also be switched to the SC-01 for special voice and sound effects.

Votrax comes with an AC power supply, interface cables, a detailed manual, a quick-reference card of Control commands, and a pocket dictionary of SC-01 phonemes. Votrax has a 3500-character buffer, the largest of all the units tested. Votrax also has a programmable exception table, useful for making up your own pronunciation rules.

Votrax measures 30.5 by 11.5 by 6 centimeters. It is the heaviest and largest of the units tested. The front panel has a volume control and a power-on lamp. The rear panel (photo 4) has serial and parallel interfaces, an AC power jack, an external speaker jack, DIP switches, and a power switch. The whole unit gives me the impression of solidity.

The configuration set-up switches are numbered from 1 to 8. Switches 1 to 3 set the data rate from 75 to 9600 bps. Switch 4 selects between XON/XOFF and RTS (request-to-send) protocols.

Switch 5 selects either a 7- or 8-bit word. Switch 6 turns the power-up message on or off. Switch 7 selects between the serial or parallel interface. Switch 8 turns the self-test mode on or off. You can reach these switches easily on the back panel.

Serial handshaking may be either XON/XOFF or RTS protocol. When the input buffer comes within 30 bytes of being full, the XOFF character is transmitted to the host computer. The XON character will be transmitted to the host once the input buffer space returns to 50 bytes. This handshaking prevents the Votrax buffer from overflowing. Intex Talker also has this handshaking capability.

The RTS protocol works just like XON/XOFF. An RS-232C signal from data terminal equipment (DTE) to data communication equipment (DCE) prepares the DCE for data transmission. Instead of sending an XON/XOFF character, the protocol lowers the RTS line (pin 4 on the serial port) to signal that the buffer is almost full. It raises the RTS line when buffer space is available.

The parallel interface has only one mode of handshaking. When the busy line (pin 14 on the parallel port) is high, the host cannot transmit to Votrax. Once this line has been lowered, the host can resume transmission.

The Votrax system's SC-01 voice processor translates standard ASCII text into phonetic code. The software signals

(continued)

## AT A GLANCE

**Name**

Votrax Personal Speech System

**Type**

Text-to-speech synthesizer

**Manufacturer**

Votrax Inc.  
1358 Rankin  
Troy, MI 48083  
(800) 521-1350

**Price**

\$400

**Size**

31.5 by 13.25 by 8 cm

**Processor**

Internal Z80

**Features**

Music and sound effects, programmable clock and alarm

**Hardware Required**

Serial or parallel card

**Software**

ROM-based text-to-speech program

**Documentation**

55-page loose-leaf binder with quick-reference card and phoneme dictionary

**Voice Chip**

Votrax SC-01

**Options**

Interface cables

**Audience**

Programmers who are adding speech to school or industrial computer systems

**Comments**

Will run on any serial/parallel computer; heavy-duty construction



Photo 4: The rear panel of the Votrax contains the on/off switch, a parallel and a serial port, DIP switches, and an external speaker jack.

the speech chip to generate the sound selected by the translator. The voice processor uses built-in pronunciation rules to create words. This allows Votrax to have an unlimited vocabulary. Although Votrax uses the same speech chip as Intex Talker, I found Votrax's speech more pleasing and effective because it has a larger set of phonetic rules in its ROM.

As is the case with any speech synthesizer, Votrax will make occasional pronunciation mistakes. To correct this, you will have to deliberately misspell words, break words into syllables with spaces, or enter words as phonemes. The Votrax phonetic dictionary will help you do this.

Votrax can make nearly any BASIC

## Talking Software

*We asked Joe Lazzaro and Henry Brugsch, both of whom are blind, to put together this sidebar on programs for the sight impaired. Mr. Lazzaro can be reached at 70 Highland St., Revere, MA 02151. Write to Mr. Brugsch at 32 Morgan Ave., Medford, MA 02155.*

Talking software sprang up out of necessity. When computers started flooding the market, blind people were cut off from them. Then a marriage took place. Blind and sighted programmers mated speech synthesizers to their Apple computers. They soon learned, however, that it wasn't enough to make a program talk. They had to develop methods to control the speech, review the screen, and stop the speech. Speech became a tool, not a toy.

Some of these programs were originally written for friends and relatives. Gradually, however, some of the talking-software developers formed companies, and now their products meet the needs of blind computer users throughout the world.

### RAISED DOT COMPUTING

Raised Dot Computing (408 S. Baldwin St., Madison, WI 53703, (608) 257-9595) is dedicated to producing quality talking software for the blind. The company also publishes a monthly newsletter. Its primary software product is BRAILLE-EDIT: a talking word processor with speech, screen, or Braille input and output. The BRAILLE-EDIT program allows

a blind person to do powerful word processing without sighted assistance. BRAILLE-EDIT translates standard text into Braille, large print, or speech. It can also translate text entered with a Braille keyboard into regular text. The program supports the Echo II, Echo GP, Votrax, and Intex Talker speech synthesizers. It also supports the Thiel, Sagem, Resus, Cranmer-modified Perkins Brailier, and Triformations Braille printers.

Raised Dot also has a Braille training program. This is a textbook on disk that teaches Braille to either a sighted or blind person. Its Numbers Program translates the Nemeth Braille code of Mathematics and Scientific Notation into standard print mathematics symbols, while the Electronic Blackboard aids blind teachers. An instructor can enter text in a Braille format and display standard text on an Apple's screen.

The Raised Dot Graphics Package will print any high-resolution file in raised-line Braille on the Cranmer Perkins Brailier. Finally, the company's Lecture Projector neatly formats screens of text or math equations from prestored BRAILLE-EDIT chapters. Raised Dot also offers special cables, Braille manuals, and interfacing guides.

### COMPUTER AIDS CORPORATION

Computer Aids (4929 S. Lafayette St., Ft. Wayne, IN 46806, (219) 456-2148) is dedicated to writing useful talking software for the visually impaired. The philosophy of Computer Aids is that software should be easy to use, thus all the company's software is user-friendly.

Documents is a talking, line-oriented, page-oriented word processor. You can move anywhere on the page, tab left or right, tab up or down, center lines, delete words, delete lines, erase entire pages, and merge files. The program costs \$195 and supports the Echo II speech synthesizer and all standard printers.

Info is a database manager with up to 30 fields. Versions are available for the Apple II+ and IIe. The program can search multiple records, merge files, sort files by field, and delete records from within files. Info costs \$195.

Work Station #1 includes Documents, Info, and Utilities, a program that can copy and initialize disks, copy and delete files, lock and unlock files, and print disk-free space. Work Station #1 costs \$375. Work Station #2 includes Documents, Info, the Utilities program, and Agenda, a talking calendar program that allows you to make notes. You can list up to 10 appointments per day and also receive notice of these appointments. You need a clock card to make full use of this program, which costs \$95. Directories allows you to create an address file or phone list. You can also make mailing labels and alphabetize the file. It costs \$95.

Talking Transcend is a speech-adapted version of the Transcend data-communications package, originally written by Robert Kniskern and Tim Dygert of Transcend Corporation. Talking Transcend allows you to communicate with other computers and timesharing systems and to save files. If you buy the Transpack #2, you get the Hayes Smartmodem and a copy of Talking Transcend for \$495. Talk-

program talk. As is the case with the other four synthesizers, you can use BASIC PRINT commands, declared variables, or data statements.

Votrax has a built-in clock and alarm, which you can set and use in applications programs. ASCII character 27 is the Apple's Escape key.

You can also play music and sound effects on Votrax. The effects are comparable to those with Intex Talker, but they are inferior to the stereo Mockingboard and Cricket. Votrax's music and sound effects have a flat, mechanical quality, while Mockingboard's and Cricket's effects have a life all their own.

Votrax cannot echo print, which prevents it from speaking every keystroke. This sometimes results in the system be-

ing a line behind what is printed on the screen. Votrax speaks only after a carriage return (ASCII character 13). This is a disadvantage for programmers using Votrax as an output device.

The Votrax documentation is for intermediate to advanced users. Parts of the manual use hexadecimal notation without adequately explaining it. The manual has a lot of examples, detailing use of Votrax's Control sequences.

Votrax is the best-constructed unit I tested. The power supply is heavy duty, as are all I/O (input/output) ports. Votrax is also the most expensive unit I tested. The high price might be warranted if Votrax had an updated speech chip that could produce more pleasing speech and music effects.

## MOCKINGBOARD

Mockingboard (photo 5) is a stereo speech and music card made especially for the Apple II. Its music and sound effects are equal to Cricket's, while its straight text-to-speech voice is comparable to Votrax's. This is because Mockingboard incorporates the SSI-263, an upgraded version of the SC-02. It is made of two General Instruments AY-3-8913 sound chips, two 6522 interface adapters, two volume controls, audio cable connectors, two 1/2-W audio amplifiers, and two Silicon Systems SSI-263 speech chips.

The software is provided on two 5 1/4-inch floppy disks and is quite extensive. One disk contains text-to-speech programs, text-file readers, text-file writers, and music and sound-effects demonstrations. I was impressed with the stereo music demo. The other disk has an arcade-style game called Battle Cruiser, which takes full advantage of Mockingboard's sound effects. Instead of the bleeps and ticks that most games have, Battle Cruiser contains earth-shattering explosions, blaster rays, and sirens right out of the arcade.

Mockingboard is not a fully interactive speech-output device. Its software does not intercept all characters sent to the screen, and you have to write special routines into BASIC programs to make the board play music, generate sound effects, or speak.

I found the Mockingboard text-to-speech utility more complicated than that of the other units. The others use standard BASIC PRINT commands to initiate speech. For the Mockingboard, you must load several machine-language speech generators, declare strings as MBS, call a subroutine at decimal location 26123, then check the value of a flag at decimal location 255.

Mockingboard does not turn your Apple into a talking computer. Instead, it allows you to write programs that can talk, sing, or explode in stereo.

The Mockingboard manual is a 60-page spiral-bound booklet divided into three basic sections—creation of speech, creation of sound effects, and creation of audio-adapted computer programs. Aimed at the beginner, it has some technical information for intermediate users as well.

Mockingboard has excellent music

(continued)

ing Transcend alone costs \$195.

Braille-out, which costs \$95, translates standard Apple text files into grade-two Braille, grade-one Braille, or computer Braille. You can set the line length, page length, indentation for paragraphs, page numbers, and page headers. It also has a user-programmable exception table for the translators. You do not have to know Braille to use this program.

## SCIENCE PRODUCTS

Science Products (1043 Lancaster Ave., Berwyn, PA 19312, (215) 296-2111) provides adapted hardware and computer products for the blind. The company sells a complete line of talking test equipment such as voltmeters, calculators, low-vision optical equipment, four-track 15/16 ips (inches per second) cassette recorders, and talking Franklin computers. The company has equipped the Franklin with a voice, using the Echo-II and Echo-GP voice synthesizers. The deluxe model is a double disk drive with volume and pitch controls, a headphone jack, and beepers on the disk drives. The Franklin system also has a special key to tell you when you are in all caps mode.

Science Products also sells accessories such as printers, printer paper, disks, monitors, and talking software. The company carries the full line of Computer Aids Corporation software and serves as a consultant for blind people interested in getting started with computers.

## STREET ELECTRONICS

Street Electronics (1140 Mark Ave., Carpinteria, CA 93103, (805) 684-4593) sells

a talking terminal program that works with the company's Echo II speech synthesizer. This program turns an Apple into an unintelligent terminal, which cannot capture incoming data. It is useful for using your Apple as a remote terminal for mainframe computer systems.

Street Electronics sells the Echo II with a special version of the Textalker text-to-speech program. This is called Textalker Blind. TextalkerBlind has a subroutine written into it that allows a blind programmer to reread what is on the screen, either line by line, word by word, or letter by letter.

## EXEC SOFTWARE

Exec Software (1201 Waltham St., Lexington, MA 02173, (617) 862-3170) produces the Termexec and Talking Termexec data-communications packages for the Apple II family. Termexec is a complete smart-terminal package that supports the Echo II synthesizer. It allows you to upload and download files, read text files, make error-free copies of programs sent via telephone lines, and use automatic log-on and auto-dial.

Talking Termexec is an upgrade of the original Termexec. Talking Termexec supports a host of special features, including the line-review mode, which allows you to view previously spoken material. The latest features allow immediate on/off switching for speech during any phase of program use. Talking Termexec also supports X-modem protocol, an error-checking system that permits the transfer of data in a variety of formats.

—Joe Lazzaro and Henry Brugsch

## AT A GLANCE

**Name**

Mockingboard

**Type**

Music and sound-effects synthesizer  
(optional speech capability)

**Manufacturer**

Sweet Micro Systems  
50 Freeway Dr.  
Cranston, RI 02920  
(401) 461-0530

**Price**

\$124.95 for music and sound effects;  
\$195 for music, sound effects, and speech

**Size**

7 by 17 cm

**Processor**

Apple 6502 dependent

**Features**

Stereo music and sound effects,  
programmable speech-rule table

**Hardware Required**

48K-byte Apple II, external 8-ohm speakers

**Software**

Sound and speech-development tools on  
two floppy disks

**Documentation**

63-page spiral-bound manual

**Voice Chip**

Votrax 2C-02 (SSI263)

**Options**

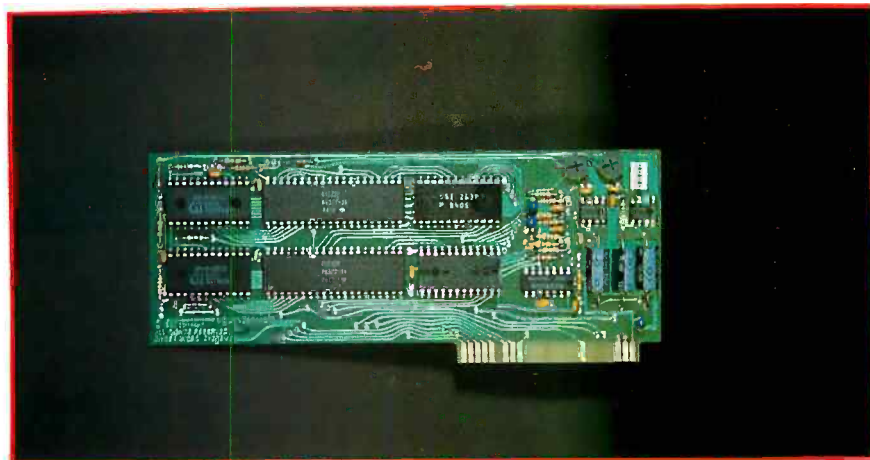
Voice-upgrade chip (\$99)

**Audience**

Programmers interested in creating stereo  
sound effects and speech for applications  
programs

**Comments**

Excellent music and special effects



*Photo 5: The Mockingboard has twin music chips and a single speech chip, but there is room for a second speech chip.*

and sound effects. Its straight text-to-speech quality is not quite as good as Cricket's or Echo II's. I like having stereo music and speech capability on a single board. When I plugged Mockingboard into my 80-W stereo receiver, it nearly brought my apartment building down.

Making a BASIC program talk is a little more difficult with Mockingboard than with the other synthesizers, but I think it is worth the extra effort. Though Mockingboard is a highly flexible music and speech synthesizer, it is not suitable for my purposes because of its inability to intercept all characters sent to the screen. If this capability were added, Mockingboard would be very close to my definition of the perfect speech synthesizer.

### CONCLUSION

All five synthesizers ran well on my Apple IIe, but each has its own personality. Cricket is a high-quality, flexible speech and music synthesizer with excellent speech and musical effects. Its disk-based text-to-speech algorithm is very accurate, and the system is easy to use because all speech and music commands mimic BASIC.

Echo II's greatest advantage is that it was made especially for Apple II vintage computers. It comes closest to my definition of the perfect speech synthesizer because it turns the Apple into a fully functional talking computer. Its only limitation is that its text-to-speech software is disk based. If this software

were burned into ROM, Echo II would probably be able to run most protected software. The system has very good speech, is easy to use, and is the least expensive synthesizer reviewed.

Intex Talker has the least-understandable speech of the units tested, but it is the only one that offers detailed hardware descriptions for the advanced hobbyist. It has the advantage of being serial and parallel driven. Intex Talker can echo print, but its voice quality suffers from a small text-to-speech algorithm.

Votrax is a heavily constructed system. Although it uses the same speech processor as Intex Talker, its ROM-based text-to-speech firmware is more comprehensive, making for better pronunciation. It has a useful built-in clock and alarm, but it cannot echo print.

Mockingboard offers high-quality stereo music effects. Its speech falls behind the Echo products but is better than either Intex Talker's or Votrax's. Its software limits its speech output, and no software drivers are available to make it intercept the screen or echo print. Its speech quality is fair.

Speech synthesis has come a long way, and the technology continues to improve. Speech synthesizers still need specialized operating software, however, and my search for perfect speech will not end until personal computers have tailor-made speech synthesizers that allow their software libraries to talk. ■



**Genicom would like to get personal with you.  
On a professional level, of course.**



Personal computers have become a valuable asset in business. The problem is that most personal computer systems are originally sold with "personal printers"...printers built for home use, not for heavier business work.

These "personal printers" are too slow for many business needs. They can tie-up your computer for extended periods of time...time you could be using to do other work.

Another problem is durability. In business, you need a printer that can produce high volume output over a long duty cycle. The common "personal printer" will often just quit under such continuous operation.

That's why Genicom has created the 3014, 3024, 3304 and 3404...professional printers built for personal computers.

Price/performance matched for small business systems, the Genicom 3000 PC printers are designed to increase productivity and maximize the value of your personal computer.

The 3000 PC printers provide 160-400 cps draft, 80-200 cps memo, and 32-100 cps NLQ printing...performance for both high productivity and high quality printing.

The 3014/3024 models print 132 columns. The 3304 and 3404

models give you a full 136 column width, and offer color printing as well.

Each printer is easy to use, lightweight, functionally styled and attractive. And you can choose options from pedestals and paper racks to document inserters, sheet feeders and 8K character buffer expansion, plus more.

Genicom 3000 PC printers feature switch selectable hardware, dual connectors and dual parallel or serial interfaces. Plus the 3014 and 3024 emulate popular protocols for both Epson MX with GRAFTRAX-PLUS™ and Okidata Microline 84 Step 2™, while the 3304 and 3404 emulate popular protocols for Epson MX with GRAFTRAX-PLUS™. So your current system is most likely already capable of working with these Genicom printers without modification.

Most important, the Genicom 3000 PC printers are quality-built, highly durable printers designed for rapid, continuous duty cycle printing. So take some personal advice. Get a Genicom professional printer for your personal computer today.

Genicom Corporation, One General Electric Drive, Dept. C421, Waynesboro, VA 22980. In Virginia, call 1-703-949-1170.

**GENICOM**

**The New Printer Company.**

For the solution to your printing needs call

**TOLL FREE 1-800-437-7468**

In Virginia, call 1-703-949-1170.

Epson MX with GRAFTRAX-PLUS is a trademark of Epson America, Inc.  
Okidata Microline 84 Step 2 is a trademark of Okidata Corporation

# APPLE'S NEW MODEM AND ACCESS II

BY HENRY BRUGSCH



Photo 1: An extremely efficient footprint characterizes Apple's modem. It requires no more desk space than a standard telephone set.

**A**pple Computer's new modem is cleanly designed, cleverly styled to fit under a standard telephone (see photo 1), and equipped with features for neophytes and experienced users alike. The modem is available in two basic configurations: a 300-bps (bits per second) version (\$235) and a 300/1200-bps version (\$499). In addition, you can buy each of these models bundled with Apple's obligatory Super-Serial Card. Terminal software and well-written documentation complete the package.

Both modem versions support several data formats, including serial, binary, and asynchronous. Custom data formats are also possible. The modem operates in several modes as well. These include manual originate and answer, automatic originate and answer, auto-dial, communications mode, and full- or half-duplex. Receiver dynamic range is a respectable 45 dB (decibels) in the full-duplex mode, and bit error rates of one in  $10^6$  bits are specified on voice grade channels. The modem also performs local analog loop-back testing.

I have been using the 300/1200-bps version of this modem for several weeks, and I find it really first-class. The only major criticism I can level at it is the way the power connector is set up. It is a nonstandard variety (see photo 2), configured in a triangle of three pins within a flexible plastic housing. The modem has a keyed slot to receive the female plug, and this is where problems arise. The female end is about a quarter-inch deep, no deeper in fact than the barrel of a typical audio earphone plug. In this constricted space reside three rather minuscule pins. The result is that

reliable connections can be problematic unless users take extreme care when plugging in the power jack.

Another power-supply-related problem I encountered was also mechanical in nature. I couldn't use the modem with a system-saver power-line filter. Ideally, the modem should occupy only one of the two sockets supplied on the system saver. Due to the way the plugs are spaced on the system saver, this is not the case. The modem plug occupies the space of two plugs. This means you must reconcile yourself to using one plug of the system saver at a time.

## MODEM COMMANDS

The Apple modem is capable of performing sophisticated data-communications operations. The degree of this sophistication is mirrored in the modem's rich command set. Apple modem commands can be divided into three categories: general, special, and dial commands.

General commands allow you to initiate specified modem functions directly from the keyboard. Special commands initiate self-test and repeat functions, as well as escape sequences. Dial commands control Touch-Tone and pulse-dialing operations. A command summary appears in table 1.

The manual recommends minimal use of complex command strings. Users are urged to let the terminal software do the work of setting data rate (the speed at which data is transmitted) and data format (the complex arrangement of data bits).

Most users will never have to deal with many of these commands. The modem's main functions are software-

## Apple's latest hardware and software offerings are a smart choice if communications are your interest

driven and thus don't require human intervention. A number of commands do have interesting effects, however. For example, I have found a feature that is quite useful. The A/ command allows you to retrieve a number you have just dialed. If you receive a busy signal from a host computer, you can hit an "h," which will issue the three plus characters to the modem, and you will be disconnected from the host in a second. Hit the A/ and you will be reinstated using the previously dialed number. Most terminal programs incorporate redial features, but sometimes it may be quicker to hit the A/ and be done.

Another interesting effect is the disconnect feature. According to the manual, three plus signs disconnect the modem from an existing connection. True, but if you are in the process of originating a call, you can escape this situation by pressing any key. This the manual doesn't tell you.

The modem also provides you with a helpful audible clue if you are not sure of what data rate you are using: 1200 or 300 bps. You can adjust the speaker volume with a screw located on the underside of the modem. The speaker can also be toggled on or off.

One slightly annoying feature is that the modem's default state, the condition it is in when switched on, is answer mode. It will answer your phone while powered up until you either shut it off or change the answer mode with the appropriate command.

### APPLETERM AND ACCESS II

The modem is supplied with Appleterm, a bare-bones terminal program that does not allow uploading or download-

ing of data. Using Appleterm, however, you can browse through information services like The Source, Dow Jones News/Retrieval, and CompuServe. (A special subscription to The Source and a free CompuServe demonstration are included in the price of the modem.) A modem self-test routine is also included in the Appleterm program. If you want more features than these simple functions, you will soon outgrow this program.

The Appleterm program is aimed at novice users. It is designed to let you use the modem without benefit of being able to save or send programs. What this program will do is let your micro-computer act as a terminal using another computer as a host.

The manuals supplied with the Apple modem detail the uses of Appleterm and exhaustively describe its features. The manuals also provide a tutorial that walks the novice through a communication session.

Apple's Access II program (\$75) is Apple Computer's attempt at a definitive communications software package. And it is just that. It allows for emulation of non-Apple terminals such as VT52 and 500 DEC terminals and also provides a number of ProDOS utilities. In fact, the program is based on the ProDOS operating system.

The program provides a wide range

*(continued)*

---

Henry Brugsch, a graduate of Tufts University, works as a piano tuner in the Boston area. He is involved in developing terminal software for the vision-impaired. He can be reached at 32 Morgan Ave., Medford, MA 02155.



Photo 2: The modem's rear panel serves as the mounting space for incoming and outgoing modular telephone jacks, three DIP (dual-inline pin) switches, power plug, on/off switch, and DB9 female connector. DIP switches control carrier-detect mode, balance capacitor insertion, and respond to data-terminal-ready signal.

**AT A GLANCE**

**Name**  
Access II

**Language**  
Pascal

**Manufacturer**  
Apple Computer Inc.  
20525 Mariani Ave.  
Mail Stop 23AD  
Cupertino, CA 95014  
(408) 996-1010

**Computer Needed**  
Apple IIe; not II or II+ due to incompatibility of keyboard configuration; minimum one 64K-byte drive

**Features**  
Auto-dial; auto-log on; Xmodem facility; Appleworks compatibility; menu-driven; based on ProDOS

**Price**  
\$75

**Documentation**  
Product training disk, manual

**Audience**  
Particularly helpful for modem novices using an Apple Modem 300 or 1200

of facilities and is menu-driven. From the menu, you can configure terminal parameters, such as data rate and data format, and the type of emulation required. You can also select whether you want to send or receive a file and whether or not you would like to enter terminal mode. There are also eight auto-dial numbers, which can be retained in memory. The program also remembers hardware and terminal protocol configurations. You can save a variety of configurations. The option to create macro commands allows you to select from the auto-dial format a specific group of pre-designated parameters. These might include the data format and data rate required by the host and your password to a given service.

Also included with the program is a tutorial disk providing a complete demonstration. This demo is so realistic, the experience of signing onto a database, collecting information, and signing off can be had without ever picking up a phone. From this tutorial, the beginner gets the feel of dealing with a remote

computer. All of the sights and sounds are there—even modem tones and the sounds of Touch-Tone dialing.

**USING ACCESS II**

Once you have mastered the tutorial and feel it is time to try some on-line communications, you may wish to tie into your favorite bulletin board or mainframe to download some information. When you boot the disk containing the Access II program, be sure you have a Super-Serial card and a modem connected to slot 2. If you do not have either of these, the disk will hang up.

Assuming that all of your hardware configurations are set and you are in terminal mode, you will see a display that informs you that you are **typed into** the mainframe you have opted to receive.

If you want to receive a file, it is wise to ensure that all prior conditions have been met. That means that an initialized ProDOS disk is available and that you know its volume and filename. This is crucial because the program must have an open recording file in order to func-

Table 1: A partial summary of Apple modem commands.

| Command         | Action                                                                                                                                                                     |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| E0              | Echo function turned off.                                                                                                                                                  |
| E1              | Echo function turned on.                                                                                                                                                   |
| F0              | Full-duplex operation selected.                                                                                                                                            |
| F1              | Half-duplex operation selected.                                                                                                                                            |
| M1              | Monitor speaker turned on during acquisition only.                                                                                                                         |
| M0              | Monitor speaker turned off.                                                                                                                                                |
| M2              | Monitor speaker turned on for duration of connection.                                                                                                                      |
| P (telephone #) | Pulse-dial mode selected; specified number dialed.                                                                                                                         |
| S0 = n          | Answer mode command where n is a number from 1 to 30, which is the length in time in seconds the phone is allowed to ring. If S0=0 is set, the phone will not be answered. |
| S2 = n          | Escape sequence or hang-up command; n = ASCII value of escape character.                                                                                                   |
| S7 = n          | Connect abort command; n=1-30 seconds.                                                                                                                                     |
| T (telephone #) | Touch-Tone dial mode selected; specified number dialed.                                                                                                                    |
| V0              | Response code displayed.                                                                                                                                                   |
| V01             | Response string displayed.                                                                                                                                                 |
| d               | Dial command; all subsequent numbers dialed.                                                                                                                               |
| A               | Answer-mode command; phone answered automatically.                                                                                                                         |
| Q0              | Modem command display toggled on.                                                                                                                                          |
| Q1              | Modem command display toggled off.                                                                                                                                         |
| A/              | Repeats previous command.                                                                                                                                                  |
| +++             | Default escape sequence; hands up phone.                                                                                                                                   |



tion properly. When you boot the program, assuming you have changed nothing, you are in a position to record a file called "Termrec." This file is available on the main program disk and is opened upon initialization. Unfortunately, there is not enough space on the Access II disk to accept a full load of data. Time to go into your utilities section of the program and create a new disk for file storage.

After this is done, you can go back to the program and reopen the recording file. You must enter the appropriate section of the menu to do this. You will be prompted by the program to enter the new volume and filename. Now you are ready to go.

This seems like a lot of work, and it is. Once you master the intricacies of ProDOS, though, you have available a fast 1200-bps system. I was able to download large amounts of data, and disk access was quick and efficient. The program holds about 3000 bytes of data in the buffer and then dumps it to disk. No matter how long the disk has been filling, or how much data has been entered, the disk access time is never more than 2 or 3 seconds.

### SOME SHORTCOMINGS

One of Access II's shortcomings is its passive answer mode. The person calling in has no control over the machine, and the program must rely on both parties in a terminal session to manage complicated file handling. For example, if you want to exchange a file under the Xmodem protocol using Access II, both parties must actively work at establishing a communications link. Once communications are established, both parties must go back to their main menus and opt for Xmodem transfer. The one who is receiving *must* set up his software first. The person who is originating the program must leave the terminal mode to send a file. To do so he has to perform a bit of mental telepathy in order to determine when the receiving end is ready to accept the first stream of data. Because of the passive nature of Access II, it is not possible for one computer to gain control over the other—thus, the communication gymnastics.

While using the Access II program, I attempted to download a file that was 150 sectors in length. As accuracy was

needed, I used the program's Xmodem option to provide error checking. After about a quarter of the file was downloaded, everything stopped with no reason given. I then was forced to reload the system, cancel the program, reinitialize the old recording file, and establish a new one. I tried several times, without success, to get the entire file down. The program died in the same place every time. I was able to use another version of Xmodem with another terminal program and receive the entire file accurately. It might be that the problem is linked to the mainframe from which I was downloading. It is also possible that an intermittent software bug or incompatibility is to blame.

Another problem I encountered relates to volume labels. It seems that if you neglect to initialize a disk with a volume and filename under ProDOS, you can't get back to the main menu once you have opted to use Xmodem. I am sure that this problem has to do with the fact that Xmodem is a third-party program and that the facilities can't be made accessible while in that mode. The manual gives ample warning about this difficulty, but not so the tutorial disk. There isn't even a section on the disk describing the Xmodem protocol. This programming and documentation oversight is unfortunate.

### IN SPITE OF IT ALL

I have found using the Apple modem and the Access II program both enjoyable and frustrating. It's likely that some of my frustration stems from a lack of experience with ProDOS. This is a situation that will be faced by many an Apple user, however. In general, the modem has functioned well during the time I have been using it. My friends are even getting used to the occasional high-pitched squeal they hear whenever they call me on voice. Aside from odd and sundry software incompatibilities, the only complaint I have with this modem is its power-supply lead configuration.

In spite of these niggling complaints, I think Apple's new modem represents a cost-effective way to get involved with computer communications. And, when coupled with the company's new Access II software, this modem supplies a host of features demanded by the most experienced users of remote databases and information services. ■

## AT A GLANCE

### Name

Apple Modem 300  
and Apple Modem 1200

### Type

300-bps and 1200-bps modems

### Manufacturer

Apple Computer Inc.  
20525 Mariani Ave.  
Mail Stop 23AD  
Cupertino, CA 95014  
(408) 996-1010

### Features

Serial, binary, and asynchronous data format; manual originate and answer, automatic originate and answer, and auto-dial operating modes; half-duplex or full-duplex on two-wire switched telephone channels; 0 to 45 dB dynamic range in full-duplex; bit error rate less than 1 in a million bits on all lines meeting Bell Tariff 3002 (standard voice grade) channel specifications, with no impulse noise or line interruptions; 13.65 by 23.18 by 3.18 centimeters

### Power Supply

Three-pronged outlet-mounted power modem capable of 8 volts AC rms and 500 mA maximum current

### Price

\$235 for 300 bps, \$499 for 1200 bps

### Audience

For modem users with multiple needs and at least moderate experience

(continued from page A16)

direct method of obtaining color with MousePaint. You select one of the colored patterns from the array at the bottom of the screen (including the four Apple colors and a few lighter patterns), and then one of the filled shapes (square, circle or oval, rounded corner rectangle, curved or straight polygon). The inside of the shape will be filled with the color or pattern, and the border will be black in the line thickness you choose from the assortment at the left. If you choose the dotted border, the shape will not have a black border.

Because of the peculiarities of Apple's high-resolution color display, if you drag a colored shape left or right one pixel, you will change its color to the complementary one. Since the patterns are constructed from an undocumented data array, it might be possible to change them, but MousePaint has no pattern editor as MacPaint and the Gibson system do.

The speed of most of MousePaint is truly amazing, but filling shapes is slower than in other graphics programs. It also needs a separate paint-can icon. Circles or ovals are drawn to fit inside a rectangular box you outline by specifying opposite corners; I prefer the method of specifying the center and radius as in the Micro Illustrator program that comes with the Koala Pad or Powerpad.

Polygons seem to have a limit of 63 sides and an arbitrary length, because without warning they suddenly finish drawing themselves. I'd like to see MousePaint use some alert boxes in cases such as this.

Fatbits, available from the Aids menu, is really impressive. With it you can zoom in on a 32- by 19-pixel black-and-white area of your picture; with the mouse I felt much more secure in this mode than with devices such as the pen. I found one bug here. I was not able to reach the far right column of the page (about 7 pixels) from Fatbits. A small area in the upper-left corner automatically shows what the whole screen would look like if it were not enlarged. Once, without realizing it, I left the grid mode turned on. This lines up *everything* along straight lines. Thereafter, nothing seemed to work right in Fatbits. MousePaint needs some way of checking, dimming, or flashing

your current choice on its menus, just as MacPaint or the pen programs do, so you know which mode you're in.

### LIGHT-PEN SOFTWARE

The Gibson light-pen software released by Koala in early 1984 contains four separate programs on two disks: Pendesigner is almost identical to what Gibson earlier called Multidraw 1.0. Penpainter includes the Pentrak 3.0 subroutines and what were earlier termed demonstration programs, plus Penanimator, a simple animation editor, and Penmusician, similar to Music Construction Set.

The Pendesigner program, albeit only black and white, is the most powerful and interesting of the Gibson programs. Its advantages are two: deck filing, with up to four cards to and from which you can transfer parts of your picture, and the ability to link your pictures to the Penpainter programs on a separate disk. These also allow you to conveniently add uppercase text or fill your artwork with color or patterns.

The Penpainter user interface has been greatly improved by partially emulating Apple's pull-down menus (I would call them "pop-down" since you don't have to hold a button down to use them). By no means do they use the

windowing technology that MousePaint exemplifies; you can't move them, size them, or put them away. You must also press a key to select your menu choice. Gibson allows you to draw on the whole screen: just wiggle the pen back and forth to make the menu bar disappear or reappear!

While the previous Gibson software suffered from a lack of uniformity, the present update with its regular command system is much easier to use. Most of the Pendesigner's files, however, retains the somewhat confusing "info-flow" diagrammatic interface of the original Gibson design. Icons are difficult to recognize when there are so many of them.

I found it somewhat harder to select from the Gibson menus with the pen, even when it was in perfect calibration. I had to place the pen exactly in the middle of the required area or else the next selection was read. The system makes you confirm or abort your choice. Also, there are some maddening audio prompts.

Some of the icons in Pendesigner are relatively clear. For example, the sketch, line, and rectangle work much the same as in MousePaint. There is no circle icon in Pendesigner, although Penpainter has one, plus 3-D boxes. The grid mode ac-



Photo 5: Gibson's Penpainter program has "pop-down" menus and icons, but you can't move the windows. To remove them you shake the pen at them. Only one shows at a time—to display them all here I had to repeatedly reset and capture the Apple screen.

tually puts dots every eight pixels on the screen, so it is easier to use than MousePaint's invisible grid. The tracking crosshairs and cursor color options are not necessary with the mouse but are essential with many backgrounds here. On the other hand, the white and black dots in the upper right-hand corner of the menu are really used as an eraser. You paint over the black dots with white to erase them. That is much slower than with the big gum eraser in MousePaint.

The zoom mode in Pendesigner enlarges the high-resolution screen so you can work on a 40- by 24-pixel area. As in MousePaint, the dots appear only in black and white. In Pendesigner you can produce only monochrome pictures, but it is possible to transfer pictures from and to other Gibson programs that use color. I found toggling the dots on and off much slower than the corresponding pencil in MousePaint because it takes time to accurately locate the cursor and press a key for each dot. In MousePaint and in Gibson's earlier Easy Edit you could just hold down the key or button. Moving the cursor is easier in Pendesigner because of the "slewing" function, which moves the whole screen as you move the pen and hold down the space bar, paddle button, or open-apple key. No other tools work in Pendesigner's zoom mode, unlike in MousePaint.

The deck function makes Pendesigner's minor hassles worthwhile. Koala supplies sample decks of engineering and architectural symbols and some simple font styles. You can make up your own "clip art." It works just like MousePaint's editing function, but decks of four cards can be saved and brought in from files separate from the picture you're working on. It won't work unless that part of the picture is smaller than a card. Just be aware that decks are saved in differently formatted files (a distinct filename suffix would help) and must be retrieved with that function in the filer; otherwise, the program may crash. One bonus with Pendesigner is that you can stretch and shrink straight lines with the editing frame.

Penpainter has a beautiful array of patterns, and you can make your own very easily with the supplied pattern editor. Only black outlines can be filled,

(continued)



Photo 6: You can add your own patterns to the pattern editor's collection.

# MODULA-2

FOR MACINTOSH, APPLE II's  
IBM-PC AND LISA



**MODULA-2 COMPILER/  
INTERPRETER — \$90**  
An advanced programming environment supplied on diskette for the Apple II, II+, and IIe, Macintosh, Lisa and the IBM PC, XT and compatibles.

**PASCAL-TO-MODULA-2  
CONVERTER — \$100**  
Increase the efficiency of your Pascal programs by converting to Modula-2. Run larger programs and take advantage of Modula Corp's efficient interpreter.

**MODULA ENHANCER MEMORY  
CARDS FOR APPLE II's AND  
IBM-PC's — \$245**  
A revolutionary idea. An extra 64K of memory and a four times increase in execution speed of your Modula-2 programs compared to Pascal.

**MODULA ENHANCER MEMORY  
CARDS AND MODULA-2 SOFTWARE  
FOR ONLY \$285**  
Get the combination for a \$50 savings. The card requires its own version of the compiler and interpreter to work properly.

## MODULA

CORPORATION

**950 N. University Ave., Provo, UT 84604 801/375-7400 or 800/LILITH2**

©1984 by Modula Corporation. Apple™ Apple Computer Inc., IBM™ IBM Corp.

but if you draw in colored lines you can change them to black. This takes some experimentation. If there is even the smallest break in the outline, the filling will leak all over the screen.

The patterns must be on the disk you have Set from the menu; if the program can't find the pattern file, it gives an unclear error message and won't let you proceed.

Freehand sketching, available from the Penpainter's Pens menu, is notable for its ease of use and a few sophisticated features. You can draw lines in any of the six Apple colors, which is hardly possible in MousePaint. These are shown in a Colors palette, but even more shades are reached through the pattern-fill icon on the Pens menu. The adjustable "inertia" feature, chosen from the Tools menu, averages the dots for you so you can make smoother curves. Likewise, the simple mirroring option is often useful. You can use this program to trace through a transparency held against the screen.

One avoidable problem with Penpainter is that hitting Control-C during the program causes it to end. You must keep the Ite Caps Lock key down. Text is only uppercase and not proportionally spaced, but you can make up your own character sets (no instructions are given, however).

### ADVANCED PROGRAMMING

MousePaint and the Gibson demonstration programs are fun and easy to learn, but the real value of the mouse and the pen may lie in how easily they can be accessed from your own programs.

I expect Apple to release a new character generator ROM for the Ite, a 6502 graphics kernel toolkit (much like Macintosh's QuickDraw), and drivers for Pascal and Apple III.

It is simple to put the mouse in BASIC mode: just PRINT CHR\$(4) "PR#4" (assuming it is in slot 4) and PRINT CHR\$(1), which zeros the mouse position. To output to the screen at the same time, you need to add a PRINT CHR\$(4) "PR#0". You can easily INPUT mouse data and draw to the screen. Sample programs in the appendix are helpful, but you'll have to move the mouse slightly, just as you run MOUSE.MOVE, or else it will never seem to do anything.

Following a discussion in Appendix B

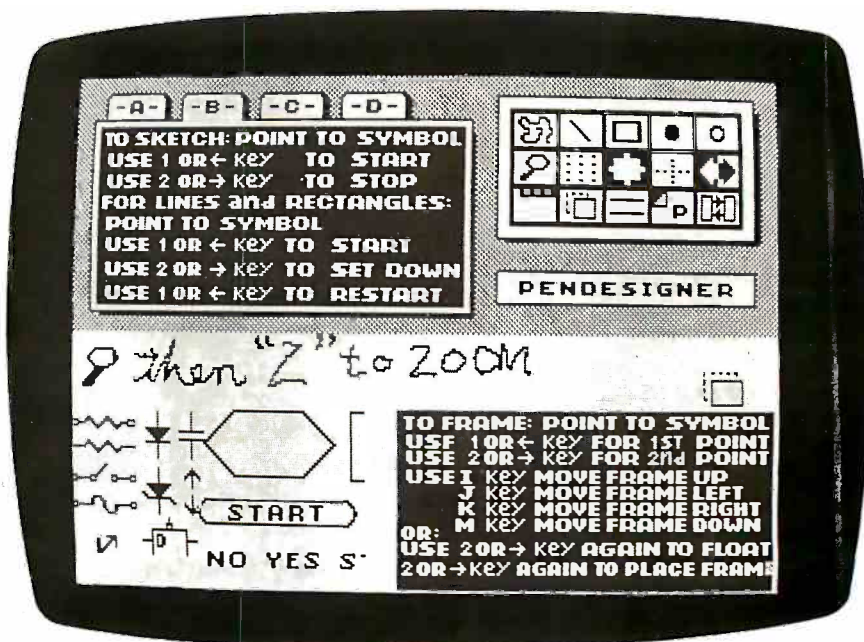


Photo 7: Pendesigner menu at upper left has many icons. Bottom shows some cards supplied with system; you can add more. Space bar toggles full-screen display.

of the mouse firmware is a machine-language program illustrating some of the routines presented. The program is a bit strange because it uses self-modifying code and does not use interrupts. Firmware routines include Setmouse, Readmouse (passive mode not using interrupts), Servemouse (for interrupt handling), Clearmouse (zeros position), Posmouse (sets position to specific values), Clampmouse (limits boundaries of mouse), Homemouse, and Initmouse.

The Pendesigner 3.0 routines on the Gibson disk are actually machine-language subroutines experienced programmers can call from Applesoft BASIC programs with the unique ampersand hook at \$3F5. The manual does not explain in any detail how to do this programming (you can type some in directly from the keyboard, too) but does list the routines and what they do. The programs are rather extensive; you can fully control the pen from software. You can specify any of Apple's screen pages to work on, and many of the commands will be familiar from Applesoft's graphics commands. The rough-terrain tracking and glitch-filter routines are especially sophisticated.

### DOCUMENTATION

Here and there, the AppleMouse II users manual shows evidence of haste

in completing the text. On the whole, however, it measures up to Apple's new and excellent documentation standards. Its photography are good, its typography clear, and its approach level-headed and nontechnical. I have already pointed out some errors, and a sheet of corrections and additions accompanies the manual.

Koala's manual is directed to the beginner and is short. Koala has deleted some of the wordiness of Gibson's first manual. You may not find enough detail to let you write your own programs, but you can list the Gibson programs, which may give you some suggestions.

Neither manual has an index, and both could profit from more examples.

### CONCLUSION

I made far fewer errors with the mouse than with the pen, and MousePaint appears to be easier to learn to use. MousePaint requires less interaction with the keyboard and less movement from one screen to another. The Gibson system has some very nice tools not yet available with the mouse and much better color. But mouse buyers can expect more software support in the future.

Though they have little place so far in business, both the mouse and the pen serve as examples of the new user interfaces that will be bringing microcomputers to more people. ■

4

*Apple II+ and the upgrades:*  
Don't go to the  
computer store  
when you need more  
computer storage.

# Go to the

## **B**UY THE SIDER:™ **10 MEGABYTES OF FIRST CLASS MASS STORAGE AT A BULK RATE PRICE.**

**\$695**

You need more storage for your Apple II+ or IIe than your trusty little floppy disk drive can deliver.

And you're thinking about going down to your local computer store to check out your next logical storage step: A hard disk file. Sure, you'll have to face several hard facts. One, you know it's going to cost you an arm and a leg, particularly from your computer dealer. And two, you heard that the state-of-the-Winchester-art is less than it's cracked up to be. But you and your Apple are caught between a rock and the hard facts. If you're going to compute, you've got to store, and what alternative is there to ye old computer store?

First Class Peripherals. And what an alternative we offer! Our message is a simple one: *We have the finest, easiest-to-install 10-megabyte Winchester hard disk subsystem in the industry today, bar none. And we have it, direct through the mail to you, for the best price. Period.*

### **The Sider: Absolutely First Class, Inside And Out.**

True to our name, we simply wouldn't offer a product that wasn't first class, inside and out. And The Sider is evidence. Outside, that fact is obvious. Just take a long, lean look at it. While Apple may have written the book on micro-

computing, First Class Peripherals has clearly written the bookend. The Sider's compact, smart-looking cabinetry is a true complement to the computer alongside which it works, and an unobtrusive, space-saving partner as well.

Inside, that quality look is matched by the highest quality components, from the half-height 10-megabyte Winchester, to the best-selling intelligent controller in the business, right down to the power supply. The most comprehensive component-to-component testing ensures first class reliability, day-in and day-out. And advanced internal design has allowed us to build these components into this modestly-sized casing in such a way that we've even eliminated the need for a cooling fan.

### **From Hotline To Swapline, A First Class Commitment To Support.**

Our name is our commitment. First Class. That's why we offer a full one-year warranty on The Sider. No hassle. No nonsense. Full documentation, of course, accompanies the subsystem. A toll-free hotline is in place to answer any technical or service question you may have concerning The Sider's operation. But if there's any problem whatsoever that relates to the manufactured quality of the product, just return it for immediate replacement.

### **Here's A First Class Idea: Order Now. 1-800-538-1307**

We expect The Sider to sell like crazy. Because the product is right for today's Apple II+ and IIe owners. And the price is, well, the price speaks for itself. You won't find an offer like this one anywhere in the industry for a long time to come.

So, act now. Complete the order form attached to this advertisement or call our toll free number. Harness the power of your Apple to the price/performance of The Sider. What a team!

# mailbox.

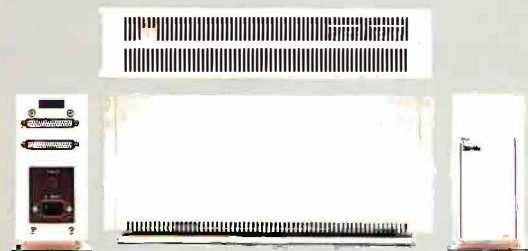


**FIRST  
PERIPHERALS  
CLASS**

# The Sider:

## A First Class Engineering Achievement.

### PUT ON YOUR SPECS AND READ OURS.



The quality of a product is often made or lost in the fine print, the nitty-gritty engineering details. That's why we're proud to say that the technical-at-heart can indeed take heart at how we put together The Sider.

Take a look at these specifications.

#### Operating Systems Supported

- Apple DOS 3.3; ProDOS™ 1.0; Microsoft CP/M® 2.23; PCPI™ CP/M 1.0, 1.5, 2.0; Apple Pascal 1.1, 1.2

#### Specifications

- Formatted Capacity: 10 MB
- Sectors/Track: 32
- Bytes/Sector: 256

#### AC Power Requirements

- Source: 100-126 VAC, 220-240 VAC
- Line Frequency: 50/60 Hz (± 2%)
- Power Consumption: 40 W

#### Environmental Range

- Temperature—Operating: 10°C to 40°C; Non-Operating: -40°C to 60°C
- Relative Humidity: 20% to 80% (without condensation)

- Altitude—Operating: -300 ft. to 10,000 ft. (-91 m to 3,048 m); Non-Operating: -300 ft. to 30,000 ft. (-91 m to 9144 m)
- Shock—Operating: 5 g; Non-Operating: 40 g
- Vibration—Operating: 2 g; Non-Operating: 3 g

#### Physical Dimensions

- Height: 7.5 in.
- Width: 3.375 in.
- Depth: 16.0 in.
- Net Weight: 11 lbs.

#### Feature/Benefit Brief

- Automatic data error detection and correction for high data integrity and faster system throughput.
- Internal diagnostics for increased subsystem reliability.
- Field-proven Winchester disk technology for better data integrity.
- Small footprint for increased workspace dynamics.
- Regulatory agency approval, meeting FCC Class B requirements.
- Menu-driven installation for increased user friendliness.
- Backup and restore utility for most operating systems, by volume, by operating system, by file, and by use of wild card backup.
- Flexible partitioning for optimizing operating system file sizes.
- Built-in modular drive expansion capability.
- Direct boot from hard disk, eliminating floppy drive booting.

**FIRST  
PERIPHERALS  
CLASS**

First Class Peripherals  
P.O. Box 6187  
Lehigh Valley, PA 18001  
1-800-538-1307



4  
Apple  
II+ and the IIx series.  
Don't go to the  
computer store  
when you need more  
computer storage.

# Go to the

## **B**UY THE SIDER:™ **10 MEGABYTES OF FIRST CLASS MASS STORAGE AT A BULK RATE PRICE.**



\$695

**Y**ou need more storage for your Apple II+ or IIe than your trusty little floppy disk drive can deliver.

And you're thinking about going down to your local computer store to check out your next logical storage step: A hard disk file. Sure, you'll have to face several hard facts. One, you know it's going to cost you an arm and a leg, particularly from your computer dealer. And two, you heard that the state-of-the-Winchester-art is less than it's cracked up to be. But you and your Apple are caught between a rock and the hard facts. If you're going to compute, you've got to store, and what alternative is there to ye old computer store?

First Class Peripherals. And what an alternative we offer! Our message is a simple one: *We have the finest, easiest-to-install 10-megabyte Winchester hard disk subsystem in the industry today, bar none. And we have it, direct through the mail to you, for the best price. Period.*

### **The Sider: Absolutely First Class, Inside And Out.**

True to our name, we simply wouldn't offer a product that wasn't first class, inside and out. And The Sider is evidence. Outside, that fact is obvious. Just take a long, lean look at it. While Apple may have written the book on micro-

computing, First Class Peripherals has clearly written the bookend. The Sider's compact, smart-looking cabinetry is a true complement to the computer alongside which it works, and an unobtrusive, space-saving partner as well.

Inside, that quality look is matched by the highest quality components, from the half-height 10-megabyte Winchester, to the best-selling intelligent controller in the business, right down to the power supply. The most comprehensive component-to-component testing ensures first class reliability, day-in and day-out. And advanced internal design has allowed us to build these components into this modestly-sized casing in such a way that we've even eliminated the need for a cooling fan.

### **From Hotline To Swapline, A First Class Commitment To Support.**

Our name is our commitment. First Class. That's why we offer a full one-year warranty on The Sider. No hassle. No nonsense. Full documentation, of course, accompanies the subsystem. A toll-free hotline is in place to answer any technical or service question you may have concerning The Sider's operation. But if there's any problem whatsoever that relates to the manufactured quality of the product, just return it for immediate replacement.

### **Here's A First Class Idea: Order Now. 1-800-538-1307**

We expect The Sider to sell like crazy. Because the product is right for today's Apple II+ and IIe owners. And the price is, well, the price speaks for itself. You won't find an offer like this one anywhere in the industry for a long time to come.

So, act now. Complete the order form attached to this advertisement or call our toll free number. Harness the power of your Apple to the price/performance of The Sider. What a team!

# mailbox.

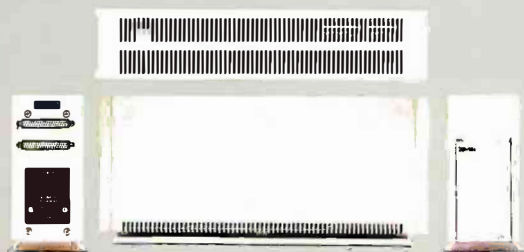


**FIRST  
PERIPHERALS  
CLASS**

# The Sider:

## A First Class Engineering Achievement.

### PUT ON YOUR SPECS AND READ OURS.



The quality of a product is often made or lost in the fine print, the nitty-gritty engineering details. That's why we're proud to say that the technical-at-heart can indeed take heart at how we put together The Sider.

Take a look at these specifications.

#### Operating Systems Supported

- Apple DOS 3.3; ProDOS™ 1.0; Microsoft CP/M® 2.23; PCPI™ CP/M 1.0, 1.5, 2.0; Apple Pascal 1.1, 1.2

#### Specifications

- Formatted Capacity: 10 MB
- Sectors/Track: 32
- Bytes/Sector: 256

#### AC Power Requirements

- Source: 100-126 VAC, 220-240 VAC
- Line Frequency: 50/60 Hz (± 2%)
- Power Consumption: 40 W

#### Environmental Range

- Temperature—Operating: 10°C to 40°C; Non-Operating: -40°C to 60°C
- Relative Humidity: 20% to 80% (without condensation)

- Altitude—Operating: -300 ft. to 10,000 ft. (-91 m to 3,048 m); Non-Operating: -300 ft. to 30,000 ft. (-91 m to 9144 m)
- Shock—Operating: 5 g; Non-Operating: 40 g
- Vibration—Operating: 2 g; Non-Operating: 3 g

#### Physical Dimensions

- Height: 7.5 in.
- Width: 3.375 in.
- Depth: 16.0 in.
- Net Weight: 11 lbs.

#### Feature/Benefit Brief

- Automatic data error detection and correction for high data integrity and faster system throughput.
- Internal diagnostics for increased subsystem reliability.
- Field-proven Winchester disk technology for better data integrity.
- Small footprint for increased workspace dynamics.
- Regulatory agency approval, meeting FCC Class B requirements.
- Menu-driven installation for increased user friendliness.
- Backup and restore utility for most operating systems, by volume, by operating system, by file, and by use of wild card backup.
- Flexible partitioning for optimizing operating system file sizes.
- Built-in modular drive expansion capability.
- Direct boot from hard disk, eliminating floppy drive booting.

**FIRST  
CLASS  
PERIPHERALS**

First Class Peripherals  
P.O. Box 6187  
Lehigh Valley, PA 18001  
1-800-538-1307

---

## PART II

# THE APPLE PERSPECTIVE, VIEWS FROM WITHIN

---

The Apple Story, Part I: Early History

An Interview with Steve Wozniak

Conducted by Gregg Williams and Rob Moore . . . A67

"C" is for Crunch

An Interview with Peter Quinn

Conducted by Gregg Williams . . . . . A75

ILLUSTRATION BY ROBERT TINNEY



# SoftCard squeezes the most juice out of your Apple.



Microsoft® Premium SoftCard™ IIe is the high-performance CP/M® board that really juices the Apple® IIe.

## Hard facts on SoftCard.

It has a high speed (6MHz) Z-80 that runs CP/M up to three times faster than lesser boards. Plus 64K memory and 80-column display that fits the IIe auxiliary slot and acts like Apple's own Extended 80-column Card. So it works with CP/M, Apple DOS and ProDOS programs, too.

Microsoft BASIC is built-in, so it's compatible with more Apple CP/M software than any other board on the market: Thousands of the juiciest business programs including dBase II®, WordStar® and sophisticated Microsoft languages like

FORTRAN-80, COBOL and BASIC Compiler.

It also has a new low price.

Juicing up the performance of computers is nothing new for us. We invented the SoftCard and make versions for the entire Apple family. We wrote Applesoft for the Apple II.

**MICROSOFT** In fact, our The High Performance Software® BASIC is the language spoken by nine out of ten microcomputers worldwide.

Get the Apple juicer from Washington. Call 800-426-9400 (in Washington State call 206-828-8088) for the name of your nearest Microsoft dealer.

SoftCard is a trademark and Microsoft is a registered trademark of Microsoft Corporation. Apple is a registered trademark of Apple Computer, Inc. IBM is a registered trademark of International Business Machines Corporation. dBASE II is a registered trademark of Ashton-Tate. WordStar is a registered trademark of MicroPro. CP/M is a registered trademark of Digital Research, Inc.



# THE Part 1: Early History APPLE STORY

CONDUCTED BY GREGG WILLIAMS AND ROB MOORE

## *An interview with Steve Wozniak*

---

*Steve Wozniak is the designer of the original Apple computer and one of the cofounders of Apple Computer Inc. Here Steve speaks at length on a variety of topics that range from the hobby activities that led to his design of the Apple I to current issues at Apple Computer. His frank comments and criticisms provide a glimpse into the workings of Apple Computer from a true insider's point of view. This is the first part of a two-part article.*

---

BYTE: *We've heard that you designed the Apple I while you were working at Hewlett-Packard in 1975. Can you tell us what you were doing before that; what lead up to the creation of the Apple I?*

Wozniak: I have been interested in electronics and computers all my life. In my high school days, I studied TV circuits and I designed about 50 computers on paper, but I couldn't afford the parts to build them. In 1970, most people couldn't afford a monitor, so I designed video outputs that plugged into an oscilloscope and had the oscilloscope draw letters on the screen.

I had also been studying software. I wanted to know how to write compilers for languages like FORTRAN or BASIC, so I studied and kept notebooks. It was all self-taught and on paper, but I never got a chance to try it out.

I took three years of college toward a computer science degree back when only a few colleges were starting to offer it as an undergraduate curriculum. My third year had been at The University of California at Berkeley.

I originally planned to take a year off from Berkeley after my third year to earn enough money as a technician for my final year of college. But my career kept advancing. I was hired by Hewlett-Packard, made an engineer there, and I started developing better design expertise. I got into chip layout and

things like that, and basically my career kept moving, my interests in life were changing, and it was too far to commute to Berkeley. I tried San José State but I didn't have the time available and it wasn't compatible with my first three years of college. It would have taken four more years to get my degree. So I never got a degree.

I was still an electronic hobbyist. I lost interest in minicomputers during the next three years, because I was doing calculator chips at HP and projects on the side at night.

I saw a Pong game in a bowling alley. So I went and designed my own. I designed the Breakout video game for Atari. I was just constantly involved in electronics as a hobby. At Hewlett-Packard we were pretty much just designing integrated circuits.

Around that time the Homebrew Computer Club got started and I happened to get directed to the first meeting by accident. I started discovering a bunch of high school kids who knew all about microprocessors and assembly language, and it was the stuff I had done up until three years before in my life. My whole life had been in minicomputers. All of a sudden, I started realizing microcomputers are the same as minicomputers, and I understood them.

BYTE: *You mentioned that you designed the Breakout game for Atari. How did that happen?*

Wozniak: Steve Jobs was working for Atari at the time. Nolan Bushnell was really annoyed because all their new games

*(continued)*

---

*Gregg Williams is a senior technical editor at BYTE. Rob Moore is a hardware designer and a frequent contributor to BYTE. They can be reached at POB 372, Hancock, NH 03449.*

---

*'I didn't want to pay to use somebody else's computer, so I decided to design my own.'*

---

were coming out at 150–170 chips. He wanted low chip counts to reduce costs, and he had seen a version of Pong that I had done, that only used about 30 chips. He appreciated that. So he said if we could design a hardware Breakout in under 50 chips, we'd get 700 bucks; and if it was under 40 chips, we'd get \$1000.

Atari didn't put us on a time schedule; Steve did. I had to do it in four days because Steve had to catch an airplane to Oregon. I was the designer—the engineer—and Steve was a breadboarder and test technician.

We gave them a working breadboard for it. My first design was 42 chips. By the time we got it working it was 44, but we were so tired we couldn't cut it down. So we only got 700 bucks for it.

## THE APPLE I

BYTE: *How did you get to the point of designing the Apple I?*

Wozniak: I had worked my way up through software using a terminal on a local time-sharing system. Sometimes I'd call it from work, but I wanted to do it at home. I eventually designed and built a TV terminal and a modem so I could call this computer and play games. I was a true hacker. I started getting on ARPA-net and accessing computers all around the country. BYTE was the first magazine to get started, and I bought issue #1 at the newsstand.

I didn't want to pay to use somebody else's computer, so I decided to design my own. I wanted to have it all in one place, and I already had a terminal, so I was part-way there.

I sat down and wrote the BASIC first, and that took a lot more time than the computer design. Once it was written, I had to build the computer. I had designed a simple 6800-based computer, but the actual choice of processors was dictated by what I could afford. At the time, most microprocessors cost hundreds of dollars, but you could buy a 6501 over the counter for \$20, and a 6502 was \$25. So I bought a 6502, built the computer, and soldered one of my small TV terminals right onto the same board. It was a small computer with a small terminal, but it had good capabilities.

In our lab at Hewlett-Packard we had a desktop computer called the 9830 that ran BASIC. It was designed for the scientific community and cost \$10,000 so it wasn't a personal computer, but you could run BASIC as soon as you sat down. That was my goal with the Apple I—you could sit down, turn it on, and start typing.

That was the main thing about the Apple I. Its characteristics were largely centered on its video terminal capability. In those days, the most common input/output mechanism was the ASR-33 teletype. It had been a standard for 10 years, and the minicomputer companies had only recently started using video terminals. So I had lots of experience using teletypes,

and now I could do it in video with my terminal.

In 1975 video terminals were designed with shift registers because there were no cheap RAMs. You'd set up a bunch of shift registers and keep shifting them around to send text to the TV screen. So the Apple I was slow. It could type out 60 characters a second—one character per scan of the TV screen. My motivation was totally to save chips, not to add features.

BYTE: *Was the Apple I really a full-blown computer?*

Wozniak: Yes, but its features were a little bit different than the Apple II's and other personal computers that followed. It was slow, and it was text only, but it was a lot faster than the teletypes we were used to. They could only type 10 characters per second. TV terminals were just starting to get popular in those days.

BYTE: *Weren't they still fairly expensive?*

Wozniak: Yes, but I had to be cheap because I didn't have any money. I used the oldest, cheapest surplus parts I could find. Don Lancaster had written an article called "TVTI" for *Radio-Electronics*, and it was the big hobbyist article of the day. He had a humongous design that used tons and tons of parts and gates, but it was a poor design. I was into tight, clever designs to cut chips down, so I was flexible about the video timing. I knew from my high school days that TVs are designed with a lot of slop. Even if my timing was a little bit off, it would still work with most TVs and monitors.

BYTE: *So you didn't worry too much about precise timing?*

Wozniak: No, I was in a very hobbyist realm. I wasn't designing a product, just something that would work at home on my own TV. The computer itself used a 6502 processor interfaced to the terminal through a parallel interface chip called a PIA. It could also read a keyboard, so I bought a surplus keyboard that was advertised in an electronics magazine for \$60. It emulated an ASR-33 teletype and did everything I wanted it to do, so I interfaced it.

Memory was my main problem. The only surplus RAMs available at the time were 2102s—1K static RAMs. I had the computer designed and the BASIC written, so I borrowed a 4K 2102 static RAM board from a friend so I could test it out. I got my BASIC going with that, but I wanted to use dynamic memories because you could cut the chip count way down.

Steve got intrigued with all these ideas and one day he asked me, "Why don't you use these new 16-pin dynamic RAMs?" I had looked at them in my work at Hewlett-Packard, but they were new and I couldn't afford any parts that didn't come my way almost free. I'm a little bit shy, and I didn't know any of the reps, but Steve just called them up and talked them into giving us samples. I jumped on it. I thought it was a great part because you could replace 32 chips on a board with just eight. It was a little more difficult to use because you had to multiplex the row and column addresses and that cost me one or two chips. But I was very happy because it was TTL [transistor-transistor logic] compatible and I could save a lot of board space because the parts were so much smaller. My whole goal was to make it as small as I could. I now had a little computer on one board about six by eight inches that



---

*'Showing off Breakout on the  
Apple II at the Homebrew  
Computer Club was the most  
satisfying day of my life.'*

---

I could take down to the club and show off. It was only 30 or 40 chips and it could run BASIC. People would look at it. It was unexpected.

BYTE: *So how did Apple Computer actually get started?*

Wozniak: Steve and I had both been going down to the [Homebrew Computer] club and giving out schematics for the computer and the terminal, even going over to people's houses and helping them build and test the computers out. Steve said, "Look, people are interested in what you've got. Why don't we make a PC board, have it silkscreened so they know what parts to plug in, and sell it at the club?"

We had about 500 members in the club, and I thought that maybe 50 people would buy it. It would cost us about \$1000 to have the board laid out, and each board would cost us about \$20. So if we sold them for \$40 and 50 people bought them, we'd get our \$1000 back. It seemed pretty doubtful. But Steve said, "Well, yes, but at least for once in our lives we'll have a company." So Steve sold his van and I sold my HP calculator to raise the money to make the PC boards.

Right away Steve got a big order from a local computer store to supply completely built computers. They ordered something like 100 units at \$500 each, to retail at \$666. It was unbelievable—a \$50,000 order. We were in business.

All of a sudden we needed about \$20,000 to buy parts. Steve went down to the local parts suppliers and we filled out financial forms. They looked at our purchase order, made phone calls, and really looked into our customer's credit. In the end, they gave us the parts with 30 days' credit. We had everything set up to build the computers and deliver them in 10 days, and it worked out great. We delivered the computers, paid off the parts suppliers, and only had to borrow \$5000 from a friend, Alan Baum, and his father.

BYTE: *How many Apple Is did you actually sell?*

Wozniak: We manufactured 200 of them and sold all but 25 over a period of nine or ten months.

BYTE: *When was that?*

Wozniak: In 1976. It was first demonstrated running BASIC in late 1975, and Steve suggested forming a company in late 1976. We formed an official partnership in March. We had a third partner at the time who had 10 percent, but he sold out for \$800 because he thought we weren't going to go anywhere except into debt, and he was the only partner with money.

BYTE: *Just to put four or five stories to rest, where did the name Apple*

*Computer actually come from?*

Wozniak: It came out of Steve Jobs's head, and he's a sort of private person, so I can't say what led up to it. He came up with an inspiration. He was working from time to time in the orchards up in Oregon. I thought that it might be because there were apples in the orchard or maybe just its fructarian nature. Maybe the word just happened to occur to him. In any case, we both tried to come up with better names, but neither one of us could think of anything better after Apple was mentioned.

BYTE: *Hewlett-Packard didn't want the rights to the Apple I. You designed it while you were working there. Did you offer it to them?*

Wozniak: Yes. There were a few of us in the lab at HP who were interested in microcomputers. We had proposed it to the lab manager. We sat down and had a meeting, and worked out on paper how we could have a little \$800 machine that could run BASIC and connect to a home TV. Now this guy had been the project manager of HP's 9830 desktop BASIC machine, and he had been through a lot of these issues. He knew why this couldn't be an HP product, and he was right. Hewlett-Packard just couldn't do a hobby product—they just couldn't get into an evolving market when it was too young and unforeseen. So he turned it down and I got a legal release. A funny thing happened. After we started shipping Apple Is, our calculator division at HP started a little 8-bit processor project called Capricorn. I had already done most of the stuff they were doing, but they wouldn't let me work on that project.

BYTE: *Can you summarize the characteristics of the Apple I?*

Wozniak: It used the 6502 and included 8K of RAM by the time we put it out as a product. You could load BASIC into 4K of memory and you had 4K left over for your own BASIC programs. We supplied the boards completely put together and it had a video connector, but you still had to connect a video monitor on your own. You also had to get a keyboard and wire it into a 16-pin DIP connector. We built a power supply onto the board, but you had to connect two transformers for 5 volts and 12 volts. It had no speaker, no graphics or color. It could just display text at 60 characters per second.

BYTE: *The display wasn't memory-mapped?*

Wozniak: No, it was just a computer with a built-in video terminal. You could hand-wire certain addresses to read the keyboard, write to the video terminal, and select addresses for 4K memory bank 1 and bank 2. It had one external card connector, and we quickly filled that with a cassette interface card. It also had a side connector where we could theoretically add something later to expand it. The idea was just very small and simple, and it was all on one board.

BYTE: *Was there a monitor in ROM?*

Wozniak: Not really. In those days PROMs were very expensive, so I just used two small 256 by 4 PROMs to give me 256 bytes of ROM. I wrote a little program that would let you type in hexadecimal codes, examine a range of memory, or run a program at a particular address. Those three functions fit in 256 bytes.

(continued)

**THE APPLE II**

**BYTE:** *How did you make the transition from the Apple I to the Apple II?*

Wozniak: We were selling Apple Is and we were just having fun and getting known. It was the most incredible thing we had ever done in our lives. I was still working at Hewlett-Packard and just moonlighting at Apple to test out boards, write more programs, and design a cassette interface so you could load BASIC in just a few minutes. [*Before the cassette interface, you had to type in the entire 4K BASIC interpreter by hand, in hexadecimal. . . . R.M.*] I had taken the machine down to the Homebrew Computer Club for its official introduction and pointed out its features. I got asked a lot of questions—people wanted to know if it could do other things.

At the time, Cromemco had just come out with a board called the Color Dazzler that did color graphics on S-100 systems. We had also had a demo, at the club, of a minicomputer running a display of a clock on the screen in color. During one of my times at Atari with Steve, I had designed a little seven-chip circuit to do color on a TV screen and it worked. So I started working on things that I wanted to add to the Apple I. I was thinking about clever color circuits and how to cut the chips down.

Remember, I had a computer with its own memory and a terminal with the display memory in shift registers. So I started thinking how I could combine parts into one—to somehow get them both to use the same memory. I finally worked out a design where a small part of the main memory was used as the terminal's video memory.

Eventually I got the whole machine done. It did everything that the Apple I did, except the display was in main memory so you could change any location on the screen instantly. I had built-in color, and EAROMs [electrically alterable read-only memories] were getting more common, so it had software built in to make it operate like a terminal. So it had color, it was very fast, and it was still cheap. In the end it was about half as many chips as the Apple I and it was many times better.

**BYTE:** *Was the designed-in color low resolution or high resolution?*

Wozniak: At first it was low-resolution color. Basically it could output characters in two different ways, either as text or as colors. I actually had to modify our horizontal video rates to be a little different from the NTSC [National Television Standards Committee] standards, because NTSC was not designed for digital video.

Once the computer was done, I started writing routines for the ROMs. I wrote terminal software so the characters would display in rows, from left to right and move down to the next line for a carriage return. I expanded my monitor routines to do more than just load hex, display memory, and run programs. I added the cassette routines because I knew they were going to be important. Eventually I started adding fancy features like a disassembler and the ability to split the screen into different windows. I would just go down to the club every two weeks and show off the latest routines I had done, because it was impressive. It wound up being a 2K monitor with graphics routines and everything included.

All my thinking from the Apple I days was carried over into the Apple II. Most people could not afford a color monitor, so it had to work with a home TV. A home TV could only

display 40 characters across the screen, and I had to do what a TV could display. It was interesting because the technology defined the product rather than the market defining the product.

**BYTE:** *What caused the odd mapping of the graphics addresses?*

Wozniak: I had horizontal and vertical counters in the video circuits, and I had to map them into the display memory addresses. If you think about it, it's simple to have a perfectly linear address space. You take the vertical count times 40 and add it to the horizontal count. But it took three 7483 adder chips to do that, and I was looking for ways to save chips in the design. I figured out a couple of tricks that let me do it with just one adder, so I was able to save two chips; that helped others at the Homebrew Computer Club.

Also, I assumed that the user would just send characters to the screen through the terminal routines in the monitor. He would never see the odd addressing. I just wanted to play games and run BASIC. I didn't perceive that anyone would want to address the screen directly. Fortunately, only the vertical addresses were out of order, and there are a lot of easy ways to handle that so it doesn't slow things down.

**BYTE:** *How did you come up with the scheme where each byte only displays 7 bits, and when did the high-resolution graphics arrive?*

Wozniak: I had used the cheapest parts available, and a 5 by 7 character generator was the only cheap one in 1975. So my characters were five dots across and they fit into a 7 by 8 matrix. From my experiments with color and my experience with TVs, I knew how much time was available to display data during a TV scan. I also knew that my master clock had to be a multiple of the color-burst frequency, so I used 14.31818 MHz, four times the U.S. color subcarrier. So with that clock, I just counted how many dots per character would get 40 characters on the screen. I could have used eight dots per character and displayed 32 characters per line, but if I tried to display 40 characters of eight dots each it would have been too wide to fit on the TV screen.

One day I mentioned to Steve that I had noticed something interesting in the video addressing. I could make a little change by adding two chips, and then I could just shift each byte out onto the screen and we'd have hi-res graphics. I wasn't sure that it was worth the two chips because I was very chip-conscious. But Steve was pushing for all the features we could get, so eventually we put it in. At the time we had no idea that people were going to be able to write games with animation and little characters bouncing all around the screen. It was a neat feature, so we put it in there. Well, now I had a computer that had color in roughly the size of the bricks in the Breakout game I had designed for Atari. I had written a bunch of assembly-language routines to draw spirals and zig-zags of color, and I would take it into Hewlett-Packard to show the engineers. Sometimes they would sit down and say, "This is the most incredible product I've ever seen in my life." Many people were saying that when they saw the colors, but it was not in BASIC yet.

I wanted to write Breakout. I knew I could do it in assembly language, but I hadn't put any graphics commands in the BASIC yet. I knew how to add commands, since I had written the BASIC, so I put in a command to plot simple color

## INTERVIEW: STEVE WOZNIAK

squares and soon got to a point where I could draw a brick wall. Then I did a ball and wrote some routines to make it bounce around. Now I needed a game paddle.

I wasn't sure how to sense the value of a paddle. I didn't want to put in 20 chips or anything expensive. So I found some little timer chips—NE555 timers. They were very cheap, but they could sense the value of a pot [potentiometer] by controlling their timeouts. There was also a larger one that was four 555 timers on one chip. So it was trivial. With a few resistors and capacitors I could read four paddles. As I got further into the game I needed sound, so I put a speaker in also.

Basically, all the game features were put in just so I could show off the game I was familiar with—Breakout—at the Homebrew Computer Club. It was the most satisfying day of my life when I went down there. I got a couple of high school kids to help me set it up, and I demonstrated Breakout—totally written in BASIC. It seemed like a huge step to me. After designing hardware arcade games, I knew that being able to program them in BASIC was going to change the world. All of that stuff is the essence of the Apple II.

**BYTE:** *We've heard that someone else helped you with the design of the I/O slots on the Apple II. Is that true?*

**Wozniak:** Yes. Many of the computers of the day had I/O card connectors, but they all required a bunch of address-decoding circuitry on each card. It was costly and required extra chips. I was into low-chip-count designs, and I wanted to have eight slots. So I was thinking of dividing part of the address space up between the eight slots and just using one decoder on my board to decode the eight different addresses. In that way, each I/O board didn't need three chips' worth of decoders on it.

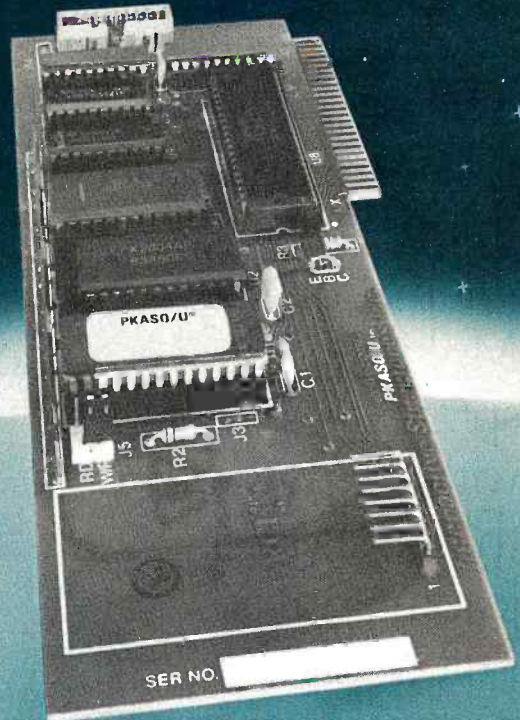
Alan Baum helped a lot. I already had some address decoders on the board that decoded every 16th and every 256th I/O address. Alan realized very clearly that each card could have its own little 256-byte PROM on it and how they could all share a bank-switched 2K space. So I could just send two decoding signals to each card. Each board had 16 addresses for its I/O and 256 bytes of space for its PROM. Alan was the most constructive person in terms of realizing very clearly just how well the hardware-software interaction would work.

I saw one of Steve Ciarcia's articles in a recent issue of BYTE. He implemented a new voice chip design on an Apple II, and he said it was "because you don't have to decode it on the board." That was exactly the purpose behind the I/O decoding Alan and I designed. Oddly enough, he and his father were the ones who lent us the \$5000 we needed in the Apple I days.

**BYTE:** *How did you raise the money to build the Apple II?*

**Wozniak:** By the time we did the Apple II, we had to build 1000 boards that cost \$250 each. We needed \$250,000 and we had nothing. Mike Markkula helped us write a business plan, and then he started perceiving that maybe this home computer market was really going to happen. He thought that home computers would hook up to your oven and refrigerator. Obviously this didn't happen, but he decided to join us as a third partner. ■

# PKASO/U®



## The Universal Printer Interface

- Universal for all standard parallel printers.
- Famous for Graphics (LoRes, HiRes, SuperRes) (Logo Compatible)
- Terrific for text (even rotates spreadsheets to print sideways)

One set of commands for all printers. One command changes character sizes. Create your own printing fonts, alphabets and symbols . . . bold face, underline, italics, subscript and superscript, HiRes Zooming.

### PLUS:

FREE Utility and Demonstration Software Disk. CLEAR, comprehensive user documentation. PKASO/U . . . for all the reasons you need an interface.



Contact us for a list of Authorized Dealers near you.



Interactive Structures, Inc.  
146 Montgomery Avenue  
Bala Cynwyd, PA 19004  
Telephone: (215) 667-1713

# Don't buy a spreadsheet

A lot of electronic spreadsheets just can't cover your needs. They don't go far enough.

They're unable to work like you or adapt to the way you think.

Time for Microsoft® Multiplan®, the high energy spread. A spreadsheet with more workspace than the other leading spread. Full of high performance capabilities for your IBM® PC, PC XT, PC jr. or other MS™-DOS microcomputer.



**Multiplan loves you as you are.**

Other spreadsheets force you to learn how they think. Multiplan learns how you think. It remembers the way you work. Anticipates frequent commands. Even offers suggestions on spreadsheet set-up.

Commands are in English. So are formulas. Instead of typing mysterious coordinates like H54 - L73 = BK154, you can simply name worksheet areas: Sales - Costs = Profit.

# that spreads too thin.

Multiplan can link information in different spreadsheets. When you make a change on one, every related one is changed.

Multiplan has optional Multiplan Application Programs that work with you to design and build custom spreadsheets for Budget Analysis, Financial Statement Analysis or Cash Planning in minutes. Not hours. Or days.

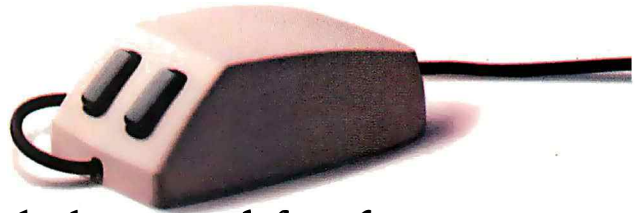
## The trained mouse.

Multiplan has an optional Mouse. A handy little critter that flies through Multiplan so easily you barely have to lift a finger to select and execute commands. Small wonder Microsoft gets more performance out of a spreadsheet. We designed **MICROSOFT** the MS-DOS operating system that tells the IBM PC how to think. And our BASIC is the language spoken by nine out of ten microcomputers worldwide.

To get the best spread call 800-426-9400 (in Washington State call 206-828-8088)

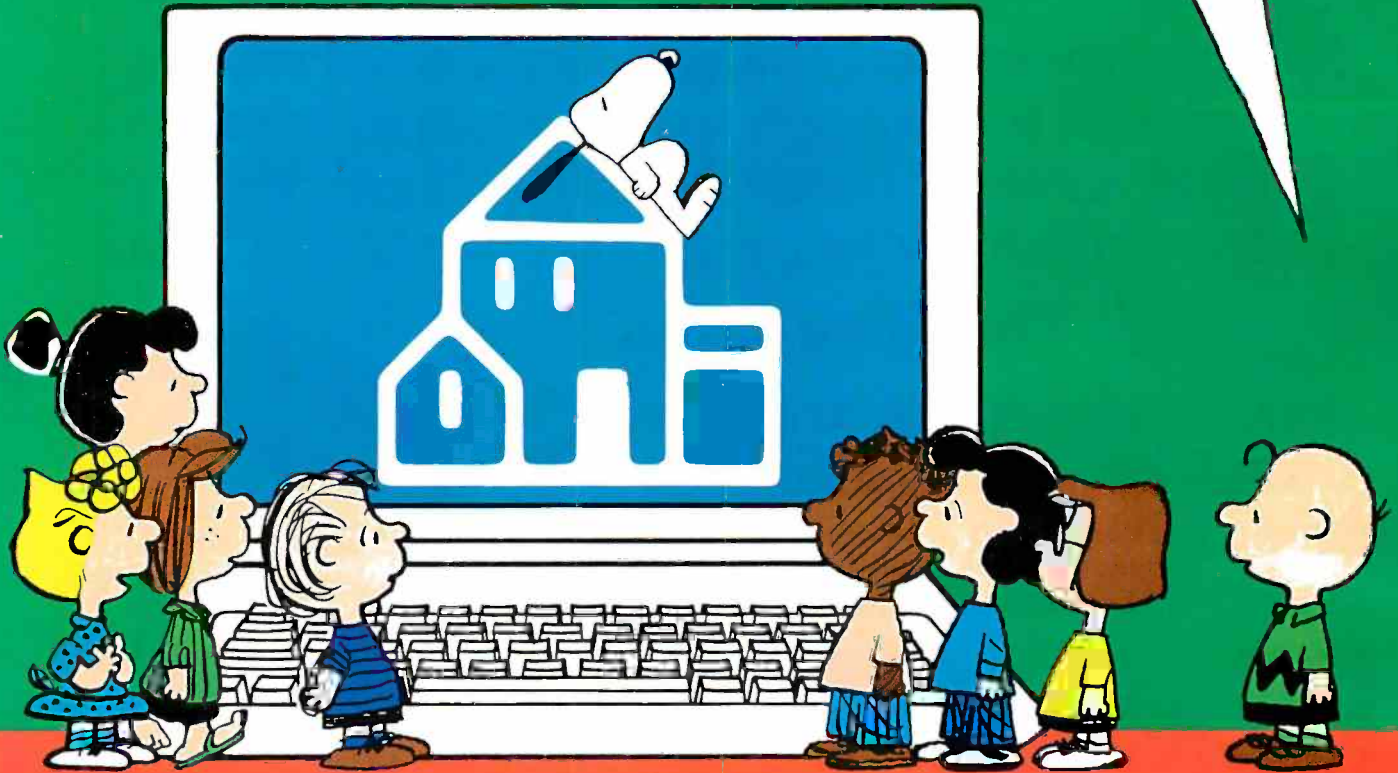
for the name of your nearest Microsoft dealer. Now featuring Multiplan at a reduced price: **\$195.**

Suggested list price shown for Multiplan.



# MULTI PLAN

GOOD GRIEF!  
LOOK WHO'S ON  
RANDOM HOUSE  
SOFTWARE!



PEANUTS Characters: © 1950, 1951, 1952, 1958, 1960, 1965, 1966, 1968, 1975, United Feature Syndicate, Inc.

## One of the world's leading children's book publishers and the world's best-loved characters are together again.

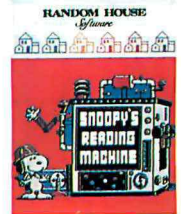
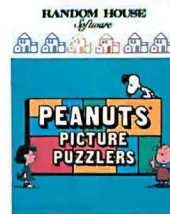
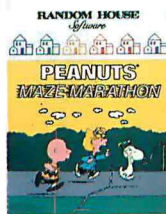
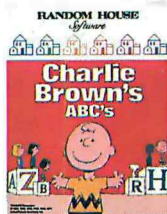
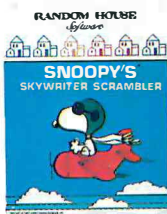
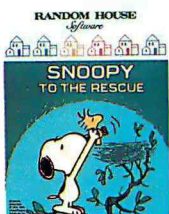
The results are these brilliant new PEANUTS® programs for your children.

They'll learn spelling, vocabulary, math and, above all, learn to love learning.

Each of these exciting

new programs uses vivid color graphics and truly lifelike animation designed for your home computer.† Plus they're on *two-sided* disks to give you *twice* the fun for the price of one.

Visit your neighborhood computer software dealer now and bring back some bright new friends for your children. The kind of friends who never have to go home.



**RANDOM HOUSE**  
Software

**ALL THE BEST FROM OUR HOUSE TO YOUR HOUSE.**

†For Apple II+, IIe, IIc. Soon for Commodore 64—disk drive only. (Trademarks of Apple Computer, Inc. & Commodore Electronics Ltd.) © 1984 Random House, Inc. All rights reserved.

“C”

# IS FOR CRUNCH

CONDUCTED BY GREGG WILLIAMS

---

[Editor's note: On March 16 and May 2, 1984, I interviewed Peter Quinn—first about the Apple IIe and later about the IIc. The Apple IIc had its roots firmly embedded in the IIe project, and parts of both machines were designed simultaneously. Here are some excerpts from these interviews. . . . G.W.]

---

---

*An interview with  
Apple IIe and IIc  
design manager Peter  
Quinn*

---

BYTE: *Were you in on the Apple IIe design from the beginning?*

Quinn: From the very beginning. I was originally hired [November 1980] to re-design the Apple III, to customize it—I'm an IC [integrated circuit] designer also. I worked on that for about six months. Then Apple approached me to manage. . . . I was the hardware design manager of the IIe and worked with the design team, including the industrial designer, the firmware people, and such. I brought that out and rolled right into this product—the IIc—where I was more like the engineering director in charge of hardware, firmware, product design, and disk drives.

BYTE: *I was particularly pleased by one of the first Apple IIe ads that showed both the II+ and the IIe and had the headline "Success/Successor." When you started out, in what ways were you attempting to make the IIe the successor? What were your design goals?*

Quinn: Well, you really have to go back to the history of the machine. Steve Wozniak started to design a custom, integrated Apple II—the project was called the Apple Annie—and the engineer he worked with at Synertek to do the custom IC was Walt Broedner. Walt was so impressed with Apple that, even after the project was cancelled, he tried to get a job here and subsequently did.

Walt always had it in the back of his mind to do a customization of the II. Management fought it for a year at least

because they weren't into custom ICs. So he'd keep on proposing it and getting knocked down. Finally, there was this reorganization. With me being an IC designer and so forth, I backed him.

Walt partitioned out the machine (the IIe) and came back with the original plan, which was fairly close to what we have now. We all knew that we had to enhance the keyboard and give it 80 columns.

To do 80-column text, Walt mirrored the text page, which is at [hexadecimal address] 400. And that's all he did. It was a 1K mirror of the text page that, every other character, you bank switched. But then he was driving home one night and he said, "Hell, if I've got the flags to switch that memory area, why don't I switch the entire 64K area?" So the idea of getting 128K in the Apple II was an inspiration that fell out of that.

The video slot—the auxiliary slot, we call it now—grew out of Walt's wanting to get 80 columns and his interest in video—[high-quality] RGB color. (Broedner later left Apple and founded Video 7, a company that manufactures RGB cards.) Another reason for the slot was because the test engineering people wanted the signals available on the

*(continued)*

---

*Gregg Williams is a senior technical editor at BYTE. He can be reached at POB 372, Hancock, NH 03449.*

*The goal was for the IIc to fit inside the standard size briefcase. . . .*

IIe motherboard. The whole idea was to make the IIe as open a machine as possible by bringing out all the major signals to either the peripheral slots or that auxiliary slot.

BYTE: *How did the IIc get started?*

Quinn: The history of the two products was so intertwined. While Walt was designing the custom ICs on the IIe, marketing was . . . starting slowly to create [the IIc]. . . adding in the disk controller, the serial port for a printer [on the main board].

[Marketing] wanted to take some of the slots out and put in some built-in peripheral handling. And engineering was quite upset about that. They felt . . . we'd have to make it [Apple's next product] as much like a II as possible, only better.

So Walt talked with Steve Jobs. And Steve said, "Yes, I think you should do the IIe the way you had planned"—with the open architecture—"but if you want to do a focused product, then this is the one." And he painted out basically what you see now in the IIc, except it didn't have the built-in disk drive. It had its built-in mouse port and one serial port and a few goodies like that. At that time the computer was called VLC for "very low-cost." It was basically a computer and a keyboard.

Walt came back and did some more work on the customs [ICs] and he said, "What if I wanted to do both the machines in one?" Basically, he put the logic for the mouse-handling stuff [into the custom chips] by using the space occupied by things that aren't in the IIe—like annunciators, the particular I/O mapping, and such. By grounding a pin when you assembled the die, you changed the complexion of the chip.

BYTE: *Are you talking about the IOU [the Input/Output Unit Apple IIe custom chip] in*

*particular?*

Quinn: And the MMU [the Memory-Management Unit custom chip]. The reason I tell this story is to show you how we had a head start on the IIc right from the beginning. I then went to marketing and said, "The chip count is minimal on the IIe. We do it this way. You let us slap out the IIe in six months or so. Then we'll turn around and divert all our energy to this more focused built-in product." And they bought it. So we finally finished up on the IIe.

BYTE: *What kinds of hardware and software compatibility problems did you have? After all, you wanted to keep the Apple IIe compatible with the II+.*

Quinn: As for firmware, I had to struggle like hell to get anybody because everybody was working on the Apple III at that time. I was able to finagle Rick Auricchio. He was one of the original Apple fanatics and hackers—he knew the history. You cannot get someone to write firmware for this machine unless he's been around for three or four years. You have to know how to weave through the mine field [of unofficial but commonly used entry points]. He was extremely good. He added in all the 80-column and Escape-key stuff, and I thought it was really clever. That was a struggle—firmware was right down to the wire on this.

BYTE: *What was the hardest hardware compatibility problem?*

Quinn: We had trouble getting the slots working, particularly with the Microsoft [Z80] card because the timing in this machine was slightly different. The guy who designed the Z80 card, although I liked him, did a schlock job of it, so we had to tune the machine [the IIe] slightly off such that it would be like the Apple II and the card would work.

BYTE: *When did you start working on the IIc?*

Quinn: Strictly speaking, work on the custom-chip design started around 1981. Then, we diverted all our energy to bringing the IIe out, which was obviously successful. A month before the IIe was introduced [in January 1983], my engineering team was winding down.

So, right after Christmas [1982], we started the Apple IIc project. Although we had already done a great deal of the circuit design, the IIc was much more

massive a project. Basically, what Steve asked was to build an Apple IIe with an 80-column card, another 64K of memory, two serial cards, a disk controller card, and a mouse card—all that to go in an 11- by 12-inch package.

The goal was for it to fit inside the standard size briefcase you buy at Sears. The things we worried about were heat, how to get the power supply in that small an area, and just how to get all that circuitry in that amount of area. I brought my handy-dandy take-apart IIc. [Peter pops open the Apple IIc; inside are a keyboard module, a disk drive, a power-supply module, and one circuit board with connectors on its rear edge.]

BYTE: *What does the power-supply box on the floor supply to the main unit?*

Quinn: The box just takes AC current and puts out semiregulated 15 volts DC. What this means is that the computer takes an input here [he points to the power-supply connector on the IIc], either from the power-supply box or from any 9- to 20-volt source. We made the range so wide because—well, you know what a car battery does in the winter in Canada. It [the power-supply circuitry internal to the IIc unit] takes any voltage in that range, does a DC-to-DC conversion, and puts out +12, -12, and +5 volts—I think we generate -5 [elsewhere] on the board because we don't use much of it.

The keyboard, we reengineered: it's our own switch. It's a low-cost but extremely reliable switch technology: a thin metal sheet with a spiral cut in it on the top and a contact at the bottom—when you push it in, it spirals in and makes contact with the bottom. We also added another spring that gives the keys a tactile feel. . . .

We've got the 65C02 [microprocessor] in there, which gives us 27 additional op codes. This allowed us to crunch the [additional] firmware into 16K, which is all we had available. Not only did we have to handle the monitor, the 80-column firmware, Applesoft, and all the IIe stuff, we had to handle the two serial ports, the mouse, and all that other good stuff.

BYTE: *The firmware on the Apple IIe mouse interface card takes up 2K of code. You must* (continued)



RS232 ADAPTER FOR VIC-20 AND COMMODORE 64

**New!**  **New!**

The JE232CM allows connection of standard serial RS232 printers, modems, etc. to your VIC-20 and C-64. A 4-pole switch allows the inversion of the 4 control lines. Complete installation and operation instructions included.

- Plugs into User Port
- Provides Standard RS232 signal levels
- Uses 6 signals (Transmit, Receive, Clear to Send, Request to Send, Data Terminal Ready, Data Set Ready).

**JE232CM . . . . . \$39.95**

**VOICE SYNTHESIZER FOR APPLE AND COMMODORE**

**Great Educating Tool!**



**JE520AP**  
**JE520CM**

- Over 250 word vocabulary - affixes allow the formation of more than 500 words
- Built-in amplifier, speaker, volume control, and audio jack
- Recreates a clear, natural male voice
- Plug-in user ready with documentation and sample software
- Case size: 7 1/4" L x 3 1/4" W x 1-3/8" H

**APPLICATIONS:**

- Security Warning
- Teaching
- Instrumentation
- Telecommunication
- Handicap Aid
- Games

**Part No. Description Price**

**JE520CM** For Commodore 64 & VIC-20 . . . . . \$114.95  
**JE520AP** For Apple II, II+, and IIe . . . . . \$149.95

**Computer Memory Expansion Kits**

**IBM PC AND PC XT**

Most of the popular Memory Boards (e.g. Quadram® Expansion Boards) allow you to add an add'l. 64K, 128K, 192K or 256K. The IBM64K Kit will populate these boards in 64K byte increments. The Kit is simple to install - just insert the 9 - 64K RAM chips in the provided sockets and set the 2 groups of switches. Complete conversion documentation included.

**IBM64K (Nine 200ns 64K RAMs) . . . . . \$43.95**

**COMPAQ • COLUMBIA • EAGLE**

These PC compatibles and others use the IBM64K for memory expansion.

**IBM64K (Nine 200ns 64K RAMs) . . . . . \$43.95**

**APPLE IIe**

Extended 80-Column/64K RAM Card. Expands memory by 64K to give 128K when used with programs like VisiCalc™. Fully assembled and tested.

**JE864 . . . . . \$99.95**

**TRS-80 MODEL I, III**

Each Kit comes complete with eight M5290 (UPD4164 116) 16K Dynamic RAMs and documentation for conversion. Model I: 16K equipped with Expansion Interface can be expanded to 48K with 2 Kits. Model III: Can be expanded from 16K to 48K using 2 Kits. Each Kit will expand computer by 16K increments.

**TRS-16K3 200ns (Model III) . . . . . \$8.95**  
**TRS-16K4 250ns (Model I) . . . . . \$6.95**

**TRS-80 MODEL IV**

Easy to install Kit comes complete with 8 ea. 4164N-20 (200ns) 64K Dynamic RAMs & conversion documentation.

**TRS-64K-2 (Converts from 16K to 64K) . . . . . \$38.95**  
**TRS-64K-2PAL (8 ea. 4164 w/Special PAL Chip to expand from 64K to 128K) . . . . . \$59.95**

**TRS-80 COLOR AND COLOR II**

Easy to install Kit comes complete with 8 ea. 4164N-20 (200ns) 64K Dynamic RAMs and documentation for conversion. Converts TRS-80 Color Computers with D, E, ET, F and NC circuit boards to 32K. Also converts TRS-80 Color Computer II to 64K. Flex DOS or OS-9 required to utilize full 64K RAM on all computers.

**TRS-64K-2 . . . . . \$38.95**

**INDUSTRIES Protect Yourself...**

**DATASHIELD® Surge Protector**

- Eliminates voltage spikes and EMI-RFI noise before it can damage your equipment or cause data loss - 6 month warranty
- Power dissipation (100 microseconds): 1,000,000 watts - 6 sockets - 6 foot power cord - Normal line voltage indicator light - Brown out/black out reset switch

**Model 100 . . . . . \$69.95**

**Protect Yourself... DATASHIELD® Back-Up Power Source**

Provides up to 30 minutes of continuous 120 VAC 60Hz power to your computer system (load dependent) when you have a black out or voltage sag - Six month warranty - Weight (PC200): 24 lbs. - (XT300): 37.5 lbs.

**PC200 (Output rating: 200 watts) . . . . . \$299.95**  
**XT300 (Output rating: 300 watts) . . . . . \$399.95**

**PROMETHEUS Intelligent 300/1200 Baud Telephone Modem with Real Time Clock/Calendar**



The ProModem™ is a Bell 212A (300/1200 baud) intelligent stand-alone modem. Full featured expandable modem. Standard features include Auto Answer and Auto Dial, Help Commands, Programmable Intelligent Dialing, Touch Tone™ and Pulse Dialing & More. Hayes command set compatible plus an additional extended command set - Shown w/alphanumeric display option.

**Part No. Description Price**

**PM1200** RS-232 Stand Alone Unit. . . . . \$349.95  
**PM1200A** Apple II, II+ and IIe Internal Unit. . . . . \$369.95  
**PM1200B** IBM PC and Compatible Internal Unit. . . . . \$269.95  
**PM1200BS** IBM PC & Comp. Int. Unit w/ProCom Software. . . . . \$319.95  
**MAC PAC** Macintosh Package. . . . . \$399.95 (Includes PM1200, Cable, & ProCom Software)

**OPTIONS FOR ProModem 1200**

**PM-COM** (ProCom Communication Software) . . . . . \$79.95  
Please specify Operating System.

**PM-OP** (Options Processor) . . . . . \$79.95  
**PMO-16K** (Options Processor Memory - 16K) . . . . . \$10.95  
**PMO-32K** (Options Processor Memory - 32K) . . . . . \$20.95  
**PMO-64K** (Options Processor Memory - 64K) . . . . . \$39.95  
**PM-ALP** (Alphanumeric Display) . . . . . \$79.95  
**PM-CC** (Apple IIC to PM1200 Cable) . . . . . \$29.95  
**PM-MC** (Macintosh to PM1200 Cable) . . . . . \$29.95

**KEYBOARDS**

**Mitsumi 54-Key Unenclosed All-Purpose Keyboard**

- SPST keyswitches - 20 pin ribbon cable connection
- Low profile keys - Features: cursor controls, control, caps (lock), function, enter and shift keys
- Color (keycaps): grey - Wt.: 1 lb. - Pinout included

**KB54 . . . . . \$14.95**

**76-Key Serial ASCII Keyboard**

- Simple serial interface - SPST mechanical switching
- Operates in upper and lower case - Five user function keys: F1-F5 - Six finger edge card connection
- Color (keys): tan - Weight: 2 lbs. - Data incl.

**KB76 . . . . . \$29.95**

**Apple Keyboard and Case for Apple II and II+**

- Keyboard: Direct connection with 16-pin ribbon connector - 26 special functions - Size: 14 1/2" L x 5 1/2" W x 1 1/2" H
- Case: Accommodates KB-A68 - Pop-up lid for easy access - Size: 15 1/2" W x 18" D x 4 1/4" H

**Part No. Description Price**

**KB-EA1** Keyboard and Case (pictured above) . . . . . \$134.95  
**KB-A68** 68-Key Apple Keyboard only. . . . . \$ 79.95  
**EAEC-1** Expanded Apple Enclosure Case only. . . . . \$ 59.95

**POWER SUPPLIES**

**TRANSACTION TECHNOLOGY, INC. 5VDC @ 1 AMP REGULATED Power Supply**

- Output: +5VDC @ 1.0 amp (also +30VDC regulated)
- Input: 115VAC, 60 Hz
- Two-tone (black/beige) self-enclosed case - 6 foot, 3-conductor black power cord - Size: 6 1/2" L x 7" W x 2 1/4" H - Weight: 3 lbs.

**PS51194 . . . . . \$14.95**

**Power/Mate Corp. REGULATED POWER SUPPLY**

- Input: 105-125/210-250 VAC at 47-63 Hz - Line regulation: ±0.05% - Three mounting surfaces - Over-voltage protection - UL recognized - CSA Certified

**Part No. Output Size Weight Price**

**EMAS/6B** 5V@3A/6V@2.5A 4 1/4" L x 4" W x 2 1/4" H 2 lbs. \$29.95  
**EMAS/6C** 5V@6A/6V@5A 5 1/4" L x 4 1/2" W x 2 1/4" H 4 lbs. \$39.95

**POWER PAC INC. REGULATED POWER SUPPLY**

- Perfect for computer systems - Output: +5VDC @ 11 Amps, -5VDC @ 1 Amp, +12VDC @ 2 Amps, -12VDC @ 0.5 Amp and +24VDC @ 3 Amps - Over-voltage protection - Size: 12 1/2" L x 6 1/2" W x 4 1/2" H - Weight: 17 lbs. - Spec incl.

**PS2922 . . . . . \$69.95**

**4-CHANNEL SWITCHING POWER SUPPLY**

- Microprocessor, mini-computer, terminal, medical equipment and process control applications - Input: 90-130VAC, 47-440Hz - Output: +5VDC @ 5A, -5VDC @ 1A, +12VDC @ 1A, -12VDC @ 1A - Line regulations: ±0.2% - Ripple: 30mV p-p - Load regulation: ±1% - Overcurrent protection - Adj. 5V main output ±10% - Size: 6 1/2" L x 1 1/2" W x 4-15/16" H - Weight: 1 1/2 lbs.

**FCS-604A . . . . . \$69.95**

**Switching Power Supply for APPLE II, II+ & IIe™**

- Can drive four floppy disk drives and up to eight expansion cards
- Short circuit and overload protection - Fits inside Apple computer
- Fully regulated +5V @ 5A, +12V @ 1.5A, -5V @ .5A, -12V @ .5A
- Direct plug-in power cord included - Size: 9 1/2" L x 3 1/2" W x 2 1/4" H - Weight: 2 lbs.

**KHP4007 (SPS-109) . . . . . \$59.95**

\$10.00 Minimum Order - U.S. Funds Only  
California Residents Add 6 1/2% Sales Tax  
Shipping - Add 5% plus \$1.50 Insurance  
Send S.A.S.E. for Monthly Sales Flyer!

Spec Sheets - 30¢ each  
Send \$1.00 Postage for your  
FREE 1985 JAMECO CATALOG  
Prices Subject to Change

Mail Order Electronics - Worldwide

**JAMECO ELECTRONICS**

1355 SHOREWAY ROAD, BELMONT, CA 94002  
12/84 PHONE ORDERS WELCOME - (415) 592-8097 Telex: 176043

MasterCard VISA

**5 1/4" APPLE™ Direct Plug-In Compatible Disk Drive and Controller Card**

The ADD-514 Disk Drive uses Shugart SA390 mechanics-143K formatted storage - 35 tracks


- Compatible with Apple Controller & ACC-1 Controller
- The drive comes complete with connector and cable - just plug into your disk controller card
- Size: 6" L x 3 1/2" W x 8-9/16" D - Weight: 4 1/2 lbs.

**ADD-514 (Disk Drive) . . . . . \$169.95**  
**ACC-1 (Controller Card) . . . . . \$ 49.95**

**More Apple Compatible Add-Ons...**

**APF-1** (Cooling Fan) . . . . . \$39.95  
**KHP4007** (Switching Power Supply) . . . . . \$59.95  
**JE614** (Numeric/Aux. Keypad for IIe) . . . . . \$59.95  
**KB-A68** (Keyboard w/Keypad for II & II+) . . . . . \$79.95  
**MON-12G** (12" Green Monitor for II/II+, IIc, IIc) . . . . . \$99.95  
**JE864** (80 Col. +64K RAM for IIe) . . . . . \$99.95  
**ADD-12** (5 1/4" Half-Height Disk Drive) . . . . . \$179.95

**DISK DRIVES**



**RFD480** (Remex 5 1/4" full-ht.) . . . . . \$129.95  
**JA551-2** (Panasonic 5 1/4" half-ht.) . . . . . \$139.95  
**TM100-2** (Tandon 5 1/4" full-ht.) . . . . . \$159.95  
**FD55B** (Teac 5 1/4" half-ht.) . . . . . \$149.95  
**SA455** (Shugart 5 1/4" half-ht.) . . . . . \$159.95  
**FDD100-8** (Siemens 8" full-ht.) . . . . . \$139.95  
**PKC-5** (5 1/4" Power Cable Kit) . . . . . \$2.95  
**PKC-8** (8" Power Cable Kit) . . . . . \$3.95

**UV-EPROM Eraser**

**8 Chips - 21 Minutes**

**1 Chip - 15 Minutes**

Erases all EPROMs. Erases up to 8 chips within 21 minutes (1 chip in 15 minutes). Maintains constant exposure distance of one inch. Special conductive foam liner eliminates static build-up. Built-in safety lock to prevent UV exposure. Compact - only 9.00" L x 3.70" W x 2.60" H. Complete with holding tray for 8 chips.

**DE-4 UV-EPROM Eraser . . . . . \$74.95**  
**UVS-11EL Replacement Bulb . . . . . \$16.95**

**NEW! Software & Documentation for CP/M Computers**



**JE664 EPROM PROGRAMMER 8K to 64K EPROMS - 24 & 28 Pin Packages**

Completely Self-Contained - Requires No Additional Systems for Operation

- Programs and validates EPROMs
- Checks for properly erased EPROMs
- Emulates PROMs or EPROMs - F832C Computer Interface for editing and program loading
- Loads data into RAM by keyboard
- Changes data in RAM by keyboard
- Loads RAM from an EPROM
- Compares EPROMs for content differences
- Copies EPROMs - Power input: 115VAC, 60Hz, less than 10W power consumption
- Includes: Color-coordinated, light tan panels with molded end pieces in microchassis - Size: 15 1/2" L x 8 3/4" D x 3 1/4" H - Weight: 5 1/2 lbs.

**JE664 A EPROM Programmer . . . . . \$995.00**  
Assembled & Tested (Includes JM16A Module)

**JE665 - RS232C INTERFACE OPTION** - The RS232C Interface Option implements computer access to the JE664's RAM. This allows the computer to manipulate, store and transfer EPROM data to and from the JE664. A sample program listing is supplied in BASIC for CP/M computers. Documentation provided about the software tooling computers than RS232C port. 9600 Baud. 8-bit word. odd parity with 2 stop bits.

**EPROM Programmer w/JE665 Option JE664-ARS . . . . . \$1195.00**  
Assembled & Tested (Includes JM16A Module)

EPROM JUMPER MODULES - The JE664's JUMPER MODULE (Personality Module) is a plug-in Module that pre-sets the JE664 for the proper programming pulses to the EPROM and configures the EPROM socket connections for that particular EPROM.

| JE664 EPROM Jumper Mod. No. | EPROM Type         | Programme | EPROM MANUFACTURER                                        | PRICE   |
|-----------------------------|--------------------|-----------|-----------------------------------------------------------|---------|
| JM08A                       | 2708               | 25V       | AMD, Motorola, Int'l, Intel, TI                           | \$14.95 |
| JM16A                       | 2716, 2708(25 pin) | 25V       | Intel, Motorola, Nat'l, NEC, TI, AMD, Hitachi, Matsushita | \$14.95 |
| JM18B                       | 2718(25 pin)       | 25V       | Motorola, TI, Hitachi, Oki                                | \$14.95 |
| JM18A                       | 2718(25 pin)       | 25V       | AMD, Fujitsu, NEC, Hitachi, Intel, Matsushita, National   | \$14.95 |
| JM22A                       | 2722               | 25V       | Fujitsu, Intel                                            | \$14.95 |
| JM24C                       | 2724               | 21V       | Intel                                                     | \$14.95 |
| JM44A                       | NC64S164, NC64L164 | 21V       | Motorola                                                  | \$14.95 |
| JM49B                       | 2764               | 21V       | Intel, Fairchild, Oki                                     | \$14.95 |
| JM49C                       | 2764               | 25V       | TI                                                        | \$14.95 |

## The two major challenges were heat and radiation.

have done a lot of crunching to get mouse-related code into the space you had in the IIc.

Quinn: Well, we had something they didn't—the custom ICs have built-in handling of the mouse. The Apple II with peripheral cards has to have a certain protocol just to go through the I/O space—this we can map direct [which also decreases the amount of code needed]. We could play a lot of tricks that way.

We made the IIc internationally configurable. This chip here [indicating the model] contains the keyboard map, which, for the international market, will give you French and German and dynamically change the layout. In the international version of the IIc, this switch [just above the "3" key] switches you from, say, a UK to a German layout. An interesting story—we had this switch on the international version and the hole in the case. Rather than tooling up two cases [an additional case without the hole for the American version], we thought about putting in a Dvorak layout for the IIc (the IIe already has it inside, but you have to change the circuit board to get it). At first, marketing wasn't very receptive, but they did some research and it is gaining ground. So, at no extra cost whatsoever, we had Dvorak for the American market.

These two chips, the ACIAs [asynchronous communications interface adapters], handle the two serial ports. We were able to crunch the circuitry down not only with a lot of [custom] integration but also with PALs [programmable array logic chips]. Right now, these are PALs, which are expensive; eventually they will be customs—the GLU is an up-and-coming custom gate array that you place here, which allows you to take these two 74LS161s out and save some cost. [Because of the miscellaneous functions it performs, GLU stands for "glue."] Eventually, you can pass that along to the user—that's what we did with the IIe.

Another way we got space out was to go to hybrids [clusters of resistors, transistors, and other components housed in one IC-like package]. For example, here we took a collection of discrete circuitry—in this case, the video circuitry—and crunched it into one of these. Again, with the audio, we went to the hybrid.

We'll also have a custom TMG [timing] chip here. And we have a third custom chip that we did in collaboration with the Macintosh group, the IWM [integrated Woz machine], which integrates the full state machine of the disk-controller card.

BYTE: *What were the biggest problems you faced in getting a board this compact to work?*

Quinn: The two major challenges were heat and radiation. There is a lot packed into this area, and we at Apple have to adhere to the corporate spec of having all equipment work up to 40°C ambient. We originally had a lot of CMOS in the computer. We experimented with lower power disk drives that would have been a lot more expensive—we tried all sorts of things. The solution we finally ended up with was to go to some very intricate venting schemes. If you look at the board, it looks like a hunk of Swiss cheese. See all the holes we have for no apparent reason? That's so we get the proper convection when it's laid in [assembled]. We get convection in the disk drive, which is, of course, the biggest offender, and it's vented in very specific ways.

It was funny, the way we decided on where the holes should be. We got out the old Black and Decker, drilled holes and tested it in the oven, taped some holes up and drilled some more—empirical. But we kept on using the low-power drive because we were still over the spec. Finally we did some control experiments and used the normal high-power drive, and that got us under the limit!

BYTE: *It generated less heat than the low-power drives?*

Quinn: The overall unit generated less heat. I took four years of physics, but it's somewhat confusing to me why a higher power drive would cause less heat. Our only explanation is that it caused enough heat such that you got a heat rise, which pulled in a vacuum—

and that got us the convection we needed.

BYTE: *How did you manage to meet the RFI (radio frequency interference) specifications?*

Quinn: We were really careful. On the top, we power-gridded the power lines very carefully and created a virtual ground plane. We were very careful with the layout of the components—for example, the oscillator, which generates 14 MHz. The higher in frequency you get, the scarier it gets, so we only ran 14 MHz to chips that were right in this immediate area.

On the bottom, where the noisier power signals are, we took this metal sheet, which is tied at about 12 points via screws so we keep the whole grounded. Unfortunately, EMI [electromagnetic interference] is something of a black art. We went through many revisions of the board until we finally got it. I'm pretty proud of that. [Peter reassembles the IIc, which takes less than 15 seconds.]

BYTE: *How does the keyboard connect to the main unit?*

Quinn: Flat cable.

BYTE: *So with the exception of some cables that you didn't put in, you're actually assembling a unit.*

Quinn: That's correct. Except for the two cables and the screws, that's it—that's my second born.

BYTE: *You once said the IIc was called a very low-cost machine.*

Quinn: The Apple IIe's first code name was LCA, for "low-cost Apple." Then this [the IIc], because everything was going to be built-in and crunched, was "very low-cost."

BYTE: *But the price really ended up not being that low.*

Quinn: Well, VLC at the time did not include a disk drive (which is a big cost factor), it was only 64K, it didn't have all the I/O the IIc has. It originally had one serial port, but marketing came back and said, "Uh-uh, everyone's going to want a modem, ultimately, in the home and in industry. Everyone is going to want a printer—and, specifically, they're not going to want to unplug one to get the other." That's how we came

(continued on page A120)

---

## PART III

# THE MACINTOSH AND THE LISA 2, THE FUTURE OF APPLE

---

|                                                                        |      |
|------------------------------------------------------------------------|------|
| <b>Extra Storage for the Mac</b><br>by Dave Smith .....                | A80  |
| <b>Multiplan/Chart on the Macintosh</b><br>by Mitch Trachtenberg ..... | A85  |
| <b>Evaluating the Macintosh Finder</b><br>by Mark S. Jennings .....    | A94  |
| <b>Habadex on Apple's Macintosh</b><br>by Léo Laporte .....            | A102 |
| <b>The Lisa 2: Apple's Ablest Computer</b><br>by David D. Redhed ..... | A106 |
| <b>The First Look at FORTH on the Mac</b><br>by Gregg Williams .....   | A115 |

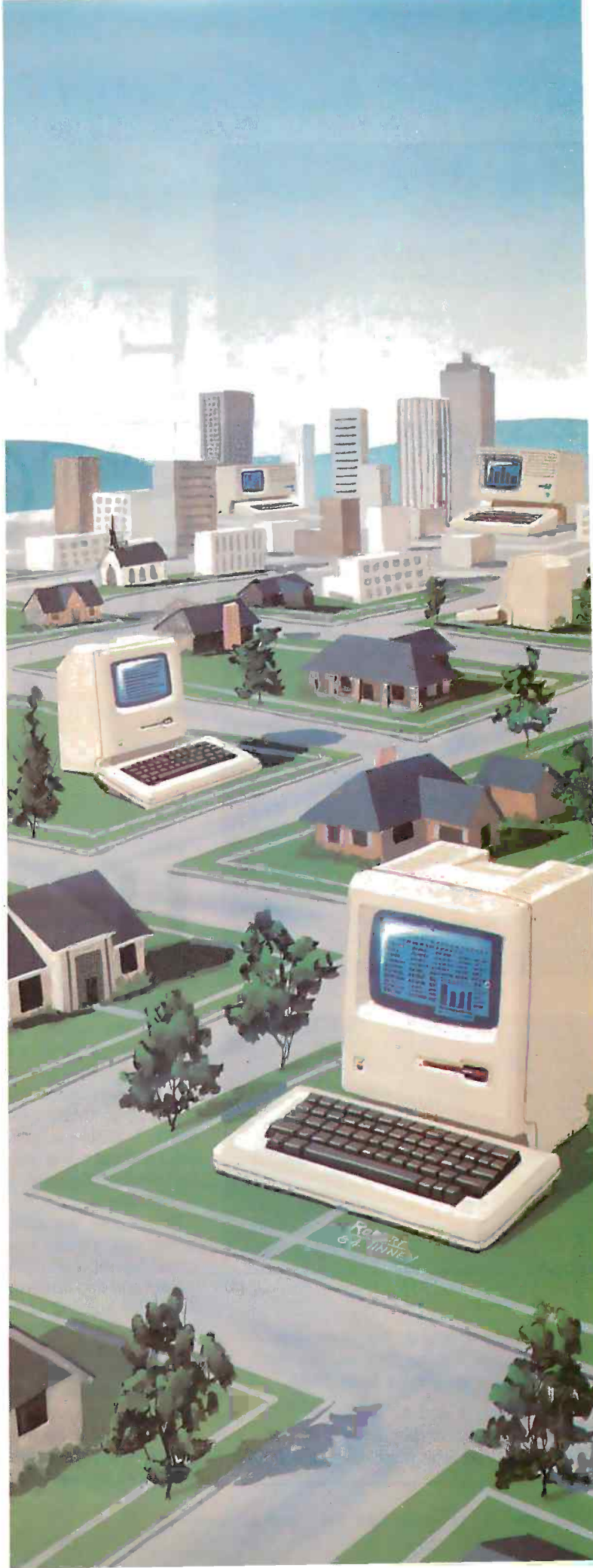


ILLUSTRATION BY ROBERT TINNEY

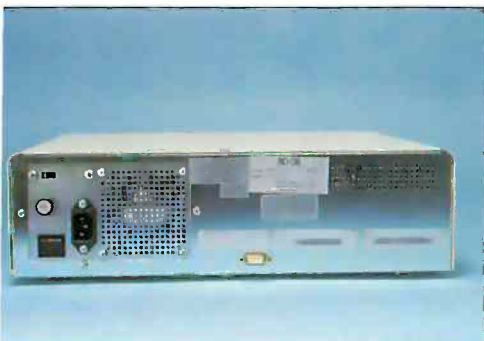
BY DAVID W. SMITH

# EXTRA STORAGE FOR THE MAC

*Tecmar and Davong face-off with two hard-disk entries*



(1)



(2)



(3)



(4)

Photos 1 and 2: *The 10-megabyte disk drive from Davong, front and rear panel. The drive is controlled by an 8088.*

Photos 3 and 4: *The Tecmar 5-megabyte cartridge disk and its rear panel. The drive is controlled by a 68008.*

**U**p until now, Apple's Macintosh computer was devoid of hardware add-ons. Tecmar's 5-megabyte cartridge-disk drive and Davong's 10-megabyte fixed-disk drive have changed that.

From the first, Mac has been in need of some disk memory expansion. A standard Mac disk holds 400K bytes. Mac's operating system files that are needed to boot and support Mac's overlays require 230K bytes, leaving only 170K bytes of usable storage for both applications and data. MacWrite and MacPaint each require 60K bytes, leaving only 50K of free space.

To alleviate the congestion on the system disk, a crafty soul might propose to use two separate disks, one for system utilities and applications and another for data. This juggling of applications and data appears to solve the space problem, but you soon find a greater problem: floppy flogging. Anyone who has used a machine with a single-disk drive can attest that very large databases (or large overlaid programs) require swapping disks to access certain data needed by the program at any given time. This

is an old problem, and Apple hasn't solved it.

## THE BETTER WAY

Tecmar's half-height 5-megabyte cartridge hard disk, the MacDrive, and Davong's 10-megabyte MacDisk hard disk both feature microprocessor control. (I have only recently received Tecmar's 10-megabyte hard disk.) These "intelligent" controlled drives are rare in the microcomputer market and may be a prelude to local-area network expansion for the Mac in the future. To that end, Tecmar has the advantage. It's a 68008-controlled drive, whereas Davong's MacDisk is controlled by an 8088. The Tecmar 68008 is consistent with the Mac's central processor, and, should expansion to a network be possible in the future, the Tecmar drive will be able to download and run code from one or more hosts. The Davong will require a motherboard swap.

*(continued)*

*David W. Smith is a freelance writer. He can be reached at 1602 Dove Haven, Pflugerville, TX 78660.*

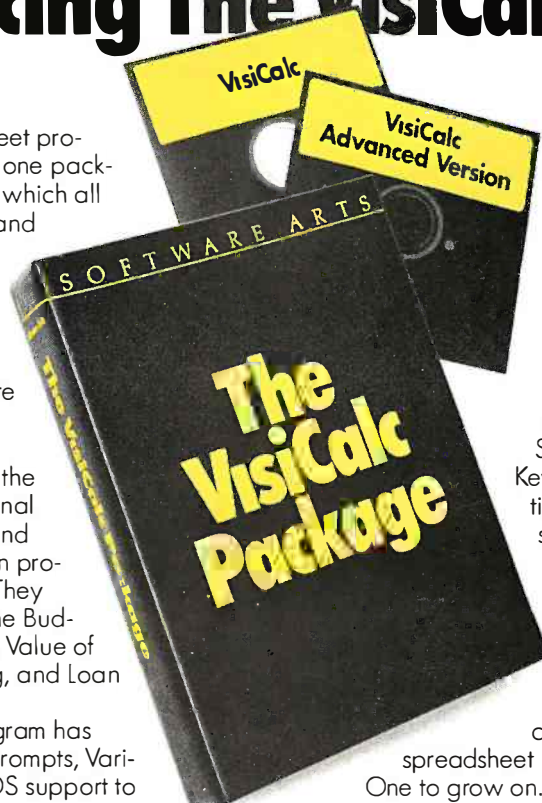
# ONE SPREADSHEET TO START ON. ONE TO GROW ON.

## Introducing The VisiCalc® Package.

Here are two powerful spreadsheet programs for the Apple®// family in one package—VisiCalc®, the standard by which all other spreadsheets are judged, and VisiCalc Advanced Version, a second generation spreadsheet for advanced users. These two programs allow you to begin with a basic spreadsheet program and later move on to a more advanced spreadsheet as your business and home needs grow.

VisiCalc is the perfect tool for the single disk-drive Apple //c personal computer. Six home budgeting and planning applications have been programmed into the spreadsheet. They are: Checkbook Balancing, Home Budgeting, Analysis of an IRA, Future Value of an Investment, Income Averaging, and Loan Analysis.

This original spreadsheet program has been upgraded with Full Word Prompts, Variable Column Widths and ProDOS support to



make the best known software program ever, even better.

VisiCalc Advanced Version is an advanced spreadsheet program for dual disk-drive systems. It contains sophisticated commands and functions to handle more demanding applications. Plus, an on line Introductory Guide to help you easily understand the program's capabilities.

Some of these advanced functions include Keystroke Memory,™ On line Context-Sensitive Help, and Print Commands for Presentation-Quality reports, among others.

And if two great spreadsheet programs aren't enough, The VisiCalc Package comes with comprehensive documentation and **The VisiCalc Book** by

Donald H. Biel. The entire package is just \$179. Stop by your nearest

computer store today and get two great spreadsheet programs in one package. One to start on. One to grow on. At one great value.

**Software Arts™**

27 Mica Lane, Wellesley, Massachusetts 02181  
Telex: 6502048741 MCI

## AT A GLANCE

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Name</b><br/>MacDisk</p> <p><b>Type</b><br/>10-megabyte Winchester hard-disk system</p> <p><b>Manufacturer</b><br/>Davong Systems Inc.<br/>217 Humbolt Court<br/>Sunnyvale, CA 94089<br/>(408) 734-4900</p> <p><b>Computer Needed</b><br/>Apple Macintosh</p> <p><b>Software required</b><br/>None; Special System version supplied</p> <p><b>Features</b><br/>8088-processor-controlled drive; 4<math>\frac{3}{8}</math> by 12 by 14 inches</p> <p><b>Options</b><br/>Winchester hard disk, sizes 10, 15, 21, 32, and 40 megabytes</p> <p><b>Price</b><br/>\$2395 (10-megabyte)</p> <p><b>Documentation</b><br/><i>MacDisk Owners Manual</i></p> | <p><b>Name</b><br/>MacDrive</p> <p><b>Type</b><br/>5-megabyte cartridge removable hard-disk system (10-megabyte Winchester hard-disk system soon to be available) 5/5 combination, 5/10 combination</p> <p><b>Manufacturer</b><br/>Tecmar Inc.<br/>Personal Products Division<br/>6225 Cochran Road<br/>Solon, Ohio 44139-3377<br/>(216) 349-0600</p> <p><b>Computer Needed</b><br/>Apple Macintosh</p> <p><b>Software required</b><br/>None; Special System version supplied</p> <p><b>Features</b><br/>68008-processor controller; 5<math>\frac{3}{4}</math> by 10<math>\frac{3}{8}</math> by 10<math>\frac{3}{8}</math> inches</p> <p><b>Options</b><br/>5-megabyte half-height cartridge, 10-megabyte half-height fixed Winchester, 5 cartridge/10 fixed combo, and 5/5 dual cartridge</p> <p><b>Price</b><br/>\$1396 (5-megabyte cartridge)</p> <p><b>Documentation</b><br/><i>MacDrive Users Guide</i></p> | <p>The Tecmar unit has two slots for its half-height drive components, and beneath that is the controller card. Under the controller card is the processor card, which includes a 68008 microprocessor, room for 128K bytes (up to 512K with 256K bytes of RAM) and two 28-pin ROM/EPROM sockets that support 2/4/8/16K-byte EPROMs (erasable programmable read-only memories). The Davong 8088 disk has its full-height drive mounted on the right side, a control panel on the left front, and a combination processor/controller card mounted on top. In addition, the board includes room for two 4816 4K by 8K RAMs and an EPROM (of up to 16K bytes). Both attach directly to the Mac through its TS-422 serial synchronous data link.</p> <p><b>OTHER FEATURES</b></p> <p>The insides of both well-constructed units are very clean. The cases of both are the same color and texture as the Mac. Both manufacturers mention placing the Mac on top of their units, and in most cases, this would be an improvement in the screen viewing angle.</p> <p>The Davong is a bit wider and shorter than the Tecmar unit. The front panels of the units are strikingly different. The Davong MacDisk has a more colorful front-panel insert, with translucent display areas where four operational messages are backlit by LEDs (light-emitting diodes). Tecmar is almost sedate in its front-panel approach. A simple one-color tag marks the unit with name and maker. In the place where a standard floppy-disk drive would have a head-load light, the Tecmar has a "hear-beat" LED. This light displays different bright and dim pulses as different tasks are being carried out: a short pulse for a write or read, long stretches for communications, and a very dim pulse during the processor's operation. If the processor stops, so does the LED.</p> <p>The back panel of Tecmar's MacDrive includes a switched 110-volt AC outlet right on the back of the unit. The manual explains that you plug the Mac into the drive and then turn the Macintosh on and off from the drive. The Tecmar box also includes a spare DB-9 connector wired in parallel with the first port. This extra connector makes AppleBus upgrading just a little simpler in that no extra connectors are needed and no Y-</p> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## EXTRA STORAGE

*Tecmar greets its customers with a very simple and explanatory users guide.*

*Unfortunately, I cannot say the same for Davong.*

cables will be necessary when multihosts start using the MacDrive.

The Davong doesn't include the little extras that Tecmar does.

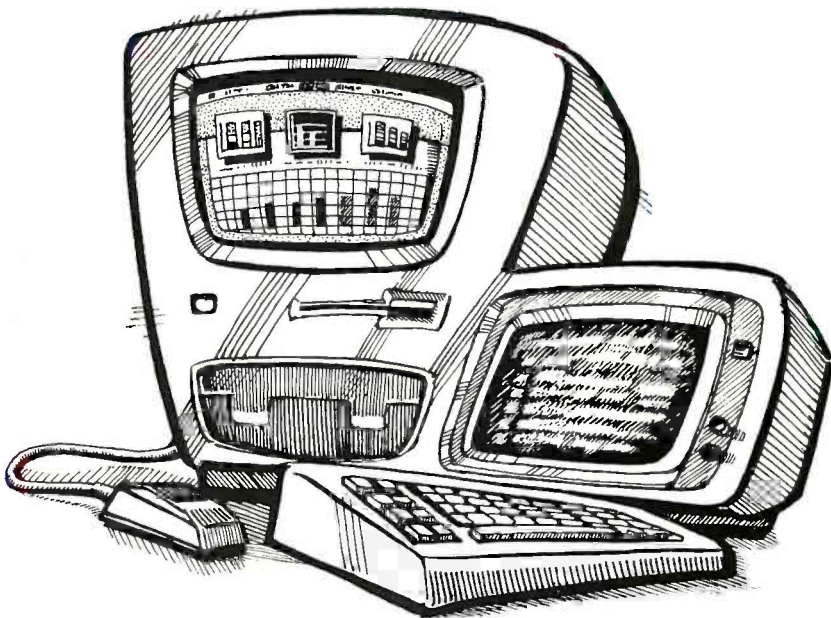
### DOCUMENTATION

Tecmar greets its customers with a very simple and explanatory users guide. The manual shows in great detail how and where to plug in the MacDrive. It shows every possible way to describe each action and every possible thing that can go wrong. It is written exceptionally well. Mention of "volumes" or "remapped sectors" or "read/write display LED" just doesn't fit in the Macintosh's market. Macintosh is the "computer for the rest of us," remember. However, the manual for MacDisk is complete and, except for the technical jargon, is readable.

The software for both drives works simply and well. Both makers provide an installed System file on a "boot" disk. In addition, Davong provides a separate disk-diagnostic routine, a disk-initialization routine, and an install routine. Why the company provides the install routine is unknown since the System file should never change. Only new versions of Finder, the locator and resource manager of Mac, should ever be updated. As for the initialization and diagnostics, they are in the Tecmar software too, and they are transparent. When a blank disk is inserted (in the case of the cartridge) or a new disk is delivered, the system automatically initializes. Same with diagnostics, except that Tecmar's report on the fly, rather than doing a special check as you request it. (Who needs to know the

*(continued)*

# WHAT DO YOU GET WHEN YOU CROSS A MACINTOSH™ WITH YOUR IBM XT™?



## BLUE MAC™!

- Hard disk access for your Mac
- An intelligent network capable of running up to 8 Macs
- Simultaneous use of your XT applications while the Macs are using the hard disk
- Very high speed I/O access
- Ability to use a printer attached to another Mac
- Ability to use a printer or modem attached to your XT
- Enhanced Mac directory management of the hard disk, however large
- User-to-user message communications

**THE BEST OF BOTH WORLDS . . . . FOR \$599.00!**

COGITATE, INC.

**A HIGHER FORM OF SOFTWARE**

24000 Telegraph Road  
SOUTHFIELD, MI 48034  
(313) 352-2345 • TELEX: 386581 COGITATE USA

MACINTOSH™ is a trademark of Apple Computer Corporation  
IBM XT™ is a trademark of International Business Machines Corporation

**DEALER INQUIRIES INVITED**

"number of sectors remapped" in a computer like the Mac?)

Tecmar's cartridge drive, as you might imagine, couldn't keep up with Davong's sealed Winchester. A modified disk write/read program, run in Microsoft BASIC, loaded 16,384 records of 64 characters (each taking 2 bytes) for a total of 2,097,152 bytes. For me to include comparison data generated from BASIC didn't seem fair, since I'd only be comparing the transfer rates. I did a direct copy of 2 megabytes with the DUPLICATE command in the file pull-down menu. This will do a machine-language speed direct copy of anything.

The results are interesting and are shown in table 1.

Just to give you an idea of the speed of the drives with respect to the built-in 5¼-inch disk, I copied the BYTE standard-length data file with DUPLICATE. First I did a file-to-file on the 5¼-inch disk, and then on the Davong and Tecmar drives. The 5¼-inch disk took 22 seconds to do the standard BASIC write and 22 seconds to read the 65,536 bytes of data. The Davong MacDisk took just 10 seconds to write and 6 seconds to read. The 5-megabyte-cartridge Tecmar MacDrive swung in pretty close with 13 seconds to write and

7 seconds to read. Keep in mind that the larger the data file size, the less time wasted.

Some other considerations: the MacDisk was noticeably louder than the Tecmar equivalent. The cooling fan is to blame: Tecmar chose a quieter and more expensive fan. There is a problem with the rubber feet Tecmar uses: they are glued on and came off almost immediately.

### SUMMARY

I would have to say that Tecmar won this one—hands down. But it is difficult to give Davong a second place. It's like saying that a Ferrari is better or worse than a Lamborghini. Both machines do their job excellently and with relative transparency to the Macintosh. But anyone who recognizes the limitations of the present Macintosh or requires more support in the future for Macintosh/Lisa local networks should take a look at the Tecmar system. ■

Table 1: Time required to copy 2 megabytes from file to file.

| Unit                                  | Duplicate time |
|---------------------------------------|----------------|
| Davong MacDisk 10-megabyte hard-disk  | 2:37           |
| Tecmar MacDrive 5-megabyte cartridge  | 4:12           |
| Tecmar MacDrive 10-megabyte hard-disk | 3:04           |

# END ALL YOUR SPELLING PROBLEMS

## THE SENSIBLE SPELLER™ WON'T LET MISSPELLINGS GET AWAY!

This unique software program, a virtual electronic dictionary, catches spelling mistakes in your writings. It actually displays misspelled words in context, suggests the correct spelling, and allows immediate replacement of misspelled words with correct ones. It derives its huge, 80,000-word vocabulary... which is all on disk... directly from the official Random House Dictionary.

Sensible Speller is friendly and fast, taking only a minute or two to correct a ten-page document. It provides room on disk to add thousands of your own words. It is compatible with nearly all Apple word processor

programs\* and runs on all Apple //c, //e, II+, and Apple-compatible computers. Yes, Sensible Speller is the "best of its kind," as stated by Softalk Magazine in its March, 1984 issue.

Sensible Speller is available for \$125 in either the "IV"\* or ProDOS version at your dealer or you may order it direct, enclosing \$1.25 for shipping. Visa/MasterCard/Check/COD welcome! And...send for a free brochure on all Sensible Software products.



**Sensible Software, Inc.®**  
24011 Seneca,  
Oak Park, MI 48237  
(313) 399-8877



\*It works with all the following word processors, with owners of trademarks indicated in parentheses: DOS 3.2 & DOS 3.3-AppleWorks & AppleWriter, all versions (Apple Computer, Inc.); Bank Street Writer (Brodebund); Format II (Kensington Microware); HomeWord & Screen Writer (Sierra On-Line Inc.); Word Handler (Silicon Valley Systems); CP/M-Wordstar (Digital Research Corp.-Micropro International); PFS:WRITE (Software Publishing, Inc.); and others. All features are not available with CP/M, PFS:WRITE & Word Handler.



BY MITCH TRACHTENBERG

---

---

# MULTIPLAN/CHART ON THE MACINTOSH

---

---

*This best-selling spreadsheet  
and its graphic complement take full advantage of Mac's high-intensity  
graphics and innovative user interface*

**B**y any standard of measure, Multiplan for the Macintosh is a winner. Not only has Microsoft managed to retain the Multiplan features that legions of spreadsheet users find so desirable, it has also managed to fully exploit Macintosh's unique graphics and user interface. By doing so, the company has created a product that rivals, and in many ways exceeds, anything else available in the spreadsheet genre, especially when combined with a companion graphics generator program called Chart (see "Chart, Multiplan's Graphics Companion" on page A90).

Not all the news is good, however. The Macintosh version of Multiplan exhibits a few idiosyncrasies, as well as some command incompatibilities with previous versions. In addition, users familiar with integrated packages may find swapping data between this spreadsheet and its graphics companion arduous.

## THE PACKAGE

Multiplan is supplied on a single 3½-inch Sony floppy disk containing the Macintosh operating system, the Multiplan program, and a Help file. Included with the disk is a surprisingly thin, 172-page instruction manual (compared with more than 400 pages in the Apple II Multiplan manual). An order form for a \$10 backup disk is also provided.

Multiplan, like its companion program

Chart, is copy-protected. Microsoft expects the purchaser to make a working copy of the programs for regular use. However, the master disk must be inserted into the Macintosh every time the computer is restarted. As a result, the possibility of disk damage due to normal wear and tear exists.

## THE SCREEN

When you first load Multiplan, the screen shown in figure 1 is presented. This screen display is a joy to behold for those who have wrestled with pre-Macintosh spreadsheet displays. Entries appear as black characters on a white background, cells are bounded by dotted lines, row and column numbers are clear, and the "current cell" is clearly identified in reverse video surrounded by a thin boundary.

The menu bar and main window will be familiar to Macintosh veterans since Multiplan's main window makes use of common Macintosh symbols. Scroll bars and arrows, title bar, sizing box, and window bars operate in usual Mac fashion. In addition, there is a formula bar between the menu bar and the main window, which shows the address and contents of the current cell. In the empty spreadsheet of figure 1, cell RIC1 (row 1, column 1) is the current cell.

One disappointment is the small size of the worksheet area that Multiplan displays. Unfortunately, worksheet clarity is gained at the expense of display

size. At its largest normal setting, the main window displays 15 rows by 6 standard (10-character-wide) columns. This compares with 20 rows by 7 columns for Multiplan on the IBM and 20 rows by 8 (9-character) columns for Lotus 1-2-3. For those who work with wide worksheets, this is not good news.

One quirky aspect of the program results in protected worksheets displaying 16 rows at a time rather than 15 rows. Room for the extra row is apparently gained by eliminating the grid lines used in unprotected worksheets.

## GETTING AROUND THE WORKSHEET

The Multiplan mouse pointer takes on different shapes as it moves across the display. These shapes correspond to the effect that a click or drag of the mouse has at various locations. When the mouse pointer is over worksheet cells ready to select a cell, it looks like a shadowed plus sign. When over the title bar, ready to move the worksheet window, it appears as a four directional arrow. Other shapes and actions are similarly logical in nature.

I am distressed by the absence of one  
*(continued)*

---

Mitch Trachtenberg (29 Inman St., Cambridge, MA 02139) edits the Macintosh newsletter for the Boston Computer Society. He is a freelance instructor, training small groups in the use of business software.

pictorial cue. To expand a formula, Multiplan accepts a click of the mouse in any worksheet cell as an instruction to enter that cell's address into the current cell's formula. At other times, a click of the mouse in a worksheet cell completes any entry in progress and selects the clicked cell. In my opinion, the program would be much easier to use if the pointer changed to indicate these different modes. Borrowing from MacPaint, I would propose using a lasso to indicate when a click of the mouse grabs a worksheet cell and places it in another cell's formula. The pointer for the other mode could simply be a bull's eye.

Getting around the worksheet is fairly simple, despite the fact that Microsoft has inexplicably eliminated the GOTO command. Clicking any cell makes it the current cell. Movement to adjacent cells is accomplished by pressing Return in order to descend, Shifted Return to ascend, Tab to go right, and Shifted Tab to go left.

Larger movements are accomplished using scroll bars. The scroll system is not a perfect solution to getting around, however. Since the scroll bars represent

the entire 63-column by 255-row worksheet, it is hard to estimate exactly where you will land when you drag a scroll box. Second, a typical move requires a horizontal scroll and a second vertical scroll. Because Multiplan doesn't cut off mouse input while the screen is updating, a click in what you thought was the current scroll box location may actually be to one side of the scroll box. If this is the case, Multiplan responds by scrolling again, generally back to where you started. This is a minor but irritating idiosyncrasy.

In addition to the scroll boxes, Multiplan allows you to select (and scroll the display to) any named range. You can also scroll to the active cell, the last cell of the worksheet, or, in a two-step process, the first cell of the worksheet. Still, it is hard to understand why Microsoft eliminated the GOTO {address} command. Such a command would provide compatibility with the GOTO commands available in the old Multiplan, Lotus 1-2-3, and most other spreadsheet programs.

Another disconcerting aspect of Macintosh Multiplan is the possibility, using scroll bars, of ending up in a sec-

tion of the worksheet that does not contain the current cell. For people trained in other spreadsheets, in which the display is scrolled by changing the current cell's location, this will cause confusion and probably some surprise changes to cells. I found myself entering material into the cell under the pointer, only to notice upon hitting Enter that my pointer was far, far away from the current cell. After a bit of use, this problem resolves itself if you adjust to the idea that you can move the display without changing the current cell.

### DATA ENTRY

Hands down, the silliest feature of previous versions of Multiplan was the ill-conceived Command menu. Instead of requesting a command by typing a slash or control character, Multiplan insisted on starting every entry with a command, except when the previous action was an entry completed with an arrow key.

Now, these machinations are unnecessary. To enter a label, you simply type the label and hit Enter, Return, or Tab. To enter a number, type the number and hit Enter, Return, or Tab. To enter a formula that might be confused with a label, precede it with an equals sign, type the formula, and hit Enter, Return, or Tab. This is an enormous improvement over preceding Multiplan procedures.

### SPREADSHEET OPTIONS

Macintosh Multiplan exhibits the standard range of spreadsheet functions and then some. It has lookup and index functions to enable one part of a spreadsheet to selectively choose data from another. Two functions—itercnt and delta—give the user control over the iteration feature used to keep recalculating circular references until they converge satisfactorily. Logical functions, such as IF, AND, NOT, OR, ISERROR, and ISNA, together with Multiplan's text string handling, allow the program to give results in English. Multiplan does, however, lack date functions like those in Lotus 1-2-3. Chart makes several additional functions available via its ANALYZE command. These functions, which generate results such as cumulative sums, trend lines, and so on, are a nice supplement to Multiplan's own.

(continued)

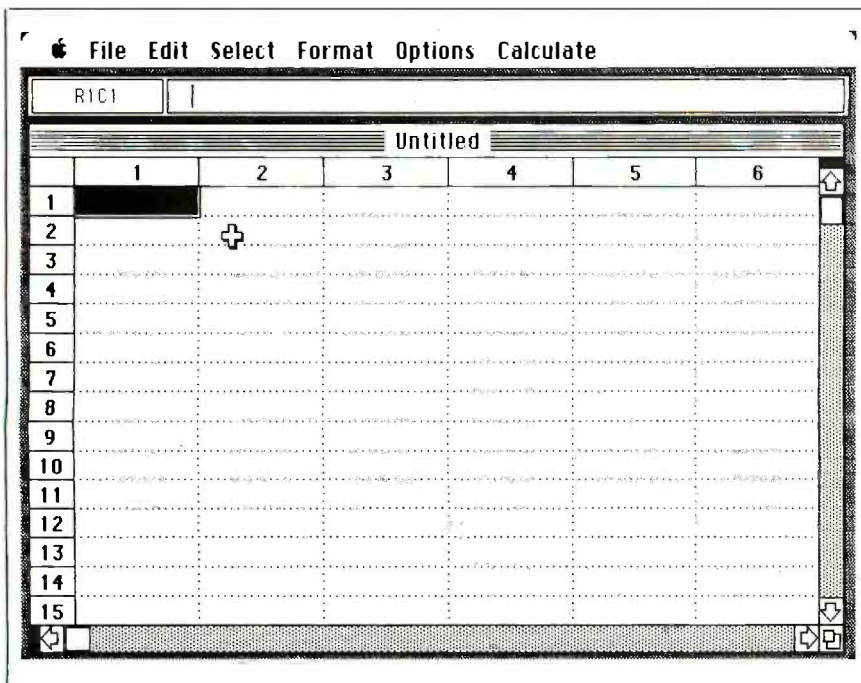


Figure 1: Multiplan's screen format is a hybrid of Macintosh and Microsoft conventions. The selected cell is highlighted in reverse video, and the shadowed plus sign signifies the cursor. The cleanliness of the overall grid is a definite plus but is offset by the limited size of the spreadsheet window—15 rows by 6 columns.

# Best Connection

## ProModem™ 1200A Apple Card Pack



It's the best 300/1200 baud 212A telephone modem for your Apple® II, II+, and IIe. "Best" because it's the easiest to install and use, provides more useful modem features for your money, and lets you add software capabilities as your needs grow.

We really do mean easy. Just plug the ProModem Card Pack into any expansion slot and connect the telephone cord. On-board intelligent software in ROM includes a simple but powerful terminal program. With a few keystrokes, you'll be "on line" and communicating.

ProModem 1200A offers you the best price-to-performance modem available with Auto-Answer and Auto-Dial, Programmable Intelligent Dialing, Built-in Speaker with Volume Control, Help Commands, Extensive Diagnostics, and more.

And when you need more sophisticated capabilities like Terminal Emulation, you're all set.

The 1200A is fully Hayes compatible. You'll be able to use most of the Apple II communications programs available.

### PRICE COMPARISON

#### PROMETHEUS

- (1) ProModem 1200A Apple Card Pack, complete with on-board software and all necessary hardware

List Price: \$449

#### HAYES

- (1) Smartmodem 1200 "standalone modem"
- (2) Serial Card
- (3) RS-232C Cable
- (4) Communications Software

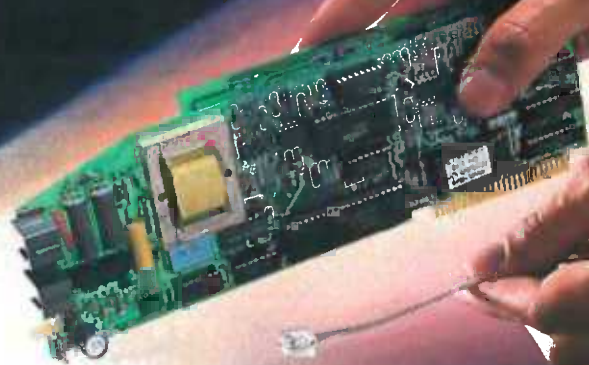
Total List Price: \$957

The "Help" Screen and "Auto redial if busy" functions make the 1200A convenient to use. The second phone jack for the telephone handset allows switching from voice to data. You get all of this, ready to use, complete with easy to understand documentation, and a telephone cord for only \$449.

See your local dealer for a demonstration. He'll show why ProModem 1200A is your best connection.

Prometheus Products, Inc.  
45277 Fremont Blvd.  
Fremont, CA 94538  
(415) 490-2370

Apple is a registered trademark of Apple Computer, Inc.



# PROMETHEUS®

To enter a reference to a worksheet cell or range into a Multiplan formula, you click the cell or drag the range. The cell or range is indicated as you press the mouse button by a slight change in the region's boundary appearance—the dotted lines become finer. The range being indicated appears and is updated instantly in the formula bar for the cell

being entered. Cells can also be entered into formulas by typing their addresses. All cell references generated by clicking or dragging a range are initially relative: that is, they identify a location based on its distance from the current cell.

The appearance of a Multiplan relative reference is unchanged from

previous versions of the program. Thus  $R|+x|C|-y|$  refers to a cell  $x$  rows down and  $y$  columns back. References can be converted from relative to absolute or vice versa with the ABSOLUTE/RELATIVE REFERENCE command on the Edit pull-down menu (or with the ^T key command). This command is a toggle type, and, in a nifty bit of programming, the name of the command that appears in the pull-down menu switches from ABSOLUTE REFERENCE to RELATIVE REFERENCE depending on the status of the command. As in other Macintosh applications, commands that cannot be used at a given moment are shown dimmed.

Adding or changing formulas is exceptionally easy with PASTE FUNCTION. Select PASTE FUNCTION and Multiplan responds with a list of available operations. Any operation can be inserted into your formula. Multiplan adds a leading equals sign if appropriate and supplies the parentheses used to bound arguments. The program will also locate your insertion point in between the parentheses.

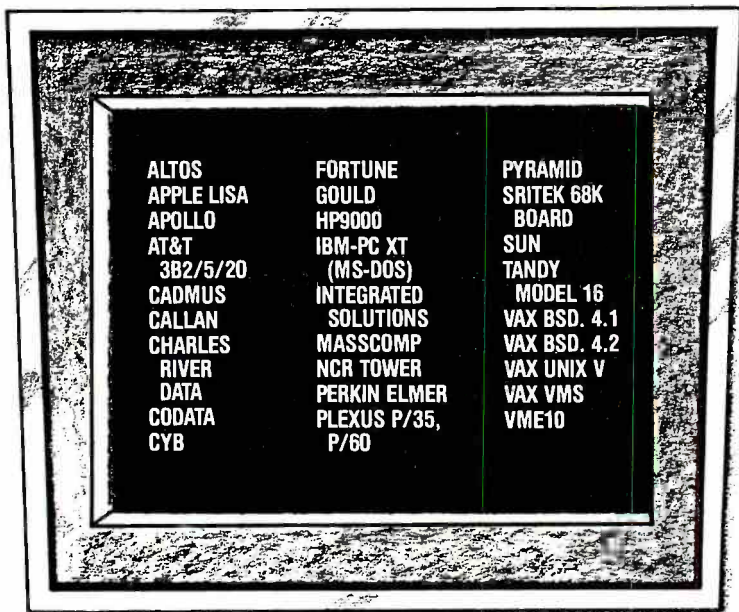
PASTE NAME works in exactly the same way. PASTE NAME allows you to choose the appropriate named range from a list of all the ranges you have defined. Together, these two commands make Multiplan formulas extremely easy to develop.

Editing entries is also easy. Moving the mouse pointer to the menu bar causes the pointer shape to change to an I-beam. When the pointer assumes this form, editing is done exactly as in MacWrite.

If, despite all of Multiplan's helpful features, you do make a mistake, you can simply undo it by selecting UNDO from the Edit pull-down menu (or typing ^Z at the keyboard). As in other Macintosh software, the UNDO command restores the worksheet to its previous state. As things stand now, there is one level of UNDO; mistakes become permanent if you don't catch them before making an additional change to the worksheet. The UNDO command itself can be undone by selecting UNDO a second time. As with the ABSOLUTE/RELATIVE REFERENCE toggle mentioned above, UNDO changes to REDO in the pull-down menu when UNDO has been chosen

(continued)

## Whatever System You Use ...



## ... there's plenty of UniPress Software from our product library

### PRODUCTIVITY AIDS

- Emacs Multi-window extensible editor
- Minimacs—Emacs without MLISP
- Phact Isam File Manager
- /RDB — Relational Database
- The Menu System

### APPLICATIONS

- OCalc Spreadsheet
- Lex Word Processing
- Leverage List Processor

In addition, we carry the UniPlus + Unix System V for the Apple Lisa and a full line of application software dedicated to the Lisa.

### LANGUAGES

- Lattice C Native
- Lattice C Cross to MS-DOS
- Amsterdam C and Pascal Compiler Kit

### SUPPORTED O.S.

- UNIX 4.1, 4.2, System III, V, V7
- VMS
- MS-DOS
- XENIX

Call or write our trained staff for more product information

## UniPress Software, Inc.

2025 Lincoln Highway, Edison, NJ 08817  
 201-985-8000 • Order Desk: 800-222-0550 (outside NJ) • Telex 709418  
 Mastercard and Visa

Japanese Distributor: SofTec Tel.: 0480 (85) 6565

Trademarks of: UniPress Software, Inc.; Lattice, Inc.; Altos Computer; Apple Computer; Apollo Computer; Western Electric; Callan; Cyb; Charles River Data Systems; Fortune Computer; Gould; Hewlett Packard; International Business Machines; Integrated Solutions; Masscomp Computer; NCR; Pyramid Technologies; Perkin Elmer; Plexus Computer; Sun Microsystems; Digital Equipment Corp.

# THE MOST REVOLUTIONARY ATTACHMENT TO THE MACINTOSH™ SINCE THE MOUSE.

The Bernoulli Box™, the cartridge disk subsystem that revolutionized mass storage for the IBM PC, XT, most compatibles, and the TI Professional, now proudly adds Apple's Macintosh to the list.

The Bernoulli Box and its 5-megabyte removable cartridges together deliver unparalleled data base dynamics. And that, more and more, is what your business needs today. Not centralized, monolithic banks of information, but data bases defined by job function and software application. Data bases that give people the versatility to work more productively.

But there is more. More performance and reliability. Transfer rates and access times faster than most Winchester. No head crashes ever. And cost per megabyte that Winchester cannot touch.

The Bernoulli Box's cartridge capacity, portability and absolute interchangeability give your business more options. You can easily build primary data bases. You can package individualized data bases, software and all—for payroll, accounting, marketing, computer graphics—in convenient, dedicated cartridges. And you can pack all of the data into a briefcase, an interoffice envelope, or even a file drawer.

The Bernoulli Box. When placed beside Apple's "computer for the rest of us," the best box you can buy. **For the dealer nearest you, call 1-800-556-1234, ext. 215. In California, call 1-800-441-2345 ext. 215.**

**Ω-MEGA™**

IOMEGA Corporation  
1821 West 4000 South  
Roy, Utah 84067



THE  
**BERNOULLI**  
BOX™

once. Thus even the menus in this program provide current information.

Multiplan can be set to recalculate automatically after each entry, or to recalculate only when requested to do so. What's different in Multiplan from other spreadsheets is the ability to suspend recalculation in order to respond

to keyboard or mouse commands. Even when recalculation is lengthy, there is no need to stop work while number crunching proceeds.

Multiplan has always excelled in the ease with which formulas or data can be copied from place to place. To copy the contents of one cell to subsequent

cells, you simply drag the mouse over the original cell and the copy-to range and choose the FILL RIGHT command from the Edit menu. An identical process is used to FILL DOWN. FILL RIGHT and FILL DOWN, like most commonly used commands, can also be selected from the keyboard by ^R and

## Chart, Multiplan's Graphics Companion

Two things can be said about Chart at the outset. First, it is an extraordinary tool for the creation of presentation graphics. It provides a wide variety of formats, allows customization of graphs in almost every imaginable respect, and has enough automatic features to be learned quite rapidly.

Second, until the Macintosh is able to run applications concurrently, Chart cannot really be used with Multiplan to generate instant what-if-type graphs.

The version of Chart I've been using is a prerelease copy, and thus subject to change. Nonetheless, Chart's documentation was final when this article was prepared, so there should be few, if any, major surprises.

Chart will look familiar to anyone who has used Macintosh Multiplan. It has the same File, Edit, and Format pull-down menu names as Multiplan, along with some new ones: Data, Gallery, and Chart.

The initial display presents two windows: a small one in the foreground, labeled New Series, and a large window in the background, labeled Untitled. Data is entered into Series windows, and the resulting Chart is drawn in the larger window.

To give you an idea of how easy it is to use Chart, let's walk through the steps involved in plotting a four-number sequence. We will completely ignore the bells and whistles Chart offers, as well as the program's manual. Results of the steps are illustrated by figures 1, 2, and 3.

The numbers we'll use are the total quarterly sales from a Multiplan printout: 310, 530, 295, and 800. Regardless of where the pointer is on the display, the moment you type the first digit a new window appears, labeled "Series HH:MM:SS XM." The time is filled in with the actual Macintosh clock time. This window, aside from the title, is a copy of the New Series window. It is divided into two columns, labeled X and Y, which accept "Categories" and "Values" (Chart's terminology). A Plot Series "button" appears above the two columns, and there is a blacked-out box labeled "Order." The number you type appears in the Y column, and the X column is automatically given the sequential value 1.

As you continue entering the values, separating them by presses of the Return or Enter key, Chart provides sequential numbers in the X column. Mistakes can be edited as in MacWrite or Multiplan; the pointer becomes an insertion point, assumes the shape of an I-beam, and can be located by clicking the mouse. Dragging will select material, which can then be deleted, cut, or copied.

Once you have made the four entries, you click the Plot Series box. In a few seconds, the large window is filled with a bar chart. A click in this large window moves it to the foreground. Figure 1 illustrates Chart's data-entry screen.

The first nonintuitive step comes when you want something other than a bar chart. When this is the case, you pull down the Gallery menu and choose the type of Chart you are interested in. Let's choose a pie chart. Chart presents a "Gallery" window (see figure 2), showing 6 styles of pie charts. Clicking any one of the Charts shown selects it, and clicking OK causes Chart to replot the data.

### CUSTOMIZING THE CHART

Pulling down the Chart menu shows an option labeled "Add Legend." When you choose this option, the chart is replotted to make room for a legend, which

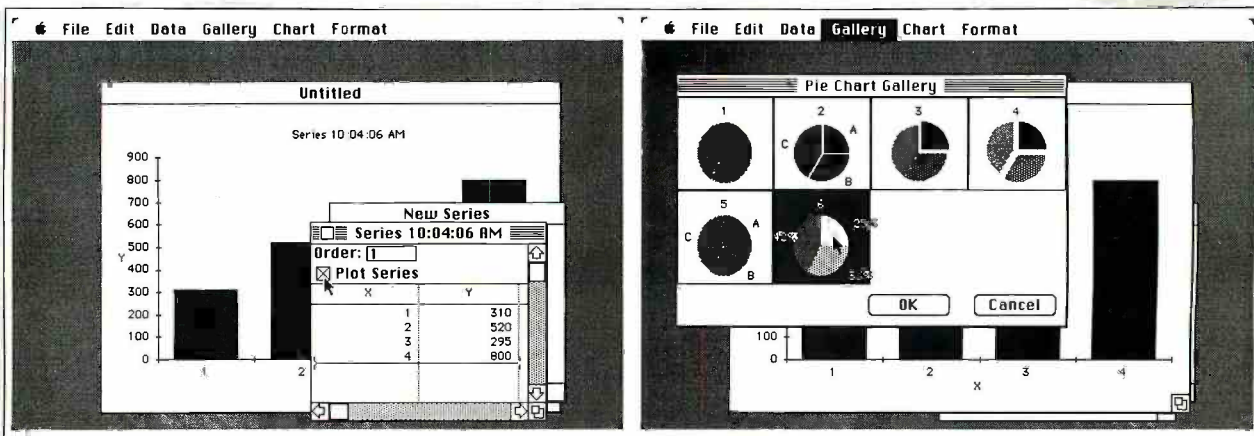


Figure 1: Chart's data-entry screen provides users with two windows on graphics activity.

Figure 2: Chart offers several styles of pie charts.

^D, respectively. Entire cells or blocks of cells can be cut or copied from the worksheet into the Macintosh Clipboard. From here they can be pasted into other sections of the worksheet, into other worksheets, or even into other application programs such as Chart.

Multiplan includes a single-key sort, which acts only on full rows, sorting the rows based on the contents of the selected column. Sorts can be in ascending or descending order. This limited sorting ability represents the extent of Multiplan's database functions. Macintosh Multiplan has extensive

formatting control over the worksheet. Selected cells or regions can be formatted to display data as integers, dollars, percentages, or in scientific notation. The number of decimal places displayed is also optional. The whole worksheet can even alternate between

(continued)

matches patterns or markers on the chart with the entries in the Y column of the series window. This is not particularly helpful in a series like my sample, in which I have simply let Chart fill in the Y column with sequencing numbers. But Chart allows you to create series windows in which the Y column is filled with text or sequential dates, making a legend very helpful.

Chart offers numerous options. Text can be boldfaced, italicized, or both. Text can be made small, medium, or large. You can change border widths, as well as the style of borders (from rectangular to beveled, double, round, or shadowed). You can select background patterns for different regions. Changes made to a chart in one format are preserved to the extent possible when additional formats are chosen. Figure 3 illustrates some of the display features available in Chart.

Users are given similar control over the display of data in the Series windows, which governs the presentation of the data on the axes of the chart. Category and Value entry columns can be independently formatted to display numbers as integers, fixed numbers with a set number of decimal places, percentages, dollars, and so on. Custom formats can also be designed by adding text before and/or after the value.

When a Series window is active, you can set the redrawing of the chart to manual, but when changes are made to the chart itself, every change causes a complete redrawing. On my version, redrawing took between 5 and 10 seconds: too long for comfort. Because much of the work of varying placement, type style, etc. is going to be trial and error, these delays add up to considerable wasted time.

**ADDING SERIES**

According to the manual, Chart can plot several series up to a total of about 100 data points. You enlarge series by either typing into the New Series window or choosing a series type from the Data menu. This is also the method used to change the Series Name, Category Name,

and Value Name, which become the chart's title, x-axis label, and y-axis label, respectively. Depending on the type of series chosen, Chart will assist you by filling in the Categories column automatically. For a date series, for example, you can instruct Chart to start with 1/1/82 and increase each entry by three months.

Not all open data series need to be plotted at a given time. Using the LIST command from the Data pull-down menu, you can select which series you want listed and which series you want plotted. In addition, the order in which series are plotted can be varied by changing the number in the "Order" box of the series you wish to change. This is important because the first series plotted is the source of the chart title and axis labels.

Whenever a series window is in the foreground, Chart offers an Analysis feature from the Data pull-down menu. This consists of several operations on data series—Average, Trend, Growth, Cumulative Sum, Difference, and Percent—each of which generates a new series, which is labeled with the name of the analyzed series and the type of analysis that has been performed. The analysis series can be plotted like any other data series. A statistical feature generates additional, unplotable information (number of points, median, standard deviation, correlation coefficient, etc.).

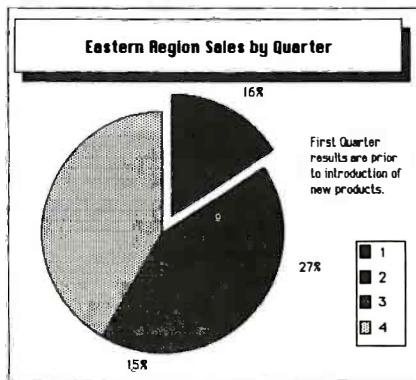


Figure 3: Graphs generated can be adorned with a variety of textures for appealing appearances.

**AT A GLANCE**

**Name**  
Chart

**Type**  
Graphics program

**Manufacturer**  
Microsoft Corporation  
10700 Northrup Way  
Bellevue, WA 98004  
(206) 828-8080

**Computer Needed**  
Apple Macintosh or Lisa running MacWorks

**Price**  
\$125

**Documentation**  
184-page manual

**Audience**  
Anyone desiring high-quality graphics from numerical information

**SORTING AND PASTING**

Chart has a Sort option that allows you to enter items in random order and sort them in ascending or descending order. This can be useful when entering unalphabetized information and then charting it in alphabetical order.

Chart will import from Multiplan worksheets or from any text file. In a text file, items must be separated by commas or tabs, and each line must end with a Return. Every line will be treated like a Multiplan row. When importing data, Chart chooses the longest dimension of the region to be imported and uses this to divide the information into series. In other words, if there are more columns than rows (the rows are "longer") in a region being imported, each row is treated as a series. If there are more rows than columns (the columns are "longer"), each column is treated as a series.

The transfer of data is accomplished via

(continued)

## AT A GLANCE

### Name

Microsoft Multiplan for Apple Macintosh

### Type

Electronic worksheet program

### Manufacturer

Microsoft Corporation  
10700 Northup Way  
Bellevue, WA 98004  
(206) 828-8080

### Format

3½-inch floppy disk (Macintosh format disk)

### Computer

Apple Macintosh or Apple Lisa running  
MacWorks

### Documentation

Three-part, 172-page manual, including  
"Learning Multiplan," "Using Multiplan,"  
and "Multiplan Reference"

### Price

\$195 (backup disk costs an additional \$10)

### Audience

Anyone doing spreadsheet-type calculations

displaying numbers with or without commas inserted.

All entries, including values, can be formatted to display with left, right, or centered orientation in their cells. Over-sized entries, when centered, spill into adjacent cells. This makes centering section titles a simple matter. Because labels always overflow into adjacent cells as long as the adjacent cells are empty, there is no need to format cells with the CONTINUOUS command, as in previous Multiplans. Alignment commands are also available from the keyboard through using the three adjacent and appropriately ordered keys ^F, ^G, and ^H.

Multiplan's useful Show Formulas option is unchanged from previous versions of the program.

Multiplan worksheets can be saved in either Normal or SYLK (symbolic link) format. SYLK files are ASCII (American Standard Code for Information Interchange) encoded for telecommunicating worksheets to and from other computers. However, saving and loading SYLK files are slow. My benchmark file took about a minute to save and slightly more than a minute to load in SYLK

format (table 1). Macintosh Multiplan cannot directly import worksheet files from non-Multiplan spreadsheets, such as VisiCalc or Lotus 1-2-3.

## PRINTING

Macintosh Multiplan excels at printing. Page breaks are determined based on the information provided in the Page Setup dialogue box (figure 2) and are visible on the screen as dashed lines. Choosing SET PAGE BREAK from the Options pull-down menu inserts a page break above and to the left of the selected range. User-set page breaks, which can be deleted, appear with longer dashes than the automatic page breaks, which cannot. This is yet another example of the exceptional use Multiplan makes of the Macintosh high-resolution display.

Multiplan can print sideways, simplifying the printout and assembly of wide spreadsheets. Unfortunately, it cannot print out a continuous sideways form.

The printing process involves the creation of a Print file. Because this takes up disk space, you may run into problems trying to print with a nearly full disk. When this is the case, you are

(continued)

the Clipboard. The region of the Multiplan worksheet that you wish to import is copied to the Clipboard. Multiplan is shut down. Chart is loaded, and the data is "pasted" with the command on the Edit menu. Depending on the type of series that is open when the PASTE command is issued, Chart will use imported text as Category labels. Unfortunately, there is no way of importing names for the Series, Categories, or Values; these must be changed manually by using the Data menu's window options.

Charts can be linked to Multiplan worksheets by choosing the PASTE AND LINK command to import data. Once linked to a worksheet, Chart will automatically check the worksheet for the most recent data before plotting. Using this feature really requires two disk drives, although a great deal of disk juggling can accomplish the same end. It is impossible to link to a word-processing document.

### SAVING, LOADING, PRINTING

Files are saved with the SAVE or SAVE AS command on the Edit menu. Both the chart format and the data series are

saved together. While formats and data are saved together under a common filename, it is possible to load only a saved format or only the saved data series. Loading saved data causes it to be added to the list of series already open, while loading a saved format wipes out the open format. This feature means that once a standard format is painstakingly established, you can easily plug different data series into it. In part, this compensates for the slowness of customizing a chart.

Chart's Page Setup and Print dialogue boxes match those of Multiplan. The printout is scaled to fill the page properly according to the information provided in Page Setup. As a result, the printed resolution often exceeds that of the display window. In my prerelease copy, the geometry of a printed graph sometimes varied from that of a displayed graph. While at first disconcerting, this feature always improved the appearance of the printed chart.

If Print is selected when a series is in the foreground, the printout will consist of the series rather than the plot, a useful method of generating tables.

## DOCUMENTATION

Chart's 184-page manual matches Multiplan's in size and format. Since Chart is a harder program to learn than Multiplan, I believe the documentation should include more examples than it does. Nonetheless, this manual, like Multiplan's, does an excellent job of giving a user both a quick tutorial and a fairly comprehensive reference.

Chart has so many options it will take a good deal of time for users to become proficient. Yet it has sufficient automatic choices that a new user can create acceptable graphics within an hour. Microsoft has done a good job of matching Chart and Multiplan; the two programs are similar enough in operation that learning one helps substantially in learning the other.

Chart's analysis features are a pleasant surprise and make the program genuinely useful for stand-alone information analysis. In combination with MacWrite, Chart could be a worthwhile purchase even for those who will not be using Multiplan.

—Mitch Trachtenberg



warned to move some documents and prompted to try again.

Printing quality is exceptional in both standard and high-quality modes, but I judge the draft-quality printout on Apple's Imagewriter unacceptable. There are too many circumstances in which columns of numbers do not align properly.

**HELP AND DOCUMENTATION**

Multiplan's Help facility, entered by choosing ABOUT MULTIPLAN from the menu, is thorough, well written, well organized, and easy to navigate. Unfortunately, it is merely an on-line manual—not a context-sensitive Help facility. Context-sensitive Help is nothing new, and it is surprising that designers who were sophisticated enough to make command names context-sensitive didn't bother to make Help context-sensitive.

On first sight, I thought the written

manual supplied with Multiplan looked rather skimpy. After using the manual, I think it is a model of the correct way to compile documentation. In its 172 pages, it includes a quick tutorial ("Learning Multiplan"), a good how-to section ("Using Multiplan"), and a well-organized reference, glossary, and index. This is a manual that explains things quickly and clearly. Three cheers for the Microsoft technical writers.

**OTHER FEATURES**

An invaluable aspect of Macintosh Multiplan is its ability to link worksheets together. Instead of the bewildering external COPY command of previous Multiplans, Macintosh Multiplan uses a PASTE and LINK command. Cells from a supporting worksheet are copied into the Clipboard, which keeps track of documents' sources. Then, the source worksheet is closed, the worksheet where the information is to go is

opened, and cells are pasted and linked into the open worksheet. Multiplan presents an alert box to let you know what you are linking and gives you a chance to cancel as well. Once the link is established, Multiplan shows the source of the linked information—both the document and the cell—in the formula bar when the linked cell is made the current cell.

Multiplan also provides versatility in the use of names. You can assign any range in Multiplan a name of as many as 31 characters. When there is text in the current cell of the selected range, Multiplan proposes this text as the range name. This makes it very easy to name worksheet rows and columns with the labels used as headings.

You can also protect information. After removing cell protection from those cells in which data entry is to be permitted, you select PROTECT DOCUMENT from the Options menu. Protected documents are displayed without grid lines or row and column headers, and unprotected cells within them are underlined.

You can create hidden columns by setting the width of any column to zero. Confidential information can be placed in these hidden columns, and, when the worksheet is protected, there is no hint to an inexperienced user that these columns exist. Hidden columns are not printed out.

Macintosh Multiplan can display as many as four windows on one worksheet. Windows are split by dragging the dark "window bars" into the scroll bars.

Multiplan allows you to freeze any number of rows and columns as titles, making it easier to find your way in large worksheets. Titles are indicated on the display by a solid line extending out from the row or column header, thus separating them from the remainder of the worksheet.

Judged on its merits as a spreadsheet, Macintosh Multiplan scores high marks. It has a wide range of functions, and its ease of use is exceptional. The Macintosh version of Multiplan takes advantage of the Mac's high-resolution display, giving substantial amounts of worksheet information via visual cues. Printing, formatting, and file handling are unmatched thanks in large measure to the Macintosh environment. ■

Table 1: Spreadsheet performance benchmarks.

| Hardware/Software Configuration | Recalc (seconds) | Load (seconds) | Save (seconds) | Disk Storage Available (kilobytes) |
|---------------------------------|------------------|----------------|----------------|------------------------------------|
| Macintosh/Multiplan             | 7*               | 8              | 8              | 11.7                               |
| IBM PC/Multiplan                | 9.5              | 7              | 8              | 10.6                               |
| IBM PC/Lotus 1-2-3              | 3                | 15             | 13             | 23.1                               |

\* Keyboard data entry available during this procedure.

The screenshot shows the 'Page Setup' dialog box with the following settings:

- Paper:**  US Letter,  R4 Letter,  US Legal,  International Fanfold
- Orientation:**  Tall,  Tall Adjusted,  Wide
- Print Row and Column Numbers
- Print Gridlines
- Page Header:** &cSales Figures for the Eastern Region
- Page Footer:** &B&D&r&t4
- Margins:**
  - Left Margin: 0.75
  - Right Margin: 0.75
  - Top Margin: 1
  - Bottom Margin: 1

Figure 2: Multiplan's print options are numerous. Here the Page Setup dialogue box prompts users to select a variety of print parameters. Page breaks are identified on the display, and sideways printing is supported.

# EVALUATING THE MACINTOSH FINDER

*The Macintosh's operating system is friendly, but at what price?*

**T**he Finder: in a world of operating systems with names like MS-DOS, XENIX, and CP/M-86, the name of the Macintosh's new operating system sounds both friendly and nontechnical. That's what Apple had in mind.

Early in the Macintosh design process, Apple set an objective—to make its new computer immediately useful to a novice. Apple's computer needed an operating system that was easy to learn. To this end, Apple designed a window and mouse operating system, called the Finder, using the graphic symbol concepts the corporation had developed for its more expensive Lisa computer.

The Finder is friendly to the novice. People with little or no computer experience can sit down before a Macintosh and perform useful work in a short time. But users are novices only once, and more experienced computer users who are new to the Macintosh may find conventional command-oriented operating systems more intelligible.

## INTERNAL ORGANIZATION

The Finder is only the top level of a multilevel Macintosh operating system. The lowest level consists of various hardware interfaces and drivers and occupies about a third of the 64K-byte ROM in the Macintosh. The next level is the user-interface toolbox, which contains a wide variety of routines for implementing complex window/mouse-based programs. This code occupies the remaining two-thirds of ROM. At the highest level of these ROM routines is the Finder program itself, stored as a disk file. The Finder has an accompany-

ing file, called the System file, mainly used to store font images, icon images, and text messages but also some code. The Finder program manages the Macintosh's desktop. It is equivalent to the command-line interpreter part of a more conventional operating system.

The Finder is a rather large program. If it were to stay in memory all the time, little memory would be left for application programs. Therefore, the Finder is dumped from memory whenever you start an application program. This differs from most microcomputer operating systems, which stay in memory and provide an interface between the application program and the hardware. Macintosh application programs do not work through the Finder; they access the Macintosh hardware by calling the routines in ROM on their own.

When you return to the Finder, the computer essentially performs a "warm boot" and reloads the Finder from disk. This makes quitting an application program a relatively time-consuming task (often taking 15 or 20 seconds).

## FINDER CONCEPTS

The Finder is built around several key concepts: the desktop metaphor, data as objects, mouse integration, and the shared user interface.

**Desktop Metaphor:** The computer's screen can be represented as a desktop. A number of items can be present on the screen "desk" at one time, just as you can have a calendar, file folder, and notepad on an actual desktop.

**Data as Objects:** Data, whether in programs or files, can be represented as objects on the desktop. You can move

them around. The Finder assigns graphic symbols (called icons) to such data-objects.

**Mouse Integration:** The mouse is an integral part of the Finder; it controls the cursor and is your interface to the operating system. The Macintosh does not include any cursor-control keys, and you cannot use the Finder without using the mouse.

**Shared User Interface:** The Macintosh provides a consistent user interface for all programs. This ROM (read-only memory) interface allows different programs to share and exchange data. To run efficiently, all software must adhere to this common interface.

## THE FINDER AT WORK

Suppose you want to use your Macintosh to write a letter. The basic steps are start the computer, load and run a word-processing program, and copy the newly created letter to a separate disk for backup. (I'll ignore printing the letter for the purposes of this example.)

When you first turn on the Macintosh, the screen prompts you to insert a disk by displaying a disk icon with a question mark. (You may turn the computer on with the disk already in the computer if you wish.) After you insert a disk, the desktop is set up, and an icon representing the disk you inserted is displayed in the upper right-hand

*(continued)*

---

Mark S. Jennings is president and founder of Digital Kinetics, a small firm specializing in technical engineering software and user manual development. He can be contacted at POB 3203, Durham, NC 27705.

Perfect Gift  
for your Favorite Investor

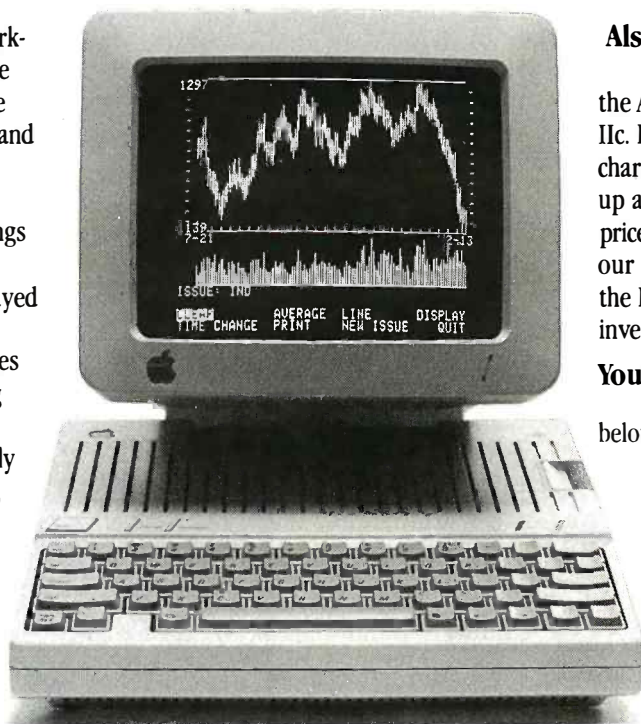
# “Now when I talk my broker listens.”

## Dow Jones Investor's Workshop™ and the Apple® IIc

The Dow Jones Investor's Workshop™, developed especially for the Apple IIc, helps you understand the market and your portfolio, so you and your broker can become a more effective team.

The Investor's Workshop brings you:

- The latest stock quotes (delayed a minimum of 15 min.) and business news from Dow Jones News/Retrieval®, the leading online information service.
- Reports that show you exactly what your portfolio is doing, at the touch of a few keys.
- Charts\* that give you a clear picture of your stocks' performance, helping you know when to buy and when to sell.



### Also Runs on the IIe and II Plus

The Investor's Workshop runs on the Apple® IIe and II Plus, as well as the IIc. It's so easy to use, you'll be creating charts and reports moments after you're up and running. With a suggested retail price of \$149 and full support from our toll-free Customer Service hotline, the Investor's Workshop is a value any investor can appreciate.

### Your broker will want to listen.

For a free brochure, mail coupon below or call:

**1-800-345-8500  
ext. 240**

(Alaska, Hawaii and foreign call:  
1-215-789-7008 ext. 240)

## Dow Jones Software™

Circle 684 on inquiry card.

For a free brochure on Dow Jones Investor's Workshop™ send this coupon to:  
Ms. Lynn Filippone, Dow Jones & Co., Inc. P.O. Box 300, Princeton, N.J. 08540.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Phone Number(s) \_\_\_\_\_

B-12

\*The chart in this ad (and, incidently, in most Apple ads for the IIc) is a Price and Volume bar chart that shows the performance of the Dow Jones Average over a six-month period. You can also construct Moving Averages and Trend Lines.

Dow Jones News/Retrieval is a registered trademark of Dow Jones & Co., Inc. Dow Jones Investor's Workshop is a trademark of Dow Jones & Co., Inc. Apple and the Apple logo are registered trademarks of Apple Computer, Inc.

Copyright © 1984 Dow Jones & Company, Inc. All Rights Reserved.

corner of the desktop (figure 1). The name of the disk ("Write" in this example) is displayed underneath the icon. Write contains the word-processing program you will be using.

To access the contents of Write, you select the disk by moving the pointer over the disk icon and pressing the mouse button. (The pointer is a little arrow on the desktop that you move around with the mouse.) This causes the icon to darken, indicating that Write has been selected. Next, you move the pointer up to the menu bar (the top line of the screen where various menu categories are displayed) and position it over File. When you press and hold down the mouse button—an operation called "dragging"—the menu choices under File pop down from the menu bar like a window roller shade (figure 2). Since you want to "open up" the Write disk, you move the pointer down to the OPEN command and release the mouse button. This opens a window on the desktop that displays the contents of Write (figure 3).

One of the files displayed in the window is the word-processing program you want to use—MacWrite. Starting the word processor involves the same sequence of steps used to open the disk: you select the MacWrite icon by clicking on it, then you drag the File menu down to the OPEN command. This opens a new window for the word-processing program (figure 4).

After exiting the word processor, the Finder dumps you back to the desktop. As you can see in figure 5, a new icon is now visible (labeled "Smith 5/19"); it represents the document file for the letter you wrote with MacWrite.

To back this file up, you need to copy it to another disk. First you need to put the backup disk on the desktop. If you have two disk drives, you simply insert the backup disk in the second drive. If you have a single-drive Macintosh, you need to eject the Write disk by selecting the Write disk icon and selecting Eject with the File menu. You then can insert the backup disk. In either case, a new disk icon (previously labeled "Backup") representing the backup disk appears on the screen.

Copying a file involves dragging its file icon to the desired destination. In this case, you need to drag the Smith 5/19 file icon to the Backup disk icon (figure

6). The Finder will then copy the file. If you have a single-drive Macintosh, you are in for a few disk swaps. (The Macintosh always ejects a disk and prompts you for the name of the next disk it

wants during disk swaps.)

### FINDER PERFORMANCE

But how well does the Finder perform? I evaluated the Finder in seven general

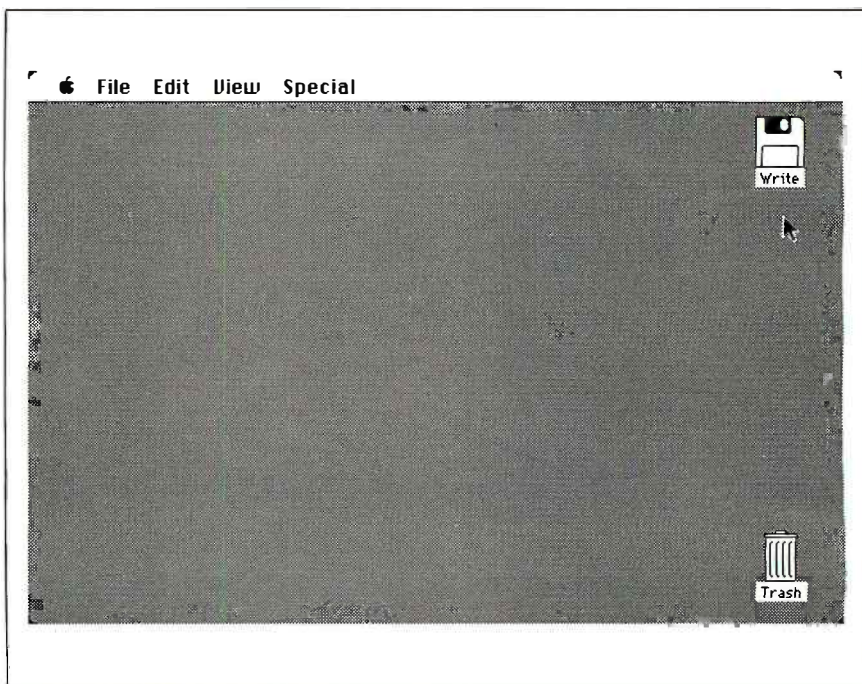


Figure 1: The Finder's desktop. The disk icon in the upper-right corner of the desktop represents the disk used to boot the computer. The Trash icon in the lower-right corner is used to dispose of files.

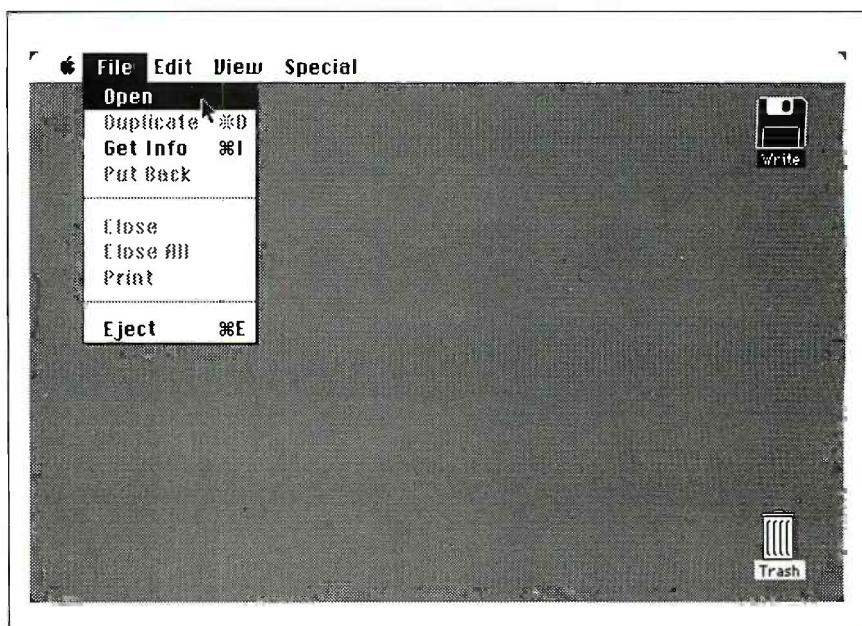


Figure 2: Using the pop-down File menu to open a disk.

## THE MACINTOSH FINDER

areas: speed, ease of use, hardware insulation, flexibility, overhead, interfacing capabilities, and ease of program development.

Although this is not intended to be a

rigid evaluation, with benchmarks and the like. I used MS-DOS 2.0 (running on a floppy-disk-based IBM PC) as a general yardstick for comparison.

Speed: The Finder seems very quick

and responsive, as long as disk I/O (input/output) is not involved. Window operations (resizing, opening/closing, and scrolling) are virtually instantaneous.

Unfortunately, the small Macintosh memory necessitates frequent trips to the disk drive. In these cases, the Finder seems quite slow compared to MS-DOS. Opening or quitting an application program typically takes from 15 to 30 seconds (30 to 60 seconds for the round trip). MS-DOS can typically load or quit application programs in a few seconds. Inserting or ejecting a disk takes from 2 to 15 seconds of computer time depending on the configuration of windows for the disk and how many disk icons are on the "desktop." With MS-DOS, disk handling is not under software control, so no computer time is required. Finally, the Finder takes from two to five times longer than MS-DOS to copy files from disk to disk. This disadvantage is most pronounced when comparing copy times on single-drive computers.

At times, these delays make the Finder cumbersome. For example, suppose you wanted to copy one small file to several different disks. With the Finder, you need to go through an ejection/insertion step for each disk just to get each disk icon on the screen; this can easily take 20 or more seconds of computer time per disk. With MS-DOS, you can perform this task as quickly as you can get disks in and out of the drive.

If your work keeps you in application programs the majority of the time, these delays make little or no difference. However, if you are running several different programs (especially with a single-drive Macintosh), these delays can become very annoying.

Ease of use: For novice users, the Finder is much easier to learn than MS-DOS. Most first-time Macintosh users are able to understand the basics of the Finder within an hour with little or no reference to the manual. The novice MS-DOS user had better plan on some serious study of a needlessly complex manual followed by a few tough initial hours at the computer.

While the first hour with the Finder may be bliss, later hours may not be as smooth. First, the Finder has a great deal of hidden behavior, and the non-technical manual glosses over explana-

(continued)

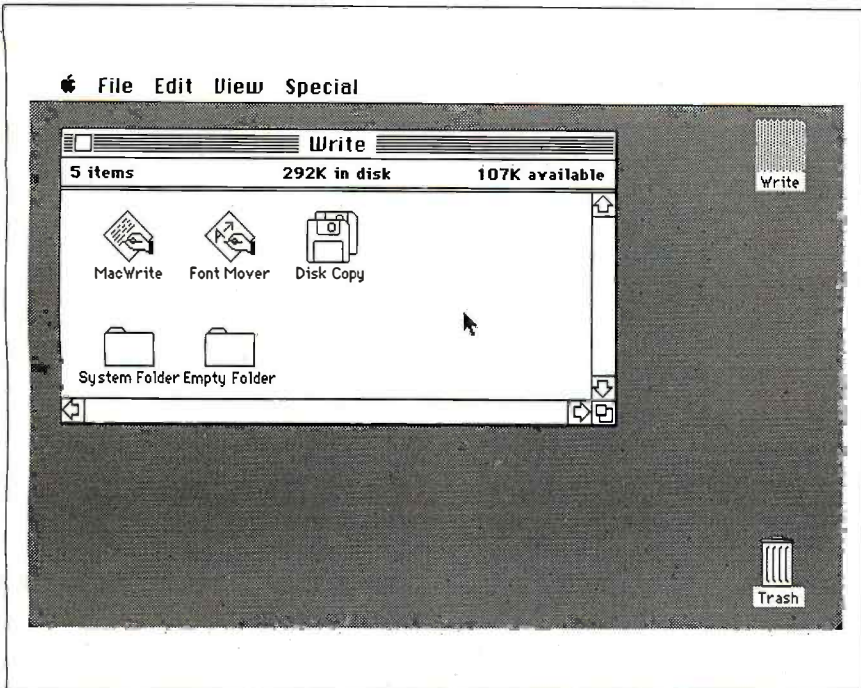


Figure 3: The desktop after a window has been opened for the Write disk. The top three icons in the window represent application and utility programs, while the lower two icons represent folders containing files.

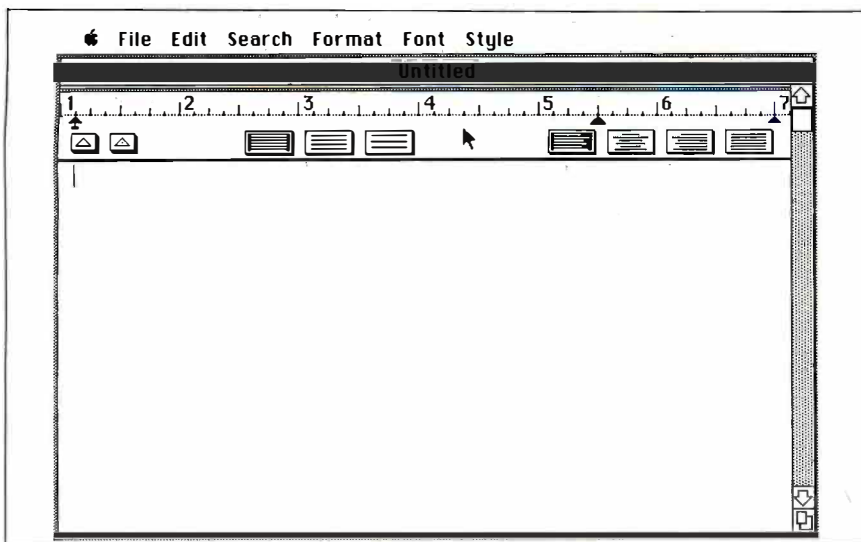


Figure 4: The MacWrite word-processor window. The bar on the right side of the window is used to scroll the document being worked on. The box at the bottom of this bar is used to resize the window. The small box in the upper-left corner of the window is used to close the window.

tions with an "I'd-only-confuse-you" sort of style. Second, efficient use of the Finder often requires careful technique in order to avoid memory and disk-space limitations (see the sidebar, "Tips for Single-Drive Users"). These techniques require a fundamental under-

standing of the Finder, which goes against its basic principles. Finally, the Finder gives up nothing to MS-DOS when it comes to cryptic keystroke/mouse sequences for a few commands (see table 1).

Hardware insulation: The Finder does

an excellent job of insulating users from the Macintosh hardware. Finder users can completely ignore issues like disk formats, serial-port configuration, file buffers, and device drivers because the Finder ignores this Macintosh hardware. While MS-DOS lets you access the serial port directly from the operating system, the Finder provides no such support; you have to use a separate application program.

Flexibility: One way to make an operating system easy to use is to limit the number of things it can do. This is the Finder's approach, and it does limit its flexibility. Here is a partial list of advanced operations supported by MS-DOS that are absent from the Finder: tree directories, batch processing, automatic batch-file execution, user-directed disk repair, user-installable device drivers, RAMdisks, I/O redirection, sorting, and filters. Of course, the first release of MS-DOS did not have many of these things, and future releases of the Finder may incorporate features that will make it more flexible. But these add-ons are likely to compromise the Finder's basic simplicity.

The Finder does support a feature that allows files to be placed in "Folders," enabling you to organize your desktop in a hierarchy similar to MS-DOS's tree directories. Unfortunately, this structure extends only to the organization of icons on the desktop and does not allow you to set up separate directories, each insulated and separate from one another. This is no great problem for a Macintosh with its 3½-inch disks, because the number of files on any disk is usually small. A hard-disk Macintosh, on the other hand, may have thousands of files, and the lack of separate directories could be a problem.

Overhead: For the Finder, it can be described in a word: high. Apple has done quite a job of squeezing an incredibly complex operating system into a small amount of code, but the disk space and memory requirements tend to push the Macintosh's limited resources.

Table 2 presents a comparison of the disk-space overhead (the amount of disk space required to store the operating system) between the Finder and MS-DOS. Memory overhead (the

(continued)

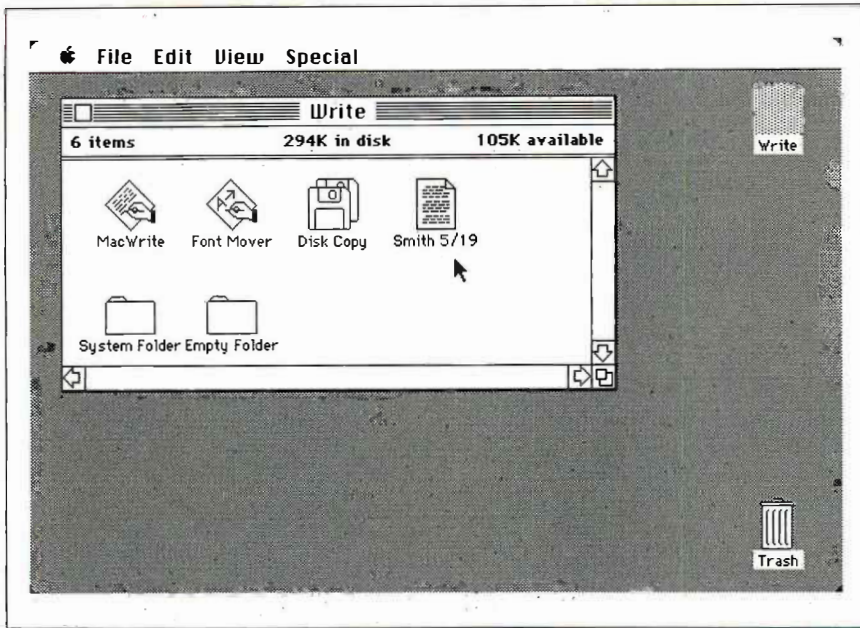


Figure 5: The desktop after quitting the word processor. A new icon representing the letter just written is visible.

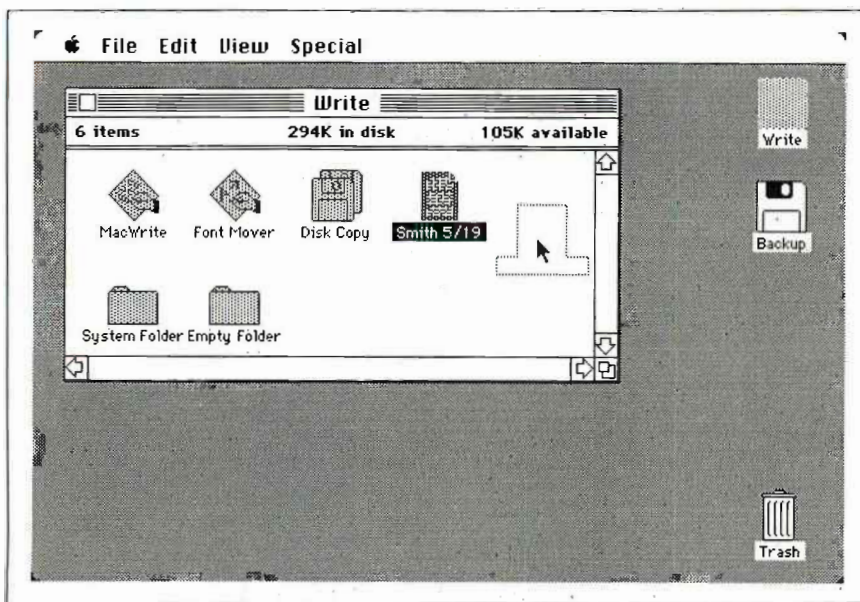


Figure 6: Copying a file from one disk to another. The file "Smith 5/19" is dragged over to the backup disk. While in transit, the outline of the document follows the pointer.

## Tips for Single-Drive Users

Apple has been widely criticized for providing only one disk drive in the basic Macintosh. While two disk drives are definitely desirable, it is certainly possible to make productive use of a single-drive Macintosh. All it takes is attention to these techniques.

*Use separate start-up disks for each major application.* Because of the Macintosh's limited memory size, most application programs are not able to fit entirely in memory. Instead, the program must often go to disk, bringing in code and data. This requires that you keep the "application disk" (the disk containing the actual application program) in the disk drive nearly all of the time.

When you're ready to save the document on which you're working, the application program will typically allow you to eject the application disk and insert another data disk. While this is handy at times, it enacts a penalty of several disk swaps every time you save your work, and you should save it often. You can avoid these swaps simply by saving your work to the application disk.

To use this strategy, you need to free as much space as possible on your application disk to make room for your data files. At first, you might think that the Finder's system files (veritable disk glutons consuming up to 230K bytes on every 400K-byte disk) would be good candidates for elimination. No way. Most application programs require frequent access to these files.

A better idea is to create separate application disks, each having the system files and a single application program. For example, to create a separate application disk for MacPaint, make a copy of your original Write/Paint master disk using the Disk Copy utility (included in version 1.1g of the Finder). Then delete everything on the copy except the system files and MacPaint. You'll end up with a stand-alone MacPaint disk that can be used to start the computer.

Using this technique (and the techniques that follow) will usually leave you with 100K to 250K bytes of open space on each application disk. This should give you plenty of breathing room for storage.

Of course, storing data on application disks is not very efficient. You can alleviate this problem by using application disks for temporary storage only; use separate data disks for permanent storage. When you quit an application, copy your document files to a separate data disk that doesn't have the system files or application program. Then you can delete your data on the application disk and make room for more files.

If you find that you frequently need to switch back and forth between two application programs (e.g., when you are cutting and pasting MacPaint images into MacWrite), you may want to have a disk with both applications. In this case, you'll probably have to keep your data on a separate data disk and endure the disk swaps every time you save the data. Try to avoid this if you can.

*Use the Font Mover utility.* The Finder stores character fonts (the bit maps that define the shape of each character) in the System file. Because these images take up quite a bit of disk space (138K bytes in version 1.1g) and because some users do not need all of the different fonts, a utility program, called Font Mover, is provided that allows fonts to be removed from the System file.

Deciding which fonts to keep is up to you. Keep in mind that the larger fonts offer the biggest rewards in disk-space savings. Note: certain fonts, required by the operating system, cannot be removed by the Font Mover program; they are Chicago-12, Geneva-9, Geneva-12, and Monaco-9.

*Stay in application programs as long as possible.* Since opening and quitting an application program are slow operations, do as much work as possible each time you run an application. For example, if you need to paste a number of images into a MacWrite document, draw all your images in one MacPaint session, storing them in the Scrapbook. This will reduce the number of times you need to open and quit an application program.

*Practice good desktop housekeeping.* The Finder stores a "hidden" file on each disk that gives the current status of windows for that disk. Updating this file often takes a significant amount of time, especially if you are ejecting and inserting several disks in sequence. Speed up your operations by keeping the number of open windows to a minimum.

*Do all file copying at once.* Every time you copy a file from one disk to another, a few disk swaps are required. If possible, postpone file copying until you can do it all at once with one copy operation. In this way, your average number of swaps per file copied will decrease.

Don't forget that the Finder has two methods of selecting multiple files. You can drag a box around the group of files (this works well when the file icons are near one another), or you can hold down the Shift key and click each file icon in turn. When you have selected all the files you want to copy, drag any one to your copy destination. Like the Blue Angels, the entire group of files will fly in perfect formation across your desktop to the destination.

*Use your Scrapbook and Clipboard effectively.* They are stored as disk files. Typically,

they are kept in the System folder. For the most part, the Finder uses the Scrapbook and Clipboard files on the start-up disk (the disk you used initially to boot the machine).

Things can get a little tricky when you start a new application program on another disk that also has Scrapbook and Clipboard files. This will cause the new application disk to become the start-up disk. But which files will the Finder use?

Actually, the Scrapbook and Clipboard behave differently. The Clipboard is copied from the old start-up disk to the new start-up disk, replacing the Clipboard file on the new disk. This means that the Clipboard will always stay intact even if you leapfrog from disk to disk as you run different applications.

The Scrapbook, on the other hand, is not copied. Instead, the Scrapbook file on the new start-up disk is pressed into service. Thus, each disk with a Scrapbook file essentially has its own Scrapbook.

This scheme has a pitfall. A typical scenario: you draw a number of images in MacPaint that you wish to paste into a MacWrite document. After carefully storing each image in the Scrapbook, you exit MacPaint. Because MacWrite is on a different disk, you eject the MacPaint disk, insert the MacWrite disk, and open up MacWrite. To your dismay, the images you have just stored have vanished. Where did they go?

They are still around, but they're in the Scrapbook file on the MacPaint disk. How do you get around this problem? One solution is to avoid using the Scrapbook; use the Clipboard instead. But this approach can be incredibly time consuming when you need to transfer several items because of the time it takes to repeatedly open and quit each application program as you cut and paste each image.

Another method is to copy the Scrapbook file from the old start-up disk to the new start-up disk prior to starting the new application program. You do this by dragging the Scrapbook file (in the System folder) to the new disk before starting the new application program.

*Use keyboard commands.* The Finder includes command key equivalents for commands that are usually selected with the mouse from the pop-down menus. Many times executing these keyboard commands can be quicker than using the mouse.

*Use the keyboard/mouse buffer.* The Finder buffers the mouse movement/clicks and keystrokes. Since many operations are repetitious, you can often anticipate the next step and place it in the buffer in order to keep the disk drive from stopping. The computer must wait for a stopped disk drive to come up to speed before you can begin reading or writing.

—Mark S. Jennings

**Table 1: Special Finder commands.** Apple touts the Finder as not requiring the memorization of any commands. As this list shows, the claim is not entirely true.

| Operation                                | Keystroke/Mouse Sequence   |
|------------------------------------------|----------------------------|
| Internal disk ejection                   | Command-Shift-1            |
| External disk ejection                   | Command-Shift-2            |
| Create a MacPaint document of screen     | Command-Shift-3            |
| Print active window                      | Command-Shift-4            |
| Print screen                             | Caps Lock-Command-Shift-4  |
| Multiple icon selection                  | Shift-Click, or Drag a box |
| Move window without making window active | Command-Drag Window        |

amount of memory used by the operating system that is unavailable to application programs) is roughly similar. The Finder's memory overhead is about 22K bytes, compared to about 25K bytes for MS-DOS. (This 22K is only the part of the operating system that stays in memory while the application is running; the Finder program itself is much larger.) Of course, 22K bytes tends to cut deeper on the Macintosh than it does on a typical IBM PC with a lot of RAM; the Macintosh is limited to 128K bytes of RAM (random-access read/write memory), and the display takes 21K bytes of this.

**Interfacing capabilities:** The Finder includes a simple but powerful system of exchanging text and graphic images between different application programs. MS-DOS has no comparable system. The Finder's system consists of two separate but complementary storage areas called the Clipboard and the Scrapbook. The Clipboard stores a single text passage or graphic image and is used as a temporary storage area for cutting, copying, and pasting operations. The Scrapbook, which can store many text passages or images, allows you to set up a library of frequently used items. Both are designed to be easily accessible from application programs, provided the programs are designed with the Clipboard and Scrapbook in mind.

The system works well. Its only drawback is slowness; both the Clipboard and Scrapbook are stored as disk files and access can be tedious.

**Ease of program development:** For noncommercial software developers, the Macintosh has (or will shortly have) a variety of innovative and easy-to-use interpreters in BASIC, Pascal, and Logo. If your program does not require the speed of a compiled program or large amounts of memory, the Macintosh, with its superior program-development and debugging capabilities, is a great machine. But MS-DOS is a better choice for large, complex programs that must run quickly. Don't expect to see something as powerful as Lotus 1-2-3 running on a 128K-byte, single-drive Macintosh.

Commercial software developers, who typically want to develop high-performance, stand-alone, compiled programs, share a problem. Macintosh software development requires a significant

**Table 2: Disk-space requirements (in bytes) to store the Finder's and MS-DOS's operating system files.** The System file for the Finder will vary depending on how many character fonts are retained. The size shown assumes that all fonts on the version 1.1g WritePaint disk are retained. Approximately 65K bytes of fonts can potentially be deleted; however, a 10K- to 20K-byte reduction is typical. The Clipboard and Scrapbook file sizes assume both are empty.

| The Finder, version 1.1g (Macintosh) |      | MS-DOS 2.0 (IBM PC)             |     |
|--------------------------------------|------|---------------------------------|-----|
| Disk-Space Requirements (bytes)      |      | Disk-Space Requirements (bytes) |     |
| System                               | 132K | IBMBIO/IBMDOS                   | 23K |
| Finder                               | 46K  | COMMAND.COM                     | 18K |
| Imagewriter                          | 17K  |                                 |     |
| Clipboard                            | 1K   |                                 |     |
| Notepad                              | 2K   |                                 |     |
| Scrapbook                            | 1K   |                                 |     |
| Total                                | 199K | Total                           | 41K |

**Table 3: Minimum recommended Macintosh software development system.** This system allows the development of stand-alone Macintosh software that can take control of the entire desktop. The cost of this system (June 1984) is approximately 50 to 100 percent higher than comparable MS-DOS development systems. (Apple has a Certified Developer Program that provides for substantial discounts for qualified commercial software developers. However, delays of several months in obtaining equipment have been typical.)

| Item                                                  | List Price |
|-------------------------------------------------------|------------|
| Macintosh computer                                    | \$2495     |
| Imagewriter printer                                   | \$ 495     |
| Lisa 2/5 computer                                     | \$4495     |
| 512K-byte memory card for Lisa                        | \$1495     |
| Imagewriter accessory kit for Lisa                    | \$ 50      |
| Lisa Pascal Workshop                                  | \$ 595     |
| "Inside Macintosh" Manual (draft)                     | \$ 150     |
| Macintosh software supplement to Lisa Pascal Workshop | \$ 100     |
| Total                                                 | \$9875     |



## Flaws in the Finder

The first released version of the Finder (version 1.0) had a number of bugs. In May 1984, Apple released a revised version (1.1g) in which nearly all of the bugs have been fixed.

Version 1.1g of the Finder includes a number of enhancements.

- You can now select an application program as a "start-up application," and the program will boot into the application. (Note: it is not obvious how you "deselect" a start-up application. Simply begin by selecting the Finder file in the System folder as the start-up application.)
- A disk-copying utility drastically reduces the number of swaps required to back up a complete disk on a single-drive Macintosh.
- There have been several changes to the character fonts provided.
- The routines for copying files between disks have been improved so that fewer disk swaps are necessary for a single-drive Macintosh.
- Superscripts and subscripts have been added to MacWrite.
- A draft printing option has been added to MacPaint offering quicker printing at some reduction in resolution.
- A FILL command has been added to MacPaint, which assists filling in designated areas with patterns.

Macintosh owners can upgrade their Finder, free of charge, by bringing their original Write/Paint disk to their Apple

dealer. Included with the upgrade are new versions of MacPaint and MacWrite.

For the record, a list of all bugs I have run across (for both Finder versions) follows. Many are very difficult to reproduce since they occur intermittently.

### BUGS IN VERSION 1.0

*Bum disks.* Rarely, the Finder will suddenly refuse to accept a previously acceptable disk. Any attempt to insert the disk (either as a start-up disk or as a disk to add to the desktop) results in a "System Error—ID=02" message indicating a memory-addressing problem. Attempting to boot from the offending disk generates a scowling Macintosh icon with the memory address 0F0064. The machine must be rebooted with a different disk.

*Jumbled display.* Rarely, dragging a disk icon to the trash will cause the display to jumble, and the machine will lock up. The computer must be rebooted to regain control.

*Lost disk space.* Rarely, duplicating an application program on a nearly full disk and then deleting the duplicate will cause loss of disk space. When this occurs, the Finder will erroneously give you the message "Out of memory—dispose of a dimmed icon," even though you have only a single-disk icon on the desktop. At this point, the Finder will not let you start an application program or copy files. The computer must be rebooted.

*Continuous disk swapping.* Occasionally, the Finder will become confused during disk swaps. It will keep requesting the same

disk over and over even though you are inserting the correct disk, or it will endlessly thrash back and forth requesting the same two disks. Rebooting is the only exit.

*Lost Scrapbook pictures.* The Scrapbook routines have a bug that will cause the message "Picture is too big to be displayed here" to be shown for a Scrapbook picture even though the picture easily fits the Scrapbook page size. Interestingly, pictures that really are too big will often be cropped at their edges, indicating that this message should never appear.

### BUGS IN VERSION 1.1G

*Wrong Clipboard file icon.* If you dispose of the Clipboard file in the System folder, the Finder will regenerate the file when you access the Clipboard. This is what it should do; however, the disk icon symbol will be incorrect. It should be a system file; instead, it comes up as a document file. This minor bug also occurs in version 1.0.

*Misregistered display.* Very rarely (I experienced it twice in approximately 100 hours of computer operation), copying an application program to another disk will cause the display screen to suddenly become misregistered (images will be distorted and blurred). The computer may allow you to do an operation or two, but it eventually crashes with a "System Error—ID=25" message and must be rebooted.

—Mark S. Jennings

investment in terms of time and money. Programming is complex. Apple has not done a good job of distributing quality technical documents. Currently, you need a Lisa system to develop stand-alone application programs (table 3).

### CONCLUSIONS

The Finder provides an excellent environment for the novice computer user, and nearly everyone will find it fun to work with. It does especially well in providing a graphic representation of your data and programs. And the Finder's method of exchanging data between application programs is innovative and powerful.

The Finder's weaknesses are not as obvious, but just as real. For one, the system seems . . . well, ponderous might be the best word. Simple tasks often seem to occur in slow motion as the

Finder shuttles back and forth to disk for code and data. The lack of any batch-processing capability means repetitious command sequences must be clicked or keyed in each time they are needed. But these drawbacks are largely academic if you stay in application programs most of the time. The window/mouse concept works beautifully in programs like MacPaint, MacDraw, and Microsoft Chart; it just doesn't seem to come off as well with the Finder.

Specialized application-program support is also a weak area for the Finder. The Macintosh is not an easy system to develop programs for, and Apple has compounded the problem by failing to provide quality technical information and software tools for the small software developer. The common applications will be well served by giants like

Microsoft, but don't expect commercial programs for managing your bowling league any time soon. The Finder is definitely not the operating system for the hacker.

More than anything, the Finder, like the Macintosh, is an enigma. It is an extremely elegant operating system that is seriously flawed because Apple did not provide sufficient memory and disk storage in the basic Macintosh. (Apple's decision to limit the Macintosh to 128K bytes—and to solder the chips directly to the main digital board—is unfathomable.) Too often, the Finder simply overwhelms the hardware. With 512K bytes and double-sided disk drives, the Finder will probably perform effectively. Until then, it will continue to attract new people to computers and frustrate users who need to get a lot of work done quickly. ■



## *Perhaps the company should have spent more time studying the possibilities of the Mac's user interface*

or type COMMAND-A to save the data and continue. By the time you've entered 20 or 30 records, you can expect a delay of several seconds after each COMMAND-A. That's not the only inconvenience, though. There's worse to come because Habadex's programmer has ignored the Mac Commandments.

In an effort to unify the way programs work on the Macintosh, Apple has built into the machine's ROM (read-only memory) a raft of useful routines and documented them in great detail in the Mac's technical bible, *Inside Macintosh*. Chief among these routines is a nifty text-editing package that most Macintosh programs use whenever text must be entered or edited with the mouse and keyboard. Haba Systems seems to have decided it could do better. The company has totally ignored the Macintosh editor and instead used its own (substandard) editing routines throughout the program.

Why not use the existing Macintosh user interface, one that all Mac users already know? Worse still, some operations that seem like standard Mac operations are not. Habadex lets you cut, copy, and paste text but doesn't save it on the clipboard, so that, while you may think you are copying something onto the clipboard for use in another program, you aren't really. Habadex only remembers it internally—you cannot transfer information between Habadex and another program.

If you survive your experiences with the Habadex text editor, you will have a directory full of names, addresses, phone numbers, and other miscellaneous information. One of the features that makes Habadex more useful than the usual paper-based phone directory is its auto-dial capability (see figure 1). Using the mouse, you can select a phone-number field, then instruct Habadex to dial it for you using your Hayes-compatible modem or a \$49.95 auto-dialer from Haba Systems. Habadex can even remember your

Sprint or MCI number and tack it onto the front of the phone number along with your access code. There is also a Quick Dial screen for frequently called numbers.

A couple of caveats, though: first, even with a modem capable of pulse dialing, Habadex works only with Touch-Tone systems. If you are in a pulse-dialing area, or your office PBX requires pulse to dial out, you will not be able to auto-dial. Second, if you opt for the Habadex auto-dialer, you may have to make some aural sacrifices.

The dialer is a small box that connects your phone to the Macintosh sound jack and your telephone wall jack. Because plugging into the Mac sound jack cuts off the internal speaker, Haba Systems' dialer has a small built-in speaker. It sounds terrible. To use the dialer, you have to turn your Macintosh sound up to at least level four, in some cases louder. This makes the small speaker sound loud and strained. It didn't take me long to unplug mine and put it in the closet. Anyone who attempts to use this device in an office will likely do the same. So much for auto-dialing.

The Habadex directory sports two reference screens: the first contains telephone area codes arranged by number; the second contains zip codes for each state, also arranged numerically. You may find these of some use. At any rate, it's a thoughtful touch.

### **THE APPOINTMENT BOOK**

Moving right along to the right side of the screen, you find the Habadex appointment book. Here you can keep track of appointments, travel, and expenses on a calendar for 1984 and 1985. (Presumably updates will extend this calendar for those still using the program in 1986.) The appointment book also has a page for special occasions and things to do. On the face of the appointment book are the date, time, your next two appointments, and

top two things to do (see figure 2).

To open the appointment book, you click on a month tab. You'll see something similar to the familiar wall calendar (sans pinup, though), with each day marked with your first two appointments and any travel plans you have entered. To look at the day in more detail, you move the pointer to it and click. Each day has room for 14 appointments, plus a line on which to indicate travel and five lines for recording the day's expenses. There is currently no way to extract expense or travel information or to print any calendar information, short of the standard Macintosh Command-Shift-4 that prints the whole window.

The appointment calendar (see figure 3) keeps your appointments in chronological order, no matter how you entered them, and their appearance on the front of the appointment book is very convenient. When it's time for an appointment, your Mac will beep loudly and persistently 15 times—enough to ensure that even the comatose won't miss any important engagements. Of course, you can turn the sound off on the Apple control panel, but then you can't use the auto-dialer. Decisions, decisions.

The things-to-do list is also handy. Keeping it updated is simple, and as long as you don't exceed the limit of 21 things to do, you should find it a useful reminder. When you've completed a task, you can use the mouse to put a big, satisfying check mark next to it.

Habadex's programmer, Gary Crandall, has done a nice job of simulating a real-world appointment book, but the only way to really make use of it would be to keep Habadex up and running on

*(continued)*

---

*Léo Laporte is a San Francisco radio personality who programs an Eagle and an Atari. He has just purchased a Macintosh. He can be reached at 1177 Polk St., San Francisco, CA 94109.*

**AT A GLANCE**

**Name**  
Habadex 1.1

**Type**  
Telephone directory and appointment calendar software

**Manufacturer**  
Haba Systems Inc.  
15154 Stagg St.  
Van Nuys, CA 91405  
(818) 901-8828

**Format**  
3½-inch disk

**Language**  
Pascal

**Computer**  
Apple Macintosh

**Price**  
\$199.95

**Documentation**  
48 pages

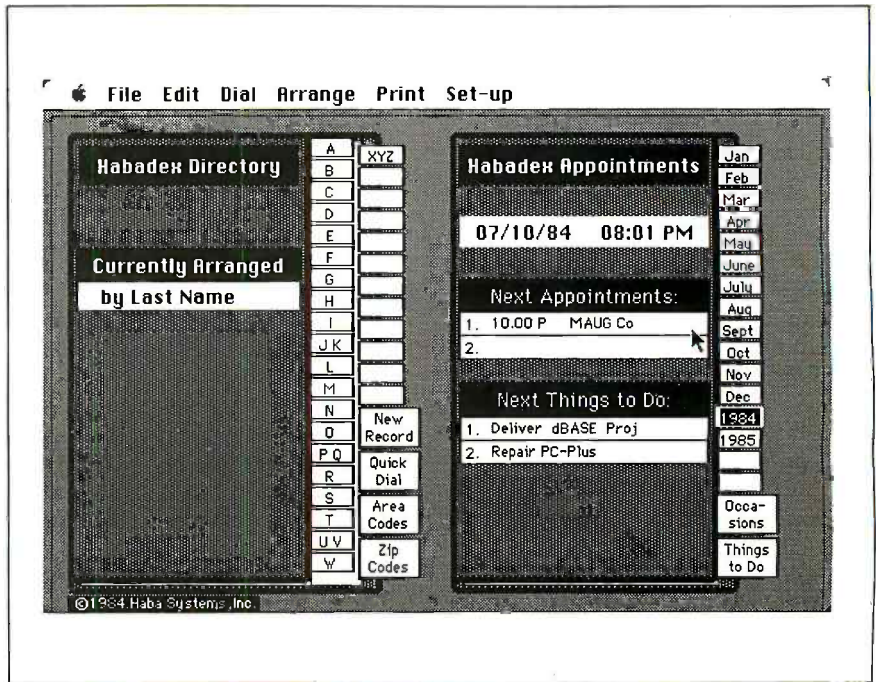


Figure 2: Habadex's main screen provides quick access to all of its functions. The time and date, your next two appointments, and top two things to do appear on the face of your appointment calendar. Clicking on the tabs on the side of either of the two books opens that book to the appropriate page.

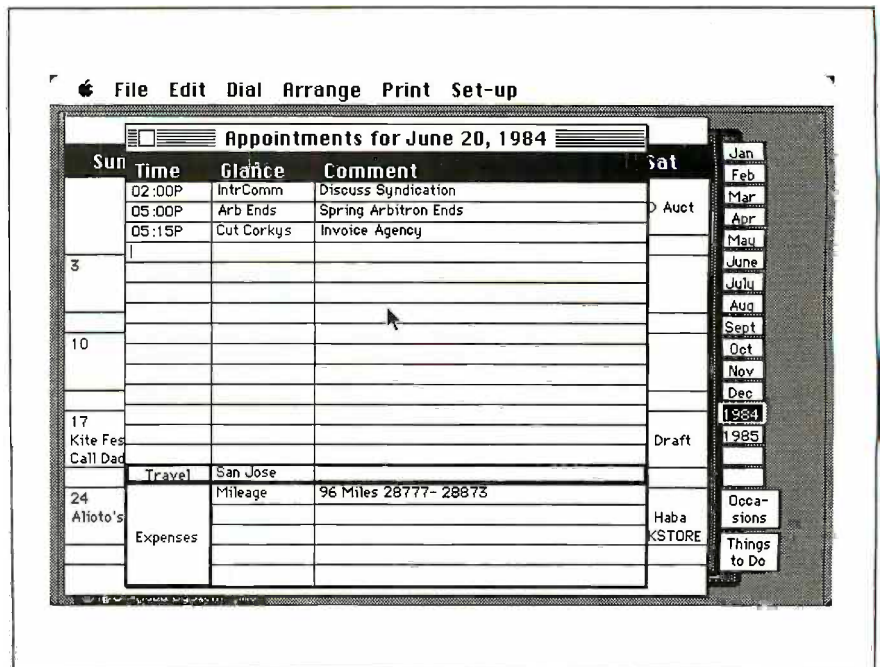


Figure 3: Habadex keeps a record of your appointments, sorted chronologically. Travel and expenses can be entered as well, but there's no way to prepare an expense report from the information stored here.

your Macintosh all day, making the Mac one of the world's most expensive desktop diaries going. Of course, since the Macintosh doesn't allow true multitasking, it's not really Crandall's fault. Perhaps this is not an application well suited to this computer.

### MAILING LISTS

The tedious job of preparing mailing lists and form letters is one almost any computer is well suited to. In this case, it is the software that falls short. Habadex can print mailing labels and prepare form letters using data from your phone directory. It's here that the program is at both its best and worst.

The way you set up your mailing labels is a good example of the power of a mouse-based interface. Using the mouse, you can arrange the information on the label and set up how the labels will print with real facility. Habadex lets you design, and will remember, three different label formats.

Once you've designed your labels, you can print them in any font. The labels can be printed alphabetically by first or last name, city or state, profession, or company, or numerically by account number or zip code. You can print on labels of any size, and from one to three across. Like MacWrite, however, Habadex supports only the 80-column Imagewriter printer.

Habadex also can make lists of the entries in your phone directory, and here, too, you can design the report form using the mouse. Habadex makes a usually difficult and time-consuming task easy by taking advantage of the Macintosh's visually oriented interface.

### MAIL-MERGE

I wish I could say the same of the Mail-Merge utility. Here is Habadex at its worst. Mail-Merge is used to integrate data from your directory into form letters created by MacWrite. The result is far from pretty.

To use Mail-Merge you must copy the body of a letter created by MacWrite onto the clipboard. (It's ironic that, while Habadex expects other programs to allow transfer of text via the clipboard, it doesn't do so itself!) During a Mail-Merge, Habadex adds the current date, an address from your directory, and the word "Dear" followed by the data field of your choice. It then prints the text

from the clipboard. You cannot incorporate data into the body of the letter.

The letters themselves look badly misformatted. The date is printed flush-left at the top, followed by an inexplicably indented address. Your salutation follows, flush-left again. Habadex mishandles letters that are right-justified. It also ignores tabs.

In short, Habadex's Mail-Merge is awkward, inflexible, and essentially useless for all but the most undemanding tasks.

Habadex's documentation is a 48-page booklet—about the size of MacPaint's. It is indexed and nicely typeset, with very clear illustrations.

At \$200, Habadex seems overpriced and underpowered. Many of its functions work awkwardly. The program has, at best, ignored and, at worst, abused the Mac user interface. Even if it worked flawlessly, I would have some doubts about its superiority over a paper-based system.

---

*The way you set up  
your mailing labels is a  
good example of the  
power of a mouse-based  
interface.*

---

Computer pioneer and visionary Alan Kay has said that the Macintosh is the first computer good enough to be criticized. Apple has set a hardware and software standard the rest of the world will now strive to match. It may be inevitable that the first few companies that try will fail. Had Habadex been released at any other time, for any other computer, it would have been met with praise. Apple's Macintosh has changed all that. Habadex is too little, too early. ■

# The \$129! Modem Starter Set

Get the complete modem/software package for your Apple II, II+, or IIE that includes 300 Baud Modem card, easy menu-driven communications software and a subscription to the SOURCE. Ask your computer dealer about the NETWORKER™ or call us at 1-800-631-3116 and we'll tell you where to pick one up. The NETWORKER™ modem is made in the U.S.A. by ZOOM Telephonics, Inc.

Z O O M

ZOOM Telephonics/207 South St./Boston, MA/02111

# THE LISA 2: APPLE'S ABLEST COMPUTER

*No other machine in Lisa's price range approaches its versatility, innovation, and power*

---

*The 11 different operating environments available on Lisa fall into three broad categories: business applications, business applications plus software development, and those used purely for software development.*

---

**L**isa may be the most underrated machine in the history of the microcomputer industry. The recently introduced Lisa 2 line is more versatile and powerful than any other machine in its under-\$7000 price category. In spite of this, the technical press remains preoccupied with Macintosh and the public remains enthralled with IBM.

Granted, Apple's marketing efforts on behalf of Lisa 2 have been less than herculean. And a dearth of software support still hobbles the entire Lisa line. Yet I see Lisa as the premier Apple offering. I've taken the time to look closely at this innovative, and now cost-effective, computer. There is simply no other machine in Lisa's price range that approaches its versatility, innovation, and power.

The three Lisa models—Lisa 2, Lisa 2/5, and Lisa 2/10—differ only in the amount of attached hard-disk storage they offer (none, 5, and 10 megabytes, respectively). The least expensive model, the Lisa 2 (\$3495), is akin to a wide-screen Macintosh with half a megabyte of main memory. The unit also sports a single 3½-inch disk drive (400K-byte capacity) for external storage. The only apparent purpose for this stripped-down Lisa is to provide a vehicle that will run Macintosh software with four times the memory capacity of the Macintosh. No other commercially available software will run on the Lisa 2.

The Lisa 2/5 (\$4495) adds an external 5-megabyte hard disk. The 2/10 (\$5495) provides an internal 10-megabyte hard disk.

When it comes to expanding Lisa's hard-disk capacity, there are many ways to go. The Lisa 2 and 2/5 can be upgraded to 2/10 status for \$2795. The Profile drive on an upgraded 2/5 can be connected through a parallel card (\$195) for a total of 15 megabytes of storage. A 20-megabyte system can also be configured using all Apple disks for \$8680. There is one external parallel port on both the Lisa 2 and the 2/5 that is intended as the connection point for the 5-megabyte Profile drive. This port (the default port) is internal in the 2/10, since the hard-disk drive is internal. Any additional drive must always connect via a parallel card, whether it is augmenting a Profile drive or a 10-megabyte drive. Lisa now supports a 70-megabyte drive manufactured by Priam and distributed by Tecmar. UNIX and XENIX users have the option of attaching drives from Corvus and Sunol in sizes from 20 to 100 megabytes.

All models of Lisa have two serial ports intended for use with printer and modem. Currently, no printers other than the Apple-provided dot-matrix and letter-quality printers run with Apple-developed software. Both the ImageWriter (dot-matrix) printer and the letter-quality printer connect through the serial ports (the Macintosh software expects a dot-matrix printer to be connected to serial port B only). UNIX and XENIX users have other printer options.

Lisa 2 has three expansion slots for peripheral cards. So far, however, only three such cards exist. Apple sells a parallel card providing two ports, and Santa Cruz Operations sells a serial card

offering four ports. The Apple card is used primarily for attaching additional Profile drives but was originally used to support the first Lisa dot-matrix printer that required a parallel interface. The serial card is primarily used for supporting terminals under multiuser (UNIX or XENIX) operating systems. The Priam disk is attached through a special-purpose interface card.

Unlike Macintosh, Lisa has both a high-resolution bit-mapped display and a character-generator display that supports a standard 24 by 80 screen. Having a standard screen-display option permits some conventional software to run on Lisa without display output conversion. This feature is critical to XENIX and UNIX users.

## LISA OPERATING ENVIRONMENTS

The 11 different operating environments available on Lisa fall into three broad categories: those supporting business applications, those supporting business applications and software development, and those used purely for software development.

Three distinct user environments focus on business applications only. These are the Office System with fully integrated applications, the Office System with QuickPort applications, and an application-oriented shell running under the Lisa Operating system.

The original Lisa software consisted only of applications that were fully integrated into the Office System. The QuickPort applications available on Lisa 2 are a new kind of application that share some, but not all, of the Office System facilities. The Lisa operating system also supports multiple shells for the purpose of creating separate user environments.

The Office System contains three elements: Desktop Manager, LisaGuide, and Lisa 7/7, a seven-function integrated program. Desktop Manager is actually a user-oriented operating system placed on top of a conventional operating system. The icons and windows and all of the actions taken to manipulate them are part of the Desktop Manager. LisaGuide is a tutorial program designed to familiarize users with Lisa's graphic interface. Lisa 7/7 is Apple's attempt to

offer an integrated package like Lotus 1-2-3. Given its greatly reduced price of \$695 for all seven functions, 7/7 should be a competitive piece of software. Current owners of Lisa Office System software can upgrade to the new release for \$150.

The seven functions provided include:

- LisaCalc, a 255 by 255 spreadsheet
- LisaDraw, presentation-quality graphics drawing
- LisaGraph, graphs of discrete functions
- LisaList, to display rows of two-dimensional tables
- LisaProject, a cost, time, and resource scheduling program
- LisaTerminal, a communication utility
- the LisaWrite word processor

These applications are called "fully integrated" because they have access to all the Desktop Manager facilities. The seven functions provided in Lisa 7/7 include window support, pull-down menus, keyboard and mouse support, and the transfer of different kinds of

data between the various applications.

Apple now considers Lisa 7/7 a complete integrated office application. In fact, Apple has discontinued support for the Toolkit, the development tool required to produce fully integrated applications. That is not a very encouraging outlook for developers or for users who want extensions to the Office System.

Software developers do have an alternative. It is called QuickPort. As the name implies, this utility provides a quick way to transport software into the Office System. QuickPort applications execute in a window on the desktop but do not have pull-down menus and associated mouse interactions. The window may be divided into two panels.

*(continued)*

*David D. Redhed is an independent consultant with Clear Skies Consulting. He can be reached at 712 35th Ave., Seattle, WA 98122. He has worked for A.P.P.L.E., an Apple user group in Kent, Washington, among other clients.*



PHOTOS BY J.C.M. DOWNS

**Photo 1:** *The Lisa 2 is an aesthetically attractive machine that occupies a minimum of desk space. An internal 10-megabyte hard disk provides plenty of storage. Those needing less storage capacity can purchase the machine with an external 5-megabyte Profile hard disk.*

one for text and one for graphics. The contents of the graphics panel can be copied onto the clipboard and pasted into any application that can take graphics information from a LisaDraw document. Information from the text panel of the window can be copied to the clipboard and taken to any application that can receive text lines (e.g., LisaTerminal or LisaWrite).

**BUSINESS APPLICATIONS AND SOFTWARE DEVELOPMENT**

Four distinct operating environments support both program development and business applications. Those are MacWorks, the Workshop from Apple Computer, UNIX from UniPress, and XENIX from Santa Cruz Operations under license from Microsoft. MacWorks is simply a program that allows Lisa to run Macintosh software. The Workshop is very similar to the UCSD Pascal system. UNIX and XENIX both use shells to provide a command-driven user interface to an underlying operating system. Users must already have or be willing to develop proficiency in computers before they can readily operate in any of these last three environments.

When you start up Lisa under Mac-

Works, a portion of the Macintosh operating system adequate to handle disk I/O is loaded into memory. In fact, the equivalent of the 64K-byte operating-system ROM is loaded and made accessible in a manner that is transparent to the Macintosh applications. From this point on, Lisa 2 functions just like a Macintosh, with two major exceptions—the display screen is larger and the central processing unit is slower. Lisa's display area is physically larger than Mac's (10½ versus 8 inches diagonally). It also has more pixels in both directions (720 by 364 versus 512 by 342), and the pixels are shaped differently. The pixels in Lisa 2 are 50 percent higher than they are wide. Macintosh pixels are square. These differences combine to provide a larger working area. Unfortunately, Macintosh graphics appear to be stretched in the vertical direction when run on Lisa. Text looks surprisingly good, but circles become ellipses and squares mutate into rectangles. Most nonmathematical shapes are acceptable in appearance, but if you create graphics on Lisa 2 using MacPaint, you are in for a rude surprise. When you print the results, the printer will show the true form of the object, not what is on the screen.

The central processor on Lisa runs at 5 MHz versus 8 MHz on the Macintosh. The 5 to 8 ratio holds for graphic operations, but the ratio is 5 to 6 for most other operations.

The MacWorks program, first available in April 1984, would not function with Lisa's hard disk. A version released in September 1984 permits use of the Profile drive, and Mac files will coexist with Lisa Office System and/or Workshop files. (They will not coexist with UNIX or XENIX files.) Attempts by Apple to develop utilities for file transfer between Macintosh and Lisa applications have not been successful. Developing programs using Macintosh BASIC or some other high-level language is practical on Lisa because of the extra available memory. However, these programs must be small enough to run in the Mac's restricted memory.

**THE WORKSHOP**

Because the Workshop's user interface is similar to UCSD Pascal's, Apple II or III Pascal users will feel at home rather quickly. The program contains many features not found in UCSD Pascal, including a mouse-driven editor and sophisticated file-manipulation facilities. The Workshop contains all Lisa and

Table 1: Lisa 2/5 and 2/10 performance figures.

|                                                  | Empty LisaWrite file |      |                   | 37,000-byte LisaWrite File |      |                   | Empty LisaDraw file |      |                   | 40,000-byte LisaDraw File |      |                   |
|--------------------------------------------------|----------------------|------|-------------------|----------------------------|------|-------------------|---------------------|------|-------------------|---------------------------|------|-------------------|
|                                                  | 2/5                  | 2/10 | Ratio 2/10 to 2/5 | 2/5                        | 2/10 | Ratio 2/10 to 2/5 | 2/5                 | 2/10 | Ratio 2/10 to 2/5 | 2/5                       | 2/10 | Ratio 2/10 to 2/5 |
| Measured times in seconds                        |                      |      |                   |                            |      |                   |                     |      |                   |                           |      |                   |
| Test run immediately after start-up              |                      |      |                   |                            |      |                   |                     |      |                   |                           |      |                   |
| Open first time                                  | 29                   | 25   | 0.9               | 33                         | 28   | 0.8               | 34                  | 27   | 0.8               | 98                        | 90   | 0.9               |
| Save and put away                                | 15                   | 20   | 1.3               | 63                         | 51   | 0.8               | 14                  | 16   | 1.1               | 13                        | 14   | 1.1               |
| Open second time                                 | 4                    | 3    | 0.8               | 7                          | 6    | 0.9               | 6                   | 5    | 0.8               | 69                        | 66   | 1.0               |
| Set aside                                        | 6                    | 3    | 0.5               | 7                          | 6    | 0.9               | 6                   | 5    | 0.8               | 8                         | 8    | 1.0               |
| Test run after two other applications are active |                      |      |                   |                            |      |                   |                     |      |                   |                           |      |                   |
| Open first time                                  | 37                   | 29   | 0.8               | 39                         | 31   | 0.8               | 36                  | 26   | 0.7               | 100                       | 86   | 0.9               |
| Save and put away                                | 16                   | 16   | 1.0               | 52                         | 51   | 1.0               | 10                  | 10   | 1.0               | 13                        | 12   | 0.9               |
| Open second time                                 | 5                    | 4    | 0.8               | 7                          | 6    | 0.9               | 7                   | 5    | 0.7               | 68                        | 70   | 1.0               |
| Set aside                                        | 6                    | 4    | 0.7               | 7                          | 7    | 1.0               | 6                   | 5    | 0.8               | 8                         | 8    | 1.0               |
| Save a duplicate                                 | 12                   | 14   | 1.2               | 16                         | 20   | 1.2               | 10                  | 9    | 0.9               | 18                        | 13   | 0.7               |
| Copy disk to hard disk                           | 3                    | 3    | 1.0               | 17                         | 15   | 0.9               | 4                   | 3    | 0.8               | 16                        | 15   | 0.9               |
| Copy hard disk to disk                           | 4                    | 3    | 0.8               | 18                         | 20   | 1.1               | 4                   | 4    | 1.0               | 20                        | 20   | 1.0               |



## AT A GLANCE

Macintosh software-development tools supported by Apple Computer. Since Pascal is the underlying language of Lisa software, all of the operating-system interfaces are in Pascal form. A 68000 assembler is available that can be used to create programs and procedures to run in the Pascal environment. A C compiler is also available, and procedures written in C can be called from Pascal (or vice versa). Both the Pascal and C compilers have an option to generate code for either Lisa 2 or Macintosh.

In releases 1.0 and 2.0 of the Workshop, Apple offered the BASIC Plus language (compatible with Digital Equipment Corp. BASIC) and Cobol (an extension of ANSI 74). Only BASIC will be offered under release 3.0, but Apple will offer no technical support. COBOL has been dropped due to an insufficient number of buyers.

Using the Workshop with Pascal, C, and the 68000 assembler, you can develop conventional keyboard-oriented applications. Further, by using a multitasking operating system, QuickDraw graphics utilities, and the mouse interaction utilities supplied by Apple Computer, you can create any kind of environment you like. You can duplicate all the visual effects and user-interface features you see in the Office System with the utility software supplied in the various elements of the Workshop.

Extensive documentation of QuickDraw (the comprehensive graphics package used in the Office system) is included, along with some sample programs. The documentation of the operating-system interfaces is also good, and access to low-level information through these interfaces is excellent.

## UNIX

The UniPress Inc. version of UNIX is based on Bell Labs System V UNIX. The operating system is supplied with a C compiler, standard UNIX utilities, and Berkeley enhancements (visual editor, C shell, terminal independent library). The entire package sells for \$1495. Hard disks from 20 to 100 megabytes are supported, and Ethernet networking is also available. Corvus and Sunol are the vendors of the hard disks that can be

(continued)

### Name

Lisa 2

### Manufacturer

Apple Computer Inc.  
20525 Mariani Ave.  
Cupertino, CA 95014  
(408) 996-1010

### Size

13.8 by 18.7 by 15.2 inches; 48 pounds

### Power Requirements

90-130 V AC, 48-68 Hz (U.S. model)  
180-260 V AC, 48-68 Hz (foreign model),  
150 watts (both models)

### Processor

MC68000, 5-MHz clock

### Interface Slots

Three slots for peripheral interface cards

### Peripheral Connectors

All models have a mouse connector, keyboard connector, and two serial-port connectors (25-pin D-shaped plugs). The Lisa 2 and 2/5 also have a parallel connector intended for connecting a hard disk (25-pin D-shaped plug)

### Keyboard

2.7 by 18.7 by 6.5 inches;  
4 pounds

### Memory

524,288 bytes (1/2 megabyte) standard for all models; expandable to 1,048,576 (1 megabyte)

### Mass Storage

All models have one Sony 3 1/2-inch drive with a 400,000-byte capacity; Lisa 2/5 has a 5-megabyte external Profile hard-disk drive; Lisa 2/10 has a 10-megabyte internal hard-disk drive

### Video Display

12-inch diagonal tube with a displayable area of approximately 8 by 6 inches; 720 pixels horizontally and 364 pixels vertically; 90 pixels/inch horizontally and 60 pixels/inch vertically (pixels are 50 percent higher than they are wide); bit-mapped graphics page requires 32,760 bytes; screen refresh rate is 60 Hz; horizontal line rate is 22,900 Hz; dot rate is 20 MHz

### Options

Parallel interface card with two ports (25-pin D-shaped plugs)

### Hardware Prices

|                                        |        |
|----------------------------------------|--------|
| Lisa 2:                                | \$3495 |
| Lisa 2/5:                              | \$4495 |
| Lisa 2/10:                             | \$5495 |
| Conversion of Lisa 2 or 2/5 to a 2/10: | \$2495 |
| Conversion of original Lisa to a 2/5:  | \$595  |
| 1/2 megabyte memory:                   | \$1495 |
| Parallel interface card:               | \$195  |
| ImageWriter dot-matrix printer:        | \$595  |
| Daisy-wheel printer:                   | \$2195 |

### Software Prices for Apple-Supplied Software

|                                                                                                                    |       |
|--------------------------------------------------------------------------------------------------------------------|-------|
| Lisa 7/7:                                                                                                          | \$695 |
| (contains Desktop Operating System, LisaCalc, LisaDraw, LisaGraph, LisaList, LisaProject, LisaTerminal, LisaWrite) |       |
| Upgrade from version 2.0 of the Office System applications:                                                        | \$150 |
| Pascal Workshop:                                                                                                   | \$395 |
| MacWorks:                                                                                                          | \$195 |

purchased through UniPress as part of a complete package for Lisa. UNIX will also work with hard-disk systems sup-

plied by Apple.

Several applications programs are available from UniPress: the EMACS

editor system, the LEX word processor, UNIFY database, /RDB Database Tools, and the Phact ISAM file system. Of

## The Lisa Office System

In July 1984, Apple released version 3.0 of all the Lisa software. What used to be marketed as seven integrated applications is now called Lisa 7/7, a single application with seven functions. The operating system is included for \$695, and release 2.0 owners can upgrade for \$150, even if they do not own all seven applications.

The seven functions available in Lisa 7/7 cover all the common activities in the business office, with the exception of accounting. The Lisa series of integrated programs can calculate, draw, graph, sort and maintain lists, make projection decisions, communicate at 110 to 19,200 bps (bits per second), and do word processing.

### THE PROGRAMS

LisaCalc is a spreadsheet calculator that offers you a 255 by 255 matrix, natural-order evaluation, and up to 126 data digits visible on the screen. The program locates circular references and each column of the spreadsheet may have a different width. The spreadsheet also performs calendar-date calculations.

The 3.0 version of LisaCalc adds the natural-order evaluations and circular references as well as internal rate of return, a display of both storage requirements and recalculation time, and an option to print with any combination of headings, grid lines, and row and column titles.

LisaDraw is especially suited to presentation graphics. Its maximum document size is four feet by eight feet, and it will print along either axis of the paper. Images are stored in mathematical form and can be easily edited and resized.

Lisa's 3.0 release of LisaDraw offers color output to Canon's color printers for the first time. You can also print up to an 11-inch boundary. Your images can be rotated, flipped, and reduced up to 25 percent.

LisaList offers users an elementary relational database, eight data types (text, number, social security, zip code, date,

time, telephone, and cost). You can sort your data on multiple columns in ascending or descending order and can search the list in any of six ways. Columns can be added or deleted, and any column can be hidden from display.

Version 3.0 of LisaList offers some increase in integration.

LisaGraph offers the same table of values as LisaCalc, 255 by 255. You can draw full-page, half-page, and quarter-page and can reduce the document to fit the display screen. Under LisaGraph, you have seven graph types—point, line, bar, stacked bar, 3-D bar, pie, and area.

The stacked bar, solid bar, and area graphs are new with version 3.0 and so is the display of linear regression and line correlation coefficient. You can also use color output to Canon's new color printer and add text anywhere on the graph.

LisaProject is a task and cost scheduler performed with Pert-chart-like diagrams. Resource and task bar charts and task cost charts are derived automatically from the schedule chart. The critical path is calculated and displayed, as are early-start/early-finish and late-start/late-finish. Fixed costs may be specified for each task and a maximum of five labor resources.

The task cost charts are new with version 3.0, as is the ability to specify resource costs and project those costs onto resource and task charts. You can also fix task costs in this new iteration of LisaProject.

LisaTerminal supports XON/XOFF protocol and can communicate anywhere from 110 to 19,200 bps. A window contains all transmissions, and you can scroll backwards. You can maintain multiple connections and switch back and forth between them. You can also retain custom transmission setups. Version 3.0 of this program offers very little that is new.

Under LisaWrite your document size is limited only to the amount of hard-disk storage available. Multiple type sizes and proportional spacing are available to you. On-screen rulers let you adjust the margins of your copy, and LisaWrite's search facilities include case and wildcard options.

Add to the above features an 80,000-word spelling checker available in version 3.0 and a 750-word extension for words of your own.

### USING LISA 7/7

The Lisa programs are integrated in three distinct ways: they each work from a common user interface; data can be transferred between most, but not all, of the modules; and you can suspend activity in one program and activate any other.

With its uniform programming conventions, Lisa's 7/7 really excels. Text-editing conventions are identical across all modules and in all circumstances. Whether you are naming a document, entering text in a document, or supplying a set of characters to search a document, you edit text in the same way. Also, the pull-down menus of Lisa are used in all functions and always operate the same way.

The various data-transfer paths are shown in figure 1. Table I shows you the data formats that each of 7/7's functions can create, receive, and/or send.

Lisa's ability to switch quickly between programs is a direct consequence of the multitasking operating system. Under 7/7, your current function is deactivated when you switch to another program. No matter how long you stay away or how many other functions you activate in the meantime, returning to the original program will recapture the state at which it was

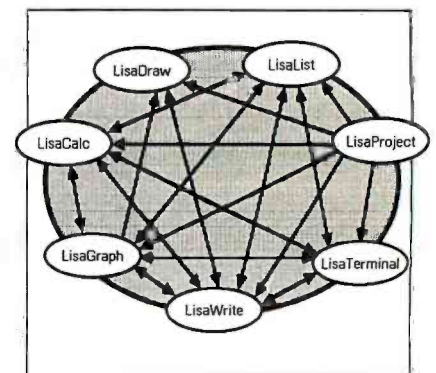


Figure 1: The paths between modules along which data can be transferred.

course, many other applications are available for UNIX, but not necessarily through UniPress. The UniPress system

contains standard UNIX development tools such as a C compiler, text processor, utilities, and the multiuser

kernel. By nature UNIX is a multiuser system. A single-user run-time system is  
*(continued)*

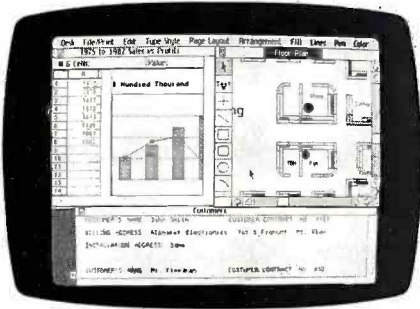


Photo 1: Three windows in Lisa showing different functions: LisaDraw, LisaWrite, and LisaGraph. LisaDraw is currently active.

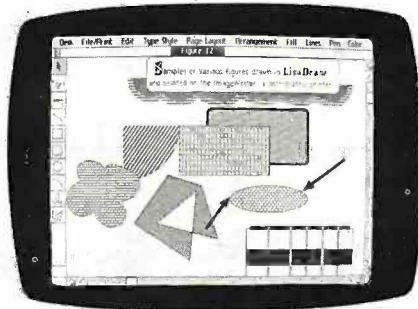


Photo 2: A sample of figures created by LisaDraw.

interrupted.

This same kind of switching applies if you activate the identical function on different documents. Thus you could have three or more word-processing documents in progress and switch back and forth between them without disturbing the states of any of them. This kind of integration is very difficult to achieve with conventional microcomputer operating systems.

Photo 1 is a screen display of three windows belonging to three different functions of Lisa 7/7: LisaDraw, LisaGraph, and LisaWrite. The dark shading around the name "Floor Plan" indicates that this is the currently active window created by LisaDraw.

Successively activating the other two functions and returning to "Floor Plan" takes a total of 14 seconds. This is contrasted with the approximately two minutes it took to open all three documents initially.

In a similar manner, if one LisaGraph document is closed and another one is opened, the only time required is that taken to load the new document and connect LisaGraph to it. The LisaGraph program is already in memory and does not have to be reloaded. In this case, the new document is displayed in a new window in just 20 seconds, in contrast to the 43 seconds for the first document opened by LisaGraph.

Obviously, the megabyte of memory in Lisa will hold only so much; then things must be moved out to make room for additional documents or functions. Even with small documents, all seven functions will not fit in memory simultaneously. I have found that three functions with moderate documents (5 to 10 pages) or two functions with fairly large documents (15 to 25 pages) will cohabit memory without requiring significant swapping to the hard disk.

Lisa 7/7 is a powerful package for the price—\$695. With a Lisa 2/5, the extra 1/2-megabyte of memory, and a dot-matrix printer, the total system price comes to about \$7300. If the functions in Lisa 7/7 satisfy your requirements, there is not a better buy.

—David D. Redhed

Table 1: Types of data that a Lisa 7/7 program may create, receive, or send.

|              | Text                      | A Table                   | Graphics                  |
|--------------|---------------------------|---------------------------|---------------------------|
| LisaCalc     |                           | Create<br>Receive<br>Send |                           |
| LisaDraw     |                           |                           | Create<br>Receive<br>Send |
| LisaGraph    |                           | Create<br>Receive<br>Send | Create<br>Send            |
| LisaList     |                           | Create<br>Receive<br>Send |                           |
| LisaProject  |                           | Create<br>Send            | Create<br>Send            |
| LisaTerminal | Receive<br>Send           | Receive<br>Send           |                           |
| LisaWrite    | Create<br>Receive<br>Send | Create<br>Receive<br>Send | Receive<br>Send           |

Text = one or more multiple-line paragraphs separated by carriage returns

A Table = multiple lines of text containing tabs and separated by carriage returns (tabs indicate columns and carriage returns indicate rows)

also available as an option (\$495), however. Additional languages that can be used with the system include FORTRAN, Pascal, BASIC Plus, RM COBOL, SMC BASIC Four, and Irvine Ada.

## XENIX

XENIX for Lisa 2 is based on UNIX System III and is available from the Santa Cruz Operation. The system includes the full set of XENIX utilities, the C shell, the full-screen visual editor, system-administration commands, electronic mail, and support for UNIX networking. XENIX also provides "vsh," the visual shell that serves as a menu interface.

## Conversion to the Lisa 2

**B**y the time this is published, most owners of the original Lisa will have converted to the Lisa 2. There are three parts to the conversion process: getting all your files ready to be converted, making the actual hardware modifications, and updating to the new system software.

The most troublesome (and potentially risky) part of the conversion is getting all your files on the Profile drive before converting the hardware. This is necessary because the new system does not have any software drivers for the old 5¼-inch disk drives. If you convert and then find some files you forgot, there is no easy way to recover them. For everyone except developers the hardware conversion is done by a dealer. (Developers are given the kit to make the conversion themselves.) It involves swapping the old 5¼-inch Apple drives for the new 3½-inch Sony drive, swapping some integrated-circuit chips, and cutting one or two resistors off a board. In my case, the conversion went very smoothly.

The last step is to update the Profile drive with the new system software. All Lisa 2 conversion kits contain release 2.0 of the Lisa software system, which involve modifications down at the disk-directory level. When you update the drive, all the file-formatting changes are made at the same time, although users are not really aware that this is happening.

Once you have converted, you are unable to do a disk-to-disk copy; you must go through the Profile drive as an intermediate step. —David D. Redhed

From one to four Profile drives can be supported by XENIX in addition to the 10-megabyte built-in disk of the Lisa 2/10. Support for other disks is not currently available, but future releases will include support for Priam and Sunol drives. XENIX will support two additional terminals through the two serial ports on Lisa. Santa Cruz Operations provides a four-port serial board to go into the standard Lisa slots. Up to two of these may be used to support as many as eight terminals.

Networking is supported through two separate features, "uucp" and "Micnet." The uucp feature provides point-to-point communication between predetermined locations. Micnet is a full networking facility for user-to-user communications between a variety of locations. The XENIX Software Development System can be added to the basic operating system described earlier. This package supplies the C compiler and various utilities to support the production of C programs, including an interactive debugger and a source-code control system.

## SOFTWARE DEVELOPMENT ONLY

Lisa 2 and Macintosh software development done by Apple so far have taken place entirely on Lisa, and the tool development by Apple has been extensive. Pascal Workshop is the host environment for all development work, and there are four separate development tools currently available. QuickPort is used to move conventional applications into the Office System. Macintosh Supplement is used to develop Macintosh software. The Toolkit is an unsupported system used to develop fully integrated applications for the Office System. Pterodactyl Software supplies an IBM BASIC Compiler with utilities that is used to convert BASIC programs written for the IBM PC for use on Lisa.

QuickPort supplies a window on the Desktop in which non-Desktop-integrated applications can execute in a conventional manner while gaining several of the Desktop features. All of the window management and icon manipulations that are part of the Desktop environment are available to users. Inside the application window, there is no support for pull-down menus or mouse

functions. Any applications desiring those features will have to provide all the graphics, menu handling, and mouse interaction. All of the utility software to do these things is supplied in the Workshop via Pascal units. This means that each developer will have to produce his own set of logic to create a user interface. It is not even possible to take advantage of existing functions used by the current Desktop applications. (These belong to the Toolkit environment.)

The positive side of QuickPort is that conventional applications that are brought over to Lisa and converted to run under the Workshop can be run on the Desktop with a minimum of changes. QuickPort is actually an application developed with the Toolkit—an application designed to run other applications. Quickport programs may consist of any combination of Pascal, C, and assembly-language code. Once a program is running in the Workshop, it can then be packaged using a special set of libraries supplied by Apple. This new package is then installed in the Office System.

Each application automatically has a portion of its window devoted to text display, and the ordinary WRITELN and READLN functions of Pascal are routed to the window. You can copy text to or from the clipboard just as with any other desktop application. In addition, you can split the window into scrollable portions, either horizontally or vertically. The application may specify a buffer size to control how much information is kept available for scrolling backwards. Optionally, an application can request a portion of the window to be set up for graphics. Any QuickDraw graphics performed by the application will be displayed in the designated portion of the window. The contents of the graphics panel can be copied out to any other desktop application that is capable of accepting graphics information (e.g., LisaDraw, LisaWrite). Thus, QuickPort is a valuable tool if you want to quickly get an application into a partial Lisa desktop environment. The Toolkit and QuickPort are the only development tools that produce software for the Desktop. Applications created with other tools, excluding those for Macintosh, must run in conventional operating environments like the Lisa

Workshop, UNIX, or XENIX.

The Macintosh Supplement to the Workshop consists of additional libraries of routines to support the development of Macintosh software. The standard Pascal compiler, code generator, and linker all have options to support Macintosh development. This supplement, along with documentation called *Inside Macintosh*, is available to interested parties willing to pay \$250.

The development approach involves creating the source code on the Lisa 2, compiling it, and then transferring object code to Macintosh for checkout. This transfer is typically done by creating a Macintosh disk on Lisa. An alternate route is through a direct communication line connected to the serial ports.

**IBM BASIC COMPILER**

A BASIC compiler for the Workshop, available from Pterodactyl Software, converts IBM PC BASIC programs to run on Lisa. Compiled into 68000 code, converted programs should run considerably faster on Lisa than on a PC. Given the 1-megabyte Lisa memory, applications could be modified to run substantially larger problems than on a PC. Communication programs are also available from Pterodactyl to transfer code from the PC to the Lisa.

**PERFORMANCE**

Lisa has taken hard knocks for performance, and not without justification.

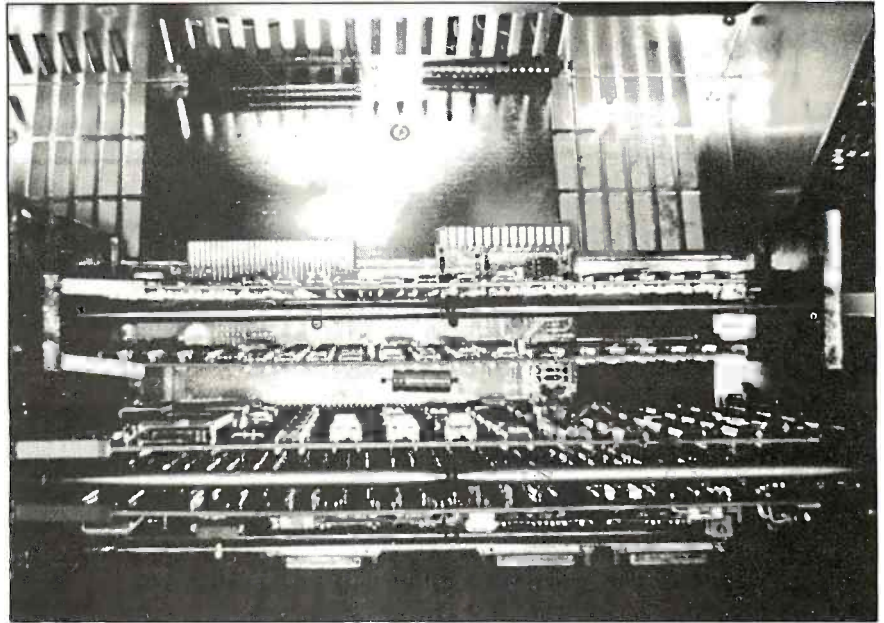


Photo 2: The four printed-circuit boards that make up Lisa's electronics are mounted in a sandwich within the card cage. Two memory boards, a CPU board, and an I/O board are included. All assemblies are color-coded and easily removed for servicing.

The first release of the Office System software was quite slow when doing I/O (input/output). Version 2.0 of the software, which improved the I/O speed quite a bit, was released in January 1984. I have not seen any comprehensive comparisons, but company claims indicated a 60 percent reduction in time for certain operations. My experience

*(continued)*

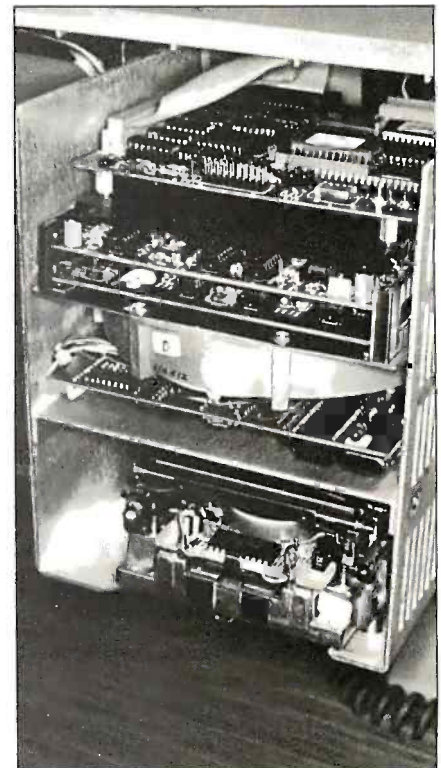


Photo 3: A close-up of the 10-megabyte drive and the Sony Micro-drive on the Lisa 2/10.

Table 2: Pascal I/O benchmark results.

| Test # | Description                                            | Time in seconds |      | Ratio to 2/5 |
|--------|--------------------------------------------------------|-----------------|------|--------------|
|        |                                                        | 2/5             | 2/10 |              |
| 1      | Write 1024 text lines of 8 bytes each (WRITELN)        | 11.0            | 11.8 | 1.1          |
| 2      | Read 1024 text lines of 8 bytes each (READLN)          | 6.5             | 6.4  | 1.0          |
| 3      | Write 8 text lines of 1024 bytes each (WRITELN)        | 8.0             | 9.3  | 1.2          |
| 4      | Read 1024 text lines of 8 bytes each (READLN)          | 4.8             | 5.0  | 1.0          |
| 5      | Write 1 text line of 8192 bytes (WRITELN)              | 8.1             | 9.0  | 1.1          |
| 6      | Read 1 text line of 8192 bytes (READLN)                | 5.8             | 6.2  | 1.1          |
| 7      | Write 8192 bytes in a single block (BLOCKWRITE)        | 1.5             | 2.3  | 1.5          |
| 8      | Read 8192 bytes in a single block (BLOCKREAD)          | 1.4             | 1.4  | 1.0          |
| 9      | Write 100 records of 100 bytes each (sequential PUT)   | 7.3             | 7.8  | 1.1          |
| 10     | Read 100 records of 100 bytes each (sequential GET)    | 1.4             | 1.4  | 1.0          |
| 11     | Read 100 random records of 100 bytes each (random GET) | 5.8             | 7.4  | 1.3          |

The industry  
may end up  
adopting Lisa  
technology  
in small pieces  
over the next  
few years.

is that the average improvement was more like 40 percent.

Table 1 contains some of my own performance figures for the Lisa 2/5 and 2/10. The 10-megabyte disk was 10 to 15 percent faster for most operations. All these tests were run under the Office System, release 2.0. Release 3.0 is not supposed to have any performance improvements, but I have not been able to verify that the performance is unchanged.

When trying to evaluate the performance of the Office System in absolute terms, you should take several things into account. "Opening a document" in Lisa includes more activities than in most systems. The 33 seconds required to open a 37,000-byte LisaWrite docu-

ment for the first time after system start-up made me wonder what exactly was going on. Actually, I discovered, quite a bit. First, the LisaWrite program is being brought into memory and activated. Second, a copy is made of the requested document. In Lisa you never work on the original. Since opening an empty document still takes 29 seconds, initiating LisaWrite accounts for most of the time required by the larger document. Note that opening the same document the second time takes just 7 seconds.

An additional factor affecting performance is the underlying overhead of a fail-safe system. The Lisa Office System is capable of recovering all the data files on the hard disk even if the main catalog is lost or damaged. This is accomplished by redundant storing of enough information to rebuild the entire directory. This fail-safe mechanism adds significantly to I/O times. You might argue that you would rather risk an infrequent loss of data than suffer speed degradation on each and every I/O operation. That, however, is a system design issue and not a valid criticism of system performance.

I also ran some tests on the 2/5 and the 2/10 for 11 different Pascal I/O operations. Here the 10-megabyte disk was never faster than the Profile drive (contrary to the Office System results). Most operations were about 10 percent

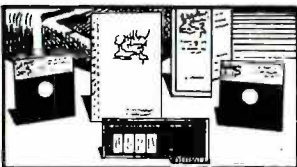
slower, and one operation was 50 percent slower. Table 2 shows the individual results along with a characterization of the type of Pascal I/O used. I am unable to reconcile these results with those from the Office System tests. I can only assume that the difference is due to a different kind of I/O logic used by the Desktop Manager.

CONCLUSIONS

It's fair to say that Lisa 2 gives its owners the freedom to run a wide variety of operating systems and applications. Its large memory and ability to use several sizes of hard disks are major factors in its versatility. Lisa's uniqueness as new technology has faded. And though Macintosh has pushed Lisa into the background, it may actually spur interest in Lisa over the long term. Further, until Macintosh is supplied with more memory, Lisa is the only practical way to run even moderately large Macintosh applications.

So far, Apple Computer does not seem inclined to market the Lisa aggressively or to give full support to Lisa software. In spite of this, I continue to think that the technology represented by the Office System is a giant step forward. It may well be that while the industry is not able to embrace it totally, it will end up adopting Lisa technology in small pieces over the next few years. ■

Triple Your Programming Speed!



GUARANTEED!

APB-102  
\$189<sup>00</sup>

Adds mainframe editing power to your Apple's language! Uses **NO** program memory space. Works with **ANY** size program! Hundreds of programming features never before combined in one package! **ALWAYS AVAILABLE** and **NEVER IN THE WAY!** The features of this system are far too extensive to describe here, so call or write for more information, and get a **FREE** quick reference card. **OEM'S PLEASE NOTE:** Now you can market your turnkey systems in ROM! Eliminate worries about copy protection. Your program auto-boots from ROM which can even eliminate the need for a disk drive. **Call or write for details.**

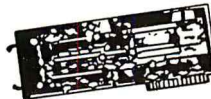
Optional Additions Include:

**NEW!! APU-2:** superENUMBER, multiHIDE, multiMERGE, VARIABLE CROSS REFERENCE, AUTONUMBER, NEW programs by Paul Johnson. Far more powerful and mistake proof than other versions... and always at hand. **\$35<sup>00</sup>**

**NEW!! COPY ZAP** by Glen Bredon, author of BIG MAC, SMART DISK COPIER, and ZAP utilities written for our system. Also copies 40 track disks! **\$39<sup>95</sup>**

**NEW!! ROM DEVELOPMENT SYSTEM:** Program your own firmware! Includes software, documentation and emulation RAM. **\$99<sup>00</sup>**

12 Bit 16 Channel A/D Convertor

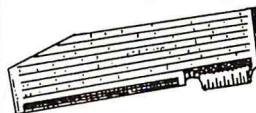


AD16B ★VERY HIGH SPEED  
\$299<sup>95</sup> ★7 VOLTAGE RANGES  
★COMPLETE SOFTWARE

SIGNAL CONDITIONING & DIFFERENTIAL INPUTS AVAILABLE

Professional Prototyping Board

THE BIGGEST—THE BEST ★IDEAL LAYOUT FOR WIRE WRAPPING



PRO-1 ★GOLD PLATED  
\$29<sup>95</sup> EDGE CONNECTOR  
★VERY LARGE—UP TO 52 (16 PIN) SOCKETS

48 Line Parallel I/O



PD48 ★48 LINES IN/OUT  
\$249<sup>95</sup> (SOFTWARE SELECTABLE)  
★6 TIMERS PLUS INTERRUPT  
★FULL DOCUMENTATION

APPLE IS A REGISTERED TRADEMARK OF APPLE COMPUTERS INC.



Hollywood Hardware 6842 VALJEAN AVENUE, VAN NUYS, CA 91406 (818) 989-1204

---

# THE FIRST LOOK AT FORTH ON THE MAC

*Creative Solutions has put some unique features  
in a language that can be frustrating  
for the beginner*

BY GREGG WILLIAMS

**C**harles Moore, the inventor of FORTH, once said, "FORTH is an amplifier. A good programmer can do a fantastic job with FORTH; a bad programmer can do a disastrous one." If that is true of FORTH (and I think it is), it is even truer of FORTH on a powerful machine—in this case, the Apple Macintosh.

FORTH is an unconventional language used to write complicated programs that run faster and fit in less memory than comparable programs written in, say, BASIC or Pascal. In FORTH you write short programs called *words*, then write more words that use the words just defined until you have a word that represents your entire program. Although FORTH is not as compact or fast as assembly language, you can (usually) write FORTH words that execute assembly-language instructions; in this way, you can further increase the speed of FORTH words that are used most often.

MacFORTH is best used by people with a detailed knowledge of both FORTH and the Macintosh hardware. The less you know about either subject, the longer it will take you to learn MacFORTH. Even though I know FORTH well, I don't know the inner workings of the Macintosh. I crashed the system dozens of times before I learned how to use MacFORTH correctly.

The style of a given implementation of FORTH resembles

the FORTH standard that it most closely follows; MacFORTH draws from the FORTH-79 standard.

## MACINTOSH + FORTH = MACFORTH

A plain FORTH on the Macintosh would be of little interest. MacFORTH is interesting because it (fairly) easily allows you to manipulate the features that make the Macintosh exciting: windows, menus, graphics, and mouse-driven input. (The computer makes these manipulations using FORTH words that directly call the 68000 QuickDraw routines in the Macintosh ROM Toolkit. This means that the computer's response to such commands is very quick.) Here are some of the main features of the language.

**Windows.** You can create a window in as few as three lines of code. Such windows can display both text and graphics; optionally, you can specify a word that executes when you "open" the window (by clicking the mouse cursor in the window). Windows can have both close and size boxes. (This version of MacFORTH does not give you access to Macintosh

*(continued)*

---

Gregg Williams, a senior technical editor at BYTE, edited and wrote for the BYTE FORTH issue (August 1980). He can be reached at POB 372, Hancock, NH 03449.

## AT A GLANCE

**Name**

MacFORTH Level 1, version 1.1

**Type**

Token-threaded 68000 code with separated heads (see text box for details)

**Manufacturer**

Creative Solutions Inc.  
4801 Randolph Rd.  
Rockville, MD 20852  
(301) 984-0262

**Format**

3½-inch hard-jacket disk, unprotected

**Computer Needed**

Standard 128K-byte Macintosh

**Documentation**

260-page users manual, wire-bound

**Price**

\$149

**Audience**

Advanced programmers

"buttons" or the horizontal and vertical scroll bars.) Once they have been created, you can move, resize, or close these windows, just as you would any Macintosh window—MacFORTH does this automatically. MacFORTH does *not* redraw the contents of a window that has been partially covered and re-exposed; however, you can program a window to do that yourself.

Given a window called W1, you can assign it a specific behavior with the phrase

```
W1 ON.ACTIVATE
 WINDOW.ACTION
```

where WINDOW.ACTION is a FORTH word defined as follows:

```
: WINDOW.ACTION
 IF <code executed when
 window activated>
 ELSE <code executed when
 window deactivated>
 THEN
;
```

The window will then execute a specified sequence of FORTH words when it is activated and another sequence when it is deactivated.

Graphics. MacFORTH allows you to

draw lines, arcs, and hollow or filled polygons and ovals. You can easily change the "color" (pattern) of the "ink" used in drawing, and you can create your own "ink colors." MacFORTH also automatically clips, scales, and rotates the drawn image to your specification. You can specify that images and text be drawn to a window in one of several modes: copy, logical OR, logical XOR, or clear-bits (dots in the source image cause corresponding dots in the destination window to be cleared rather than set).

**Menus.** You can add a pull-down menu to the menu bar with about 10 lines of code that define the contents of the menu and the FORTH words that will execute when you choose a selection. You can modify the contents and the behavior of the menu while a program is executing, as well as add or remove check marks, disable certain selections (turning them gray), and add or delete menu selections.

**The Mouse.** You can track the location of the mouse cursor, change its shape, and sense the state of its button. Given these abilities, the mouse becomes just another input device that can be used to control the behavior of a running

## MacFORTH's Internal Structure

FORTH, like other languages, can work in one of several ways; the most common method is called indirect-threaded code. In such FORTH systems, a word is stored as the character string signifying its name followed by pointers to the address of the other FORTH words that make up the new word's definition (I'm simplifying here).

MacFORTH is a token-threaded language with separated heads. *Token-threaded* means that the FORTH words composing the new word's definition are pointed to by tokens, not addresses. In the Macintosh, addresses take 4 bytes, while token size is up to the designer. The MacFORTH creators decided on a token size of 2 bytes, which saves an impressive 2 bytes for every word used in a definition but still allows a maximum of 65,536 words (surely a reasonable limit) to be defined in the system.

*Separated head* means that the character string representing the name of the word

being defined (called the *head* or *header*) is stored in a different area from the definition of the word. One possible use for separated heads is to reduce the size of a completed program by throwing away all the headers except the one used to start the program running. (The space saved can be considerable, especially when you have hundreds of words with long, meaningful names such as DRAW.MENU.BAR.)

Separated heads are also used to create *vocabularies* in MacFORTH. By separating related words into vocabularies, you make them easier to manage and prevent possible word-naming conflicts. In MacFORTH, the bodies of all words are stored together in a data structure that takes memory from the Macintosh heap; only the headers are separated into dictionaries. The resulting system appears to the user as a traditional dictionary structure but uses Macintosh memory in a more versatile way. —Gregg Williams



program.

### DISK I/O

Most FORTHS use screens (blocks of 1024 characters) to store FORTH programs or, sometimes, data. These screens are usually written directly to disk, totally ignoring the file structure that is usually associated with the host computer. (This is usually bad because it means that the information in the FORTH screens cannot be used by other programs.)

MacFORTH screens are stored in standard Macintosh document files, which have icons that look like a page of paper with the upper-left corner folded down. Although this choice is anathema to some FORTH purists, it has several advantages: groups of screens can be named, several unrelated sets of screens can exist on the same disk, a single disk can contain both the FORTH language itself and files of screens, and screen files can be copied and moved exactly as other Macintosh files.

### DATA FILES

I am fond of saying of FORTH, "The good news is that you can do anything in FORTH; the bad news is that you will probably have to do it yourself." In most FORTHS, you have to write your own words that allow you to use FORTH screens to store data; you can create libraries of words that implement sequential, random-access, or indexed file structures.

MacFORTH does this for you; it implements three file types: fixed, text, and virtual. *Fixed files* have records of a predetermined length and can be read or written in any order. *Text files* are records of variable length ended by a carriage return; they must be read and written in order. *Virtual files* are arbitrary streams of characters; you can begin reading and writing at any character position, and you are responsible for organizing and retrieving your data in a meaningful way. All the file types are easy to use. Together, they remove a traditional weakness of FORTH implementations.

### MISCELLANEOUS FEATURES

Believe it or not, most FORTHS don't include words for numeric and string input ("FORTH can do anything but . . ."). MacFORTH includes words for both, as well as a handful of words that make

Table 1: *The Sieve of Eratosthenes benchmark for various machines and languages.*

| Computer              | Operating System | Language               | Time (seconds) |
|-----------------------|------------------|------------------------|----------------|
| 68000 8 MHz           | None             | Assembly language      | 0.49           |
| 68000 8 MHz           | Sun PM68K ROS    | Telesoft Pascal        | 4.28           |
| IBM PC (8088)         | DOS 2.0          | Microsoft FORTRAN 3.20 | 23.7           |
| 68000 8 MHz Macintosh | MSP68000 1.1g    | Hemenway FORTH         | 27.0           |
| IBM PC (8088)         | DOS 2.0          | MacFORTH               | 36.2           |
| IBM PC (8088)         | DOS 2.0          | MMS FORTH              | 55.3           |
|                       |                  | BASICA                 | 2002.1         |

## MacFORTH Levels 2 and 3

By the time you read this review, Creative Solutions will have two new products available, MacFORTH levels 2 and 3. Level 1 is seen by Creative Solutions as being "for the hobbyist or those just getting started with the Macintosh." Level 2, which costs \$249, is intended for "the professional who will be using MacFORTH in his/her work." It includes a 68000 assembler, a floating-point package (most FORTHS work with only fixed-point arithmetic), and a richer set of words that give you full access to the Macintosh Toolkit routines (horizontal and vertical scrollbars, for example—a

useful-window attribute that is not supported in level 1). You will probably need to buy and study the massive two-volume reference work *Inside Macintosh* from Apple (it costs \$150 and is very difficult to read).

Level 3, for professional program developers, will "allow you to do all of your program development and then generate run-time-only versions of your product," according to Creative Solutions. Level 3 costs \$2500 and includes a limited licensing agreement and extensive help from the Creative Solutions staff.

—Gregg Williams

string manipulation easier than it is in other FORTHS.

MacFORTH gives you several words to manipulate the time and date (to the nearest second) as given by the internal Macintosh clock. It also includes words that manipulate the Macintosh speaker and serial port. You can easily print text and graphics to the ImageWriter, and the MacFORTH manual gives you hints on using other serial printers with your MacFORTH program.

Two features I used briefly are debug/trace and the user-specified error handlers. The former allows you to get the name of each FORTH word as it executes and a picture of the FORTH stack; the latter allows your program to try to recover from errors that would normally abort the program (division by zero, for example). The trace feature is of limited use because it gives you two lines of output after every FORTH word that is executed; since most FORTH

words are defined in terms of other FORTH words (often from six to ten levels deep), this indiscriminate tracing gives you more detail than you need. The feature would be more useful if you could specify which words (or how many levels deep) generate output.

MacFORTH allows you to create simple tones through the Macintosh speaker. If you have access to the Apple *Inside Macintosh* documentation, you should (according to the MacFORTH documentation) be able to do multiple-voice music and human speech.

### PERFORMANCE

No review would be complete without a benchmark program to argue about. Table 1 shows the results of BYTE's infamous Sieve of Eratosthenes (see BYTE, January 1983, page 286). MacFORTH compares favorably to several FORTHS running compiled 68000 code

(continued)

## A Sample MacFORTH Program

on machines running at 8 MHz (the same speed as the Macintosh).

### DOCUMENTATION

The printed MacFORTH manual is 299 pages long. It includes six tutorial chapters on using the main features of MacFORTH (windows, screen editing, graphics, and menus), six reference chapters, and a 118-page glossary that briefly defines the words included with the system (800 of them!). Unfortunately, the definitions of many words are unclear, incomplete, or inappropriate (the latter is true when the glossary includes words that are not supported in this version of MacFORTH).

The manual (which was written on and printed with a Macintosh) is well-written and relatively error-free. (This last is because of MacFORTH users' reporting errors in the first version of the manual.) Also included is an interactive computer-aided tutorial program called "Going FORTH" that runs on the Macintosh.

Finally, MacFORTH (according to its documentation) supports interaction with other Macintosh programs through text-type documents. Unfortunately, the documentation does not explain how to do this. The MacFORTH screen editor can cut and paste text data to the Note Pad, Gallery, and Scrapbook if the text is in lines of 64 characters or less, each line ending with a carriage return. Studying the editor's source code (included) might produce some clue on how to exchange information with other programs.

### CAVEATS

FORTH derives much of its power from its philosophy of giving the user complete access to (and responsibility for correctly using) the hardware. On the other hand, FORTH is a difficult language for most people to learn. In addition, the Macintosh is a complicated piece of hardware and software that is difficult to learn and, in the learning phase, easy to "crash."

I strongly recommend that you consider these factors before buying MacFORTH. If you want to develop Macintosh software, MacFORTH is an alternative language to BASIC, Pascal, or 68000 assembly language that, once mastered, offers greater productivity and compactness of code than the

The program shown here establishes three windows, titled Binary, Decimal, and Hex (see figure 1). Executing the FORTH words `goto.binary`, `goto.decimal`, and `goto.hex` transfers all keyboard I/O (input/output) to the appropriate window and changes the arithmetic computation base to base 2, 10, and 16, respectively. This program also creates a custom menu called `Arith. Base`, which lets you transfer control to the appropriate window by selecting a menu item. (The screen dump shows all three windows and the custom menu.)

The code in screen 18 creates the windows `binary.win` and `hex.win`. (The system window is renamed "Decimal" at the top of screen 19.) Note that a window is created in five lines and that the Binary window has a size box but that the Hex window doesn't (see figure 1 and listing 1, screen 18, lines 5 and 11). The windows can move over and under each other, and all but the Hex window can be changed to different sizes; all three windows can

be closed by clicking the close box in the upper left-hand corner of the window.

Screens 19 and 20 define the three `goto ...` words. The last line of each definition (beginning with `srccopy ...`) is needed to change the window's output parameters to a mode and font appropriate to text display. (The default parameters are best for graphic output.) Note that the Hex window prints in a bold text style.

Screen 23 defines a pull-down menu and its behavior in 13 lines of code! Line 5 defines the menu title, and line 6 defines each menu selection; the "D" after "Decimal" causes the Macintosh to recognize the cloverleaf-D keystroke as a substitute for the Decimal menu selection. Lines 9 through 13 define the behavior associated with each menu selection. Lines 3 through 13 define the word `make.arith.menu`; line 15 executes that word and thereby creates the menu.

—Gregg Williams

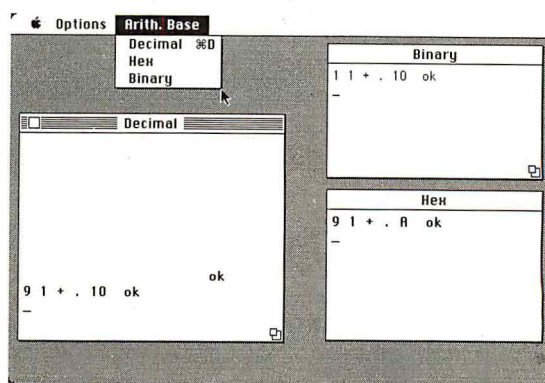


Figure 1: Multiple windows and a custom menu. Notice that each box interprets numbers in a different way (the phrase  $x + y + .$  adds two numbers and prints the sum). The three selections in the "Arith. Base" menu execute the words `goto.decimal`, `goto.hex`, and `goto.binary`.

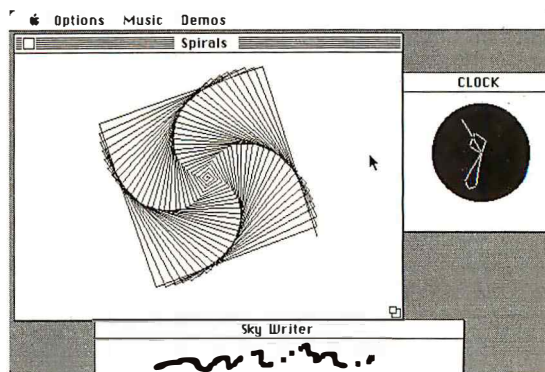


Figure 2: Demo programs running in MacFORTH. Each window, when activated, runs a specific program. *Spirals* (currently active) draws different spiral patterns. *Clock* displays the time on a simulated analog watch face. *Sky Writer* lets you doodle in its window using the mouse cursor.

Listing 1: A sample MacFORTH program.

```

SCR # 18 "FORTH Blocks 2" 06/11/84 10:30:27 AM
0 (sample windows program) (061084 gw)
1 4 constant monaco (name typefont)
2
3 new.window binary.win (name window)
4 " Binary" binary.win w.title (title window)
5 close.box size.box + binary.win w.attributes (give attbts)
6 45 300 150 150 binary.win w.bounds (set position onscreen)
7 binary.win add.window (create window)
8
9 new.window hex.win
10 " Hex" hex.win w.title
11 close.box hex.win w.bounds
12 180 300 300 500 hex.win w.bounds
13 hex.win add.window
14
15

SCR # 19 "FORTH Blocks 2" 06/11/84 10:30:34 AM
0 (sample windows program) (061084 gw)
1
2 " Decimal" sys.window set.wtitle (rename default window)
3
4 : goto.hex (transfer to hex window, go to base 16 arith.)
5 decimal 16 base !
6 hex.win window
7 srccopy textmode monaco textfont bold textstyle ;
8
9 : goto.binary (transfer to binary window, base 2 arithmetic)
10 DECIMAL 2 base !
11 binary.win window
12 srccopy textmode monaco textfont plain textstyle ;
13
14
15

SCR # 20 "FORTH Blocks 2" 06/11/84 10:30:39 AM
0 (sample program) (061084 gw)
1
2 : goto.decimal (transfer to decimal window, base 10 arithmetic)
3 decimal
4 sys.window window
5 srccopy textmode monaco textfont plain textstyle ;
6
7
8
9
10
11
12
13
14
15

SCR # 23 "FORTH Blocks 2" 06/11/84 10:48:29 AM
0 (menu sample) (061184 gw)
1 4 constant base.menu (menu number of new menu)
2
3 : make.arith.menu
4 base.menu delete.menu
5 0 " Arith. Base" base.menu new.menu (specify menu title)
6 " Decimal/D;Hex;Binary" base.menu append.items
7 (specify pull-down menu items)
8 draw.menu.bar
9 base.menu menu.selection: 0 hilite.menu
10 case 1 of goto.decimal endof (specify behavior of)
11 2 of goto.hex endof (each menu item)
12 3 of goto.binary endof
13 endcase ;
14
15 make.arith.menu (create new menu)

```

others. (For software development, you will probably want to buy MacFORTH level 2 or 3; see text box.) MacFORTH level 1, the product reviewed here, will give the casual user more access to the system than other languages, but it will still require patience, experimentation, and study to be useful.

FORTH requires you to learn the function of many words that do one small task each. Unlike Pascal, which has a few dozen keywords, the average FORTH has well over a hundred. The glossary supplied with MacFORTH has 800 words, most of which deal with Macintosh-specific actions. You will need to know several hundred of them well; you should be aware of a few hundred more; as to the remainder, you may never figure out exactly what they do. The glossary in the back of the MacFORTH manual helps, as do the examples of FORTH code supplied with the system (which you should print out and study).

The people at Creative Solutions in Rockville, Maryland, creators of MacFORTH, are looking into creating a supplementary book about the Macintosh. Creative Solutions maintains a hotline, but calls are limited to questions simple enough to be answered in five minutes.

The documentation is better than most, but it is a tutorial on neither FORTH nor the Macintosh. I spent about 30 hours learning how to do simple window-based programs, and I crashed the system at least 40 times.

FORTH is very unforgiving of errors. I once crashed the system when I copied (or so I thought) the following word from the manual:

WINDOW

I should have typed

RESULTS WINDOW

which switched to a window named RESULTS. The omission of that one word caused MacFORTH to crash. (Version 1.1 is an improvement over version 1.0 in that some words that originally crashed when given too few arguments are now "trapped" and give an error message instead of crashing.) Using MacFORTH is like using a chain saw instead of an axe to cut wood—you can get more work done, but you'd better know what you're doing. ■

(continued from page A78)

to put in two serial ports, and of course that adds to the cost. Also, as we use more custom parts, get the manufacturing more automated, and lower our overhead in general, that'll bring the price down. Look at the trend of the IIe; we introduced the basic unit at \$1395—that was with no disk drive, no anything. Now the same box with a disk driver and controller is going for \$995.

BYTE: *There are a lot of parallel-oriented peripherals out there. How did the Apple designers decide to go with serial ports instead of parallel ports?*

Quinn: A number of reasons, not the least of which is the amount of space you need to bring out all the major signals for an 8-bit data bus—we didn't have a whole lot of space.

BYTE: *You mean you didn't have enough space on the rear panel.*

Quinn: Right—a parallel port would normally be as wide as a DB25 [connector]. The main thrust in our peripherals—the Imagewriter and our modem—is serial. So it fell out from there.

BYTE: *Another important connector on the rear panel is for [high-quality] RGB color.*

Quinn: Actually, it's called the video expansion port. All the major signals are brought out there, where hardware designers can get their mitts on them. In fact, we bring out sound here—when you connect a TV set through an RF modulator, you can go to the TV and turn the sound down. [Sound comes out of a small speaker beneath the keyboard on the Apple IIe and earlier computers and cannot be turned down.] So that was one feature we wanted. We knew we wanted RGB ultimately; we wanted a lot of video modes. With another box, we can convert the [American] NTSC [National Television Standard Committee] signal to PAL [Phase Alternate Live], the British standard.

And one of the guys at Apple, Rick Geiger, was saying that flat-panel technology was right around the corner. And we said, "Yeah, sure" [he laughs]. But we were smart enough to think that maybe we didn't know everything, so we bought out basically all varieties of video signals. And that allowed us to get the flat-panel capability when it came

out—it came out a lot sooner than I thought.

I have a model here; we have five working prototypes, but I couldn't get one for today. The first one we got working, we made this cable that goes from here into a cigarette lighter. I took it out of the car and sat there and played Lode Runner. This is a state-of-the-art LCD [liquid-crystal display]—it's got 560 by 192 pixels, which will give you full double high-resolution pixels as well as the 80-column by 24-line display.

BYTE: *What are some of the ROM changes that were made to the IIc? I've heard that some bugs in the IIe ROM have been fixed, and there are 32 graphics characters.*

Quinn: The 32 graphics characters are what's called Mousetext. They are icons—hands, open and closed apples—embedded in the character set. They [software developers] were running into problems doing very fast, very quick word processors, for example, in high-resolution graphics. You're handling a chunk of data and scrolling becomes noticeably slow, but that's the only way you can get icons because your character set has nothing but ASCII characters.

The older Apple IIs have inverse and flashing characters in the character set. They [the Apple IIc design team] took some of these characters out and put in the icons. There are some pluses and minuses to doing that—it causes some incompatibilities with software already out. But the developers gave it an overwhelming "Please do it!"

BYTE: *What about Apple IIe bugs?*

Quinn: One of them doesn't affect the user, but it affects Apple. Do you know what "screen holes" are? [They are bytes within the text-page area of memory that do not show on the screen.] Obviously, we have those in our main 64K bank of memory, but you also have corresponding screen holes in both versions of the Apple IIe 80-column card. It turns out that if some Pascal routine looks at a certain screen hole and the firmware is pointing to its alternate—all this depends on how the RAM powered up, whether a certain location was 1 or 0—the computer would reset on scrolling. It turns out that the 64K-bit RAM chips [used on the extended 80-column card] come up in

the right state. But the static RAMs for the regular 80-column card can come up either way—it depends on sunspots or what day of the week it is, I don't know. Anyway, we had to trash a certain percentage of our RAM chips [because of this].

There's some problem if you're using it [the Apple IIe] with a modem and [an Apple] Super Serial type [interface] card [running] at 1200 baud—I don't have the details.

BYTE: *Some problems with different kinds of modems or just one?*

Quinn: Basically, all kinds, I think. It actually worked, but you'd load your buffer and get garble on the screen. So it was loading in the text or whatever fine, but it would upset the user a bit.

[Editor's note: Once the IIc had been out for a while, some users found that it worked with a modem at 300 bps but not at 1200 bps. Apple traced the problem to a hardware design flaw. According to Peter Quinn, new IIcs will have the flaw fixed and existing IIc owners can get both a software patch and a hardware modification from their dealers. . . . G.W.]

BYTE: *Tell me something more about how you used the 65C02 to crunch the code down to a smaller size.*

Quinn: The 65C02 gives you 27 additional op codes. Not only were they able to write more crunched code for the peripheral-handling stuff, they also went back and crunched some of the existing video-handling routines. They were fixing bugs while they were at it. The developers can use this code, too, but they have to make a choice of whether or not they want to make their software backward compatible [with Apple II+ and IIe].

Later in the year or early next year, we'll probably offer an upgrade kit [with a 65C02 and a character generator ROM] that will fix the [IIe] bugs, but it will give you Mousetext. That causes some incompatibilities [with existing software].

BYTE: *I take it there have been no changes to the Applesoft ROM?*

Quinn: There have been. We decided to make lowercase [BASIC keywords] work.

BYTE: *Are you going to get any increased performance on Applesoft because of the 27 additional [65C02] op codes?*

Quinn: I didn't have the guts, when we brought out the IIe, even to touch that ROM space. But [with the IIc] I had the best three firmware writers in the world—Dick Huston, Ernie Beernink, and Rich Williams—working for me, and we made the choice [to add lowercase BASIC keywords]. But as far as going in and using different op codes, I wasn't that gutsy.

**[Editor's note: An interesting aside—the firmware writers embedded their names in the IIc. To see them, do an IN#5, then INPUT AS, then PRINT AS. Slot 5 has no use in a IIc, so the designers designed in a "ghost" peripheral that gives their names in a string as its input to the Apple. . . .G.W.]**

BYTE: But there's a difference between, say, a speech-synthesis board, which needs a couple of bytes every few milliseconds, and a coprocessor board, which supposedly takes over the whole box. Wouldn't that be impossible for your serial port [on the IIc]?

Quinn: Well, we don't have just the serial

port; we also have the disk-drive port, which runs at more than 400K baud. Depending on how much intelligence you put on that outer box, nothing is impossible for an Apple II. Look at the Rana [8088 coprocessor] box—its coprocessor does MS-DOS and all that and hooks into an Apple II. Of course, it goes through the [peripheral] slot.

BYTE: That's what I'm saying. Without slots [which the Apple IIc doesn't have], how can you get the throughput you need for a coprocessor? Quinn: Several ways. One, you use a more or less high-level language [for] swapping between this processor and that processor. So the crunching happens over there and then comes back and is delivered through this I/O [the IIc serial ports]. You don't need that tremendous throughput. And there are other ways. Of course, these serial ports go up to 19,200 baud, and I believe with some tricks should do better than that. As you know, the Apple third-party de-

velopers are the first to find the tricks usually. So the door is not closed by any means.

BYTE: I guess the only question to end with is a general one: where do you see the Apple II product family going?

Quinn: Two years from now, you know the technology is going to progress even farther. Flat-panel displays will be a dime a dozen. VLSI will be more than feasible, so we'll be able to crunch more. So we'll do what we've always done in the past—take the same machine, maintain its greatness and its compatibility, and add value for the same price. Building in modems, building in RGB, you just take a shopping list and add to it. We may extend it lower—we're working on that. It depends on what makes sense—when you've got it bread-boarded and wire-wrapped, does it look right? Does it feel right? Do you want one? We are unwilling to create anything we wouldn't want ourselves. ■

## Friendly Computer Center, Inc.



NEW LOW PRICES!



### EPSON

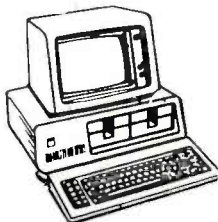


Epson Geneva PX8 Portable \$895

|        |        |
|--------|--------|
| RX100  | \$399  |
| RX80FT | \$279  |
| RX80   | \$225  |
| FX80   | \$399  |
| FX100  | \$599  |
| LQ1500 | \$1049 |

### MONOCHROME PRO PACKAGE \$2249

- IBM® PC 64K
- 2-320K DS/DD DRIVES
- MONOCHROME DISPLAY CARD
- MONOCHROME MONITOR



### APPLE

APPLE III Entry System \$895

NEW APPLE DUODISK DRIVE W/EXTENDED 80 COLUMN CARD IN STOCK—MACINTOSH CALL



### DOUBLE SIDED SANYO MBC-552-2 \$1049

W/DRIVE AND SOFTWARE

NEWAPPLE IIC \$875

TO ORDER CALL TOLL FREE

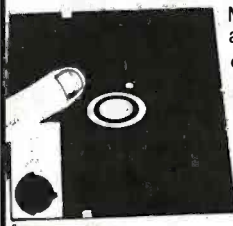
Friendly Computer Center, Inc.

1381 Coney Island Ave Brooklyn, New York 11230

(800) 258-5805 (718) 252-9737

Circle 702 on inquiry card.

## \*REDUCES DISKETTE COST 50%!



Make use of the back of your 5 1/4" Diskettes and SAVE

- **NIBBLE NOTCH** tools make it easy.
- Adds the precise notch where you need it.
- Doubles diskette space or MONEY BACK!

### NIBBLE NOTCH I

Cuts square notch for Apple, II, II+, IIe, III, Franklin and Commodore.

only \$14.95 each

add \$1.50 each P&H (\$4.50 each foreign P&H)

### DISK OPTIMIZER® SYSTEM SOFTWARE FOR APPLE, II, II+, IIe, III & Franklin

- 469% FASTER Than Similar Programs!
- Certifies your "new" disk 100% Error Free
- Removes Bad Sectors • Adds 36th Track
  - Performs Disk Drive Speed Check
  - Adds DOS and More

only \$24.95 each

add \$1.50 each P&H (\$4.50 each foreign P&H)

— OR BUY BOTH —  
only \$29.95

add \$2.50 each set P&H (\$6.50 foreign P&H)

\*Florida Residents Add 5% Sales Tax\*

SATISFACTION GUARANTEED OR YOUR MONEY BACK!

## ORDER TODAY!

CALL TOLL FREE: 1-800-642-2536

OR SEND CHECK OR MONEY ORDER TO:

**NIBBLE NOTCH COMPUTER PRODUCTS**  
DIVISION OF CORTRAN INTERNATIONAL

4211 NW 75th TERRACE • DEPT. 86 • LAUDERHILL, FL 33319  
PAT. PEND. ALL TRADEMARKS ARE ACKNOWLEDGED



Circle 670 on inquiry card.

## AT A GLANCE

### Name

Premium Softcard IIe (for the Apple IIe only)

### Version of CP/M

2.2

### Manufacturer

Microsoft Corporation  
Microsoft Building  
10700 Northup Way  
Bellevue, WA 98004  
(206) 828-8080

### Price

\$395

### Documentation

*Osborne CP/M User Guide*, installation and operations guide, and *Microsoft Basic Reference* manual

### Features

Effective clock rate of 6 MHz; includes "standard set" of CP/M utilities, plus GBASIC (extra: if you return your warranty card, you will receive an assembly-language programmers manual); has 64K bytes of on-board RAM, which is available to Apple DOS and extends Apple IIe memory to 128K bytes for programs that are designed to use this added capacity; provides 80-column capacity

(continued from page A47)

The primary reason for this is that in order to be sure that the information in the disk cache is still accurate, the system must still briefly access the disk to make sure you have not changed the disk since the last time it was read. (Some systems have a way of sensing whether the user has opened the disk door; standard Apple disk units provide no such capability.)

### CP/M CARD

If you purchase the ALS CP/M card and also the additional programmer's kit, you will have the same documentation that comes with the Gold Card. Additionally, the *Systems Guide* is supposed to contain a listing of the BIOS (basic input/output system) of the system.

Just a side note about CP/M 3.0 systems: the beginning user of CP/M would more likely make use of the installation guide and the *CBASIC Reference Manual*. The rest of the documentation, though, will be the most useful to the software developer or the hardware-system developer anxious to adapt his hardware to this new system.

### APPLI-CARD

I was highly skeptical when I first received this card from Personal Computer Products Inc. (PCPI). My primary objection was the apparent lack of documentation with the unit. Still, I was able to run the applications programs I wanted. And the CP/M books could handle most of the rest of my requirements. (As mentioned before, MicroPro markets this card as StarCard.)

With the Appli-card, even though the standard CP/M commands (ED, STAT, PIP, etc.) are not explained in the manual, the programs that PCPI supplies are all well documented and menu-driven. One of the best features is a menu-driven install program that lets you make changes easily to the BIOS (similar to the so-called SYSGEN programs of the "old days" of CP/M).

One change I made in the system configuration was to install the RAMdisk software as drive A in the system. This was necessary to allow the maximum speed of a particular benchmark I was trying to put together.

The following information is provided separately from the benchmarks in the next section because none of the other

cards tested had RAMdisk software available. (The Gold Card is specified for one of the comparisons—for the case in which its disk cache had an effect. For the other tests, all of the CP/M cards would have performed the same as the nonbanked version as indicated in the MBASIC read/write test.)

Table 1 shows the results of a "quickie" file copy test.

The file create and destroy test (see table 2) consisted of a sequence of 10 repeats of the commands:

```
SAVE 160 A40KFILE
ERA A40KFILE
```

in a file named TEST.SUB. This test file was run as a SUBMIT file from the RAMdisk in each case. To run it in the first case, both SUBMIT.COM and the command test file were on the RAMdisk, but the RAMdisk was not installed as the primary drive. The command was run by the sequence:

```
A>M:
M>SUBMIT TEST
```

In the second case, the RAMdisk was installed as the primary drive (A:) using the menu-driven install software. The timing difference came from the fact that CP/M 2.2 always writes a file named \$\$\$SUB onto the primary drive and steps back and forth between the directory and the file until the commands are all completed. The excess time shown in the table is due solely to the drive-access time.

Notice that the RAMdisk time of 0.86 seconds average for this operation is comparable to the result of 21 seconds for the original disk file copy (the RAMdisk created and destroyed a file 10 times in 8.6 seconds). This simply points out that there is some advantage to choosing the best way to use a RAMdisk when available.

As a final RAMdisk comparison, I switched over to the PCPI implementation of a RAMdisk under AppleDOS (see table 3). Only a very simple benchmark was tried: that of creating and saving a 31K-byte file (the limit of the BSAVE command). Here are the two commands I used:

```
BSAVE A31KFILE,A$400,L$7FFF
BLOAD A31KFILE
```

I used standard AppleDOS 3.3 (released in August 1980) for this test.

**THE BENCHMARK TESTING**

For benchmark testing, I used an Apple IIe as the host for all of the tests. Since the same program could be run, there would be no variation due to anything other than the processor card itself. I did not feel much would be gained by adding a disk-access benchmark to this test, since all of the processor add-on boards rely on the 6502 to do the disk access for them. With the exception of the Microsoft Premium Softcard IIe, which uses the auxiliary slot of the IIe, all were tested in slot 4.

The program was run, in all but one case, using Microsoft Softcard MBASIC. The program is a slightly modified version of the standard BYTE benchmark for the Eratosthenes Sieve prime-

number program (see listing 1). It differs from the standard implementation only in the use of an integer variable (FL%) used as a replacement for a floating-point variable (FLAGS) throughout the program. I did this because some of the versions of the operating system did not allow enough free space to run the program as originally written. The free-space number reported by MBASIC is also shown in the performance chart.

For the tests using Microsoft Multiplan, I used the standard BYTE spreadsheet. This consists of a 25 by 25 matrix in which each cell differs from the cell to its immediate left by a factor of 1.001. Additionally, the leftmost cell of any row is 1.001 times the rightmost cell of the

*(continued)*

**AT A GLANCE**

**Name**

Gold Card

**Version of CP/M**

3.0

**Manufacturer**

Digital Research  
POB 579  
Pacific Grove, CA 93950  
(408) 649-3896

**Price**

\$775 (banked system—192K bytes on-board RAM), or \$495 (nonbanked system—64K bytes)

**Documentation**

An installation guide, the Digital Research *CP/M Plus User's Guide*, the Digital Research *CBASIC Reference Manual*, DRI's *CP/M Plus Programmer's Guide*, DRI's *CP/M Plus Programmer's Utilities Guide*, DRI's *CP/M Plus Systems Guide*, and DRI's *SID Reference Guide*

**Features**

Effective clock rate of 6 MHz; comes with "standard set" of CP/M utilities including DIR, DIRSYS, ERASE, TYPE, USER, DATE, DEVICE, DUMP, ED, GET, HELP, INITDIR, PIP, SET, SETDEF, SHOW, and SUBMIT; also includes CBASIC (Digital Research version of BASIC) and several programming utilities including MAC, RMAC, HEXCOM, LINK, SID, and two kinds of cross-reference utilities (CBASIC and MAC files); has 80-column capability with the highest display update speed in the group tested (however, 80-column card is active only under CP/M); has 64K or 192K bytes in the banked version of on-board RAM; RAM is not available to Apple DOS

**Table 1: Results of the file copy test.**

|                        | Time to Copy (seconds) | Notes                               |
|------------------------|------------------------|-------------------------------------|
| Gold Card (nonbanked)  | 21.0                   |                                     |
| Gold Card (banked)     | 21.0                   |                                     |
|                        | 15.0                   | second-time copy (disk cache helps) |
| Appli-card (64K-byte)  | 21.0                   |                                     |
| Appli-card (192K-byte) | 21.0                   | disk to disk                        |
|                        | 12.6                   | RAMdisk to disk                     |
|                        | 9.5                    | disk to RAMdisk                     |

Note: File created by the command: SAVE 160 A40KFILE; file copied by the command: PIP B:=A:A40KFILE

**Table 2: Results of the file create and destroy test performed 10 times.**

|                         | Time to Copy (seconds) | Notes                              |
|-------------------------|------------------------|------------------------------------|
| Appli-card (192K bytes) | 22.0                   | A: is Apple Disk and M: is RAMdisk |
|                         | 8.6                    | A: is RAMdisk                      |

**Table 3: Results of the file create and save test.**

|                   | Time to Save (seconds) | Time to Load (seconds)   |
|-------------------|------------------------|--------------------------|
| BSAVE to disk:    | 44.5                   | BLOAD from disk: 33.2    |
| BSAVE to RAMdisk: | 10.4                   | BLOAD from RAMdisk: 10.2 |

Note: RAMdisk free space under Apple FID is 731 sectors (187K bytes)

## AT A GLANCE

### Name

CP/M Card

### Version of CP/M

3.0 (also known as CP/M Plus)

### Manufacturer

Advanced Logic Systems  
1195 East Arques Ave.  
Sunnyvale, CA 94086  
(408) 730-0306

### Price

\$399

### Documentation

A 40-page *CP/M Card Users Guide*, the Digital Research's (DRI) *CP/M Plus Users Guide*, and DRI's *CBASIC Reference Manual*; available separately at extra cost of \$79 are DRI's *CP/M Plus Programmer's Guide*, DRI's *CP/M Plus Programmer's Utilities Guide*, DRI's *CP/M Plus Systems Guide*, and DRI's *SID Reference Guide*

### Features

Effective clock rate of 6 MHz; has 64K bytes of on-board RAM; "standard set" of CP/M 3.0 utilities; also includes CBASIC (Digital Research's version of BASIC) and several programming utilities including MAC, RMAC, HEXCOM, LINK, SID, and two kinds of cross-reference utilities (CBASIC and MAC files); does not have 80-column capability; does not have RAM available to Apple DOS

preceding row. There is only one independent cell in the entire matrix, at location I,I. When its value changes, the whole spreadsheet must be recalculated. Except as noted in table 4, the 25 by 25 size was maintained.

### OTHER BENCHMARKS

In addition to those shown in table 4, I ran the BYTE benchmarks for file creation and rereading. There was no discernible difference between any of the CP/M cards tested in this regard. Only the Digital Research Card was not tested in this manner due to BIOS interaction with the Softcard version of MBASIC. (Notice that this is not a problem; the standard CP/M version of MBASIC will run correctly with this card. It simply was not available for the review. Additionally, Digital Research does provide you with its own version, CBASIC.)

The results of the file create test are consistent at 69 seconds, while read-back of the file created took 65 seconds. These figures can be used to compare the Apple, under CP/M 2.2 or 3.0, with other systems.

A listing of the programs as used with MBASIC is shown below:

#### File Create:

```
100 A$ = "12345678123456781
234567812345678"
120 B$ = A$ + A$ + A$ + A$
140 NR = 512
```

```
160 OPEN "O",1,"B:TEST"
180 FOR I = 1 TO NR
200 PRINT #1,B$
220 NEXT I
240 CLOSE
260 PRINT "DONE"
```

#### File Read:

```
300 NR = 512
320 OPEN"!",1,"B:TEST"
340 FOR I = 1 TO NR
360 INPUT#1,B$
380 NEXT I
400 CLOSE
420 PRINT "DONE"
```

The only surprise was that the Microsoft Softcard IIe performed exactly the same as the others. Because of the Multiplan results in the spreadsheet save section, I had expected that the results would be different. I have not yet discovered the reason for this seeming inconsistency.

### CONCLUSIONS

You have many choices in expanding your Apple to add CP/M. Your decision should be based on support, cost, and speed.

The Apple slots have provided manufacturers the opportunity to offer a wide variety of products. Unfortunately, it is not always possible for products to talk to each other, or even to coexist. If the only kind of system you will ever have

#### Listing 1: The BYTE Eratosthenes Sieve prime-number program (as modified by the author).

```
800 SIZE = 7000
820 DIM FL%(7001)
830 PRINT"START ONE ITERATION"
840 COUNT = 0
850 FOR I = 1 TO SIZE
860 FL%(I) = 1
870 NEXT I
880 FOR I = 0 TO SIZE
890 IF FL%(I) = 0 THEN 970
900 PRIME = I + I + 3
910 K = I + PRIME
920 IF K > SIZE THEN 960
930 FL%(K) = 0
940 K = K + PRIME
950 GOTO 920
960 COUNT = COUNT + 1
970 NEXT I
980 PRINT "DONE: ";COUNT;" PRIMES FOUND"
990 END
```



**AT A GLANCE****Name**

Appli-Card (also known as the StarCard)

**Version of CP/M**

2.2

**Manufacturer**

Personal Computer Products  
11590 West Bernardo Court  
San Diego, CA 92127  
(619) 485-8411

**Price**

6-MHz version, \$395; 6-MHz version with RAMdisk (128K), \$595; also available from MicroPro, packaged with WordStar or InfoStar, as the StarCard (a "free" accessory)

**Documentation**

A 60-page *Installation and User's Guide* and the *CP/M Primer*

**Features**

Effective clock rate of 6 MHz; comes with the "standard set" of CP/M utilities, the Apple DOS RAMdisk utility, a combined disk copy and format utility, and a program for transferring files from and to Apple DOS; in addition, an install program allows the installation of new device drivers into the system (device drivers are generally developed by the manufacturers of Apple peripherals and may be linked into this system using the install program); can provide a 70-column software-controlled display or a 40-column display with as many as 255 scrollable columns without installing an 80-column card if desired (however, functions normally with an 80-column card installed in the Apple); has 64K bytes of on-board RAM, plus either 64K or 128K-byte extender available; RAM is available to Apple DOS as a RAMdisk of 183K bytes under Apple DOS, as well as a 110K-byte RAMdisk under CP/M 2.2

is a standard Apple II product with a pair of floppy-disk drives, then any one of the CP/M cards will serve your purposes well. However, if you plan to expand your system in ways such as adding an 8-inch disk controller, a set of high-capacity 5¼-inch drives, a hard disk, or a RAMdisk of some kind, plan ahead!

Ask the manufacturer of the peripheral you want to add which, if any, of the versions of CP/M can be adapted to the product.

For the older products, such as the Softcard and the Z-card, some manufacturers already have patches that allow their products to interface to CP/M

(continued)

**Now, a parallel printer interface for the Apple IIc**

# The Belkin Hamlet

**\$98<sup>50</sup>**  
LIST  
PRICE

**FOR ALL MAJOR CENTRONICS PRINTERS**

The Belkin Hamlet Interface connects the Apple IIc with all major Centronics parallel printers. It has been tested successfully on *all* these leading printers.

**COMPLETE PACKAGE WITH ADAPTER AND CABLES**

Hamlet package contains AC adapter and all required cables. Installation is simple. Everything needed is included.

**COMPACT IN SIZE**

This interface is compact in size, measuring only 3½ × 4 × 1 inches. It is easily tucked out of the way. Hamlet allows almost unlimited distance from computer to printer.

*Ask about our cables and Data Switch Boxes. Call Collect (213) 644-3184 for the name of your nearest Belkin dealer. Dealers provided liberal discount.*



**BELKIN COMPONENTS**

4718 W. ROSECRANS  
HAWTHORNE, CALIFORNIA 90250  
(213) 644-3184

Apple IIc is a registered trademark of Apple Computer.

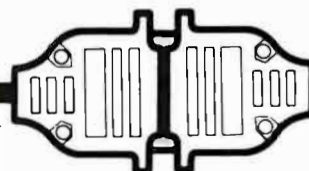


Table 4: Benchmark results using the Eratosthenes Sieve prime-number program.

| CP/M Card Type        | "Bytes Free" reported by MBASIC | MBASIC Sieve | Multiplan Tests |      |      |        | Notes |
|-----------------------|---------------------------------|--------------|-----------------|------|------|--------|-------|
|                       |                                 |              | % Free          | Load | Save | Recalc |       |
| Z-engine              | 26483                           | 5:51         | 4               | 26   | 11   | 31.8   | 1,2   |
| Softcard              | 26483                           | 4:36         | 6               | 21.6 | 14.5 | 28.7   | 2     |
| Softcard IIe          | 34675                           | 2:04         | 53              | 12.7 | 4.5  | 9.6    | 2     |
|                       |                                 |              | 38              | 17.0 | 4.8  | N/A    | 3     |
| CP/M Card             | 35699                           | 2:41         | 42              | 26.6 | 12.0 | 15.6   | 4     |
| Appli-card            | 32883                           | 1:53         | 31              | 18.7 | 11.7 | 13.3   | 4     |
| Gold Card (nonbanked) | 33651                           | 1:54         | 6               | 16.5 | 10.7 | 9.3    | 2     |
| Gold Card (banked)    | 26483                           | 1:54         | 34              | 18.8 | 11.2 | 11.5   | 4,5   |
|                       |                                 |              |                 | 6.8  |      |        | 6     |

## Notes:

(1) This timing reflects the difference in bus access modification specified in the At a Glance box for this card. The times for the preceding version (Z-card II) were found to be identical to those of the Softcard. The version of MBASIC supplied with the Softcard is incompatible at the disk I/O level. I used the Microsoft Softcard boot disk instead of the ALS disk here since the hardware design is similar. Thus the benchmark could be run as stated, just to compare processing speed versus disk-access time.

(2) The standard BYTE benchmark for Multiplan calls for a 25-column by 25-row spreadsheet. Due to memory limitations, I was able to use only a 19-row by 25-column spreadsheet for those marked. The free space and timings reflect this reduced size.

(3) When I loaded the benchmark standard size spreadsheet, there was no problem. However, when I tried to perform a recalculate function on the 25 by 25 matrix, the system hung up after completing row 8. This may be due to some reaction between my version of Multiplan and the current BIOS of the Softcard IIe. I have Multiplan CP/M-80 version 1.05 and Softcard IIe BIOS version 2.2.6. The problem has been reported to Microsoft. Since I couldn't do a 25 by 25, I dropped back to the smaller 19-row by 25-column sheet. Since this is still a significant overall size, I don't consider this a major problem. (Since I ran these tests, Microsoft has assured me that its version 1.06 of Multiplan does not exhibit this problem.)

(4) Standard sized spreadsheet (25 by 25 cells).

(5) Again a difference in the BIOS prevented disk I/O under MBASIC. Because the hardware design did not allow a boot of an alternate system, the disk file create/reread under MBASIC was not performed for the Gold card.

(6) This reflects a second load of the same spreadsheet. CP/M 3.0 performs "disk cache" operations. If it knows it has either read or written certain tracks before and that they have not been changed since, then the data comes from the disk-cache (high-speed RAM) instead of the disk.

*The flexibility of manufacturers to allow multiple nonrelated products is limited by two factors: economy and space.*

properly. However, it has been my experience that if I have a hard-disk drive and an 8-inch disk drive coterminous in the system, I must boot each manufacturer's version of CP/M separately and transfer data between the drives using the 5¼-inch floppy disks. The flexibility of the manufacturers to allow multiple

nonrelated products is limited by two factors: economy and space incentives.

Very few people have unusual combinations of cards in their systems, and manufacturers must dedicate their time and resources to whatever will pay them best. And in the bus-sharing approach, if you want to keep a 56K-byte TPA (transient program area) for the Z80, not much room is left to define many different kinds of I/O devices to which the 6502 can talk.

Again, these older cards are perfectly acceptable if you know what your applications will be and what your system will contain.

#### FOR THE FUTURE

The Apple CP/M user has hope for future device compatibility through the adaptable systems as used in the Appli-card and the CP/M Plus/CP/M 3.0 offerings (Gold Card and CP/M Card). Because the coprocessor approach is used, a lot more room is left in the 6502

program space, where device drivers can be created and linked together. This still leaves a large enough area for the transient programs.

These CP/M boards offer an adaptable BIOS, which enables you to add and modify device drivers.

If you need modem software, I recommend that you ask the CP/M manufacturer for specific recommendations or help in getting on line. My primary gripe is that none of them offers any form of communications software of the MODEM7-compatible sort in the box with the unit.

#### A FINAL NOTE

Once you have purchased a CP/M card, I recommend that you join a CP/M user's group. Take advantage of some of the "freeware" (free software) available to the user community. Some of it is good, some bad, some just fun. People out there are often just waiting to help you through your problems. ■

## PRESHIFT-TABLE GRAPHICS

(continued from page A29)

**Listing 3: The Shiftline routine.** This 6502 assembly-language routine shifts one line of a video image as described in figure 7. We used the Apple DOS Tool Kit assembler to create the object-code file, which is named SHIFTLINE ROUTINE.OBJ0.

```

SOURCE FILE: SHIFTLINE ROUTINE
----- NEXT OBJECT FILE NAME IS SHIFTLINE ROUTINE.OBJ0
5210: 1 ORG $5210
5210: 2 ;
5210: 3 ; PRESHIFT GRAPHICS ROUTINE
5210: 4 ; BY ROB MOORE & BILL BUDGE
5210: 5 ;

5210: 7 ;
0040: 8 BASE1 EQU $40 ; BASE PAGE ROW ADDR POINTER
5210: 9 ;
5210: 10 ; LOOKUP TABLES
5210: 11 ;
4000: 12 SHFTSTAY EQU$4000 ; SHIFTOUT TABLES
4700: 13 SHIFTOUT EQU$4700 ; SHIFT TABLES
4E00: 14 XDIV7 EQU $4E00 ; INDEX DIV 7
4F00: 15 XMOD7 EQU $4F00 ; INDEX MOD 7
5000: 16 ROWTBL EQU $5000 ; SCREEN ROW ADDR LO-BYTES
50C0: 17 ROWTBH EDU $50C0 ; SCREEN ROW ADDR HI-BYTES
5210: 18 ;
5210: 19 ; IMAGE DEFINITION PARAMETERS — SET BY USER
5210: 20 ;
5210: 21 IROWS EQU $5200 ; # OF ROWS — 1
5210: 22 IDOTS EQU $5201 ; DOT WIDTH — 1
5202: 23 IBWIDTH EQU $5202 ; IMAGE BYTE WIDTH
5203: 24 IBITS EQU $5203 ; ADDR OF IMAGE DATA
5205: 25 X1 EQU $5205 ; IMAGE LEFT X-COORD
5206: 26 Y1 EQU $5206 ; IMAGE TOP Y-COORD
5210: 27 ;
5210: 28 ;
5210: 29 ; FIRST, SET UP THE VARIOUS PARAMETERS TO PREPARE
5210: 30 ; FOR THE IMAGE DRAW.
5210: 31 ;
5210:8E E9 52 32 DRAWIMAGE STX XSAVE ; SAVE BASIC X-REG
5213:AD 06 52 33 LDA Y1 ; IMAGE TOP ROW #
5216:18 34 CLC
5217:6D 00 52 35 ADC IROWS ; + # OF ROWS — 1
521A:8D E1 52 36 STA Y2 ; = BOTTOM ROW #
521D: 37 ;
521D:AE 05 52 38 LDX X1 ; IMAGE LEFT X-COORD
5220:BD 00 4E 39 LDA XDIV7,X ; DIVIDED BY 7
5223:8D E2 52 40 STA LBYTE ; = IMAGE LEFT BYTE #
5226: 41 ;
5226:BC 00 4F 42 LDY XMOD7,X ; IMAGE LEFT BIT #
5229:B9 DA 52 43 LDA LMASKS,Y ; INDEXES LMASK TABLE FOR
522C:8D E3 52 44 STA LMASK ; IMAGE LEFT BIT MASK
522F: 45 ;
522F:98 46 TYA ; IMAGE LEFT BIT #
5230:18 47 CLC ; + SHIFT TABLES ADDRESS
5231:69 40 48 ADC #<SHFTSTAY ; + 256
5233:8D 8A 52 49 STA PATCH3 ; TO SHIFT PATCH
5236: 50 ;
5236:69 07 51 ADC #7 ; OFFSET TO SHIFTOUT TABLES
5238:8D 84 52 52 STA PATCH2 ; SETS UP SHIFTOUT PATCH
523B: 53 ;
523B:98 54 TYA ; IMAGE LEFT BIT #
523C:18 55 CLC
523D:6D 01 52 56 ADC IDOTS ; + IMAGE DOT WIDTH
5240:AA 57 TAX
5241:BD 00 4E 58 LDA XDIV7,X ; DIVIDED BY 7
5244:8D E5 52 59 STA SBWIDTH ; = SHIFTED DATA BYTE WIDTH
5247: 60 ;
5247:BC 00 4F 61 LDY XMOD7,X ; RIGHT EDGE BIT #

```

(continued)

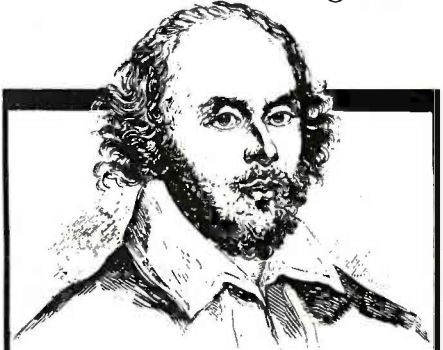
Circle 701 on inquiry card.

*At Christmas I no more  
desire a rose*

*Than wish a snow in May's  
new fangled mirth*

*But like of each thing  
that in season grows*

—King Lear



## MacInker

### A Gift For Christmas A Gift For All Seasons

If Shakespeare had had a word processor he would have consumed about 25 cartridges to run a first draft of his works. At an average of \$10/cartridge the cost is \$250. With MAC INKER he would use one cartridge, his total would be 50 cents in ink and his print-out quality would be much improved.

MAC INKER is very simple to use and automatic. Average ink cost/re-inking is 5 cents. We support 535 printers and we have 20,000 units in the field, in the US and in 5 continents.

MAC INKER, a gift for Christmas, that will last for years in many seasons to come. **\$54.95+**



## MacSwitch

Choose also our popular MAC SWITCH, serial or parallel switch - the ideal companion for the user who has 2 printers or 2 microcomputers or both. **\$99.00**



Order toll free 1-800-547-3303  
or ask for free brochure

## Computer Friends

6415 S.W. Canyon Court  
Suite #10  
Portland, Oregon 97221  
(503) 297-2321

## PRESHIFT-TABLE GRAPHICS



### Apple II + Paper Tape I/O Is This Easy

10101011010001010:.....  
 01010101010010100:.....  
 One minute you're without, the next you're up and running! Just plug into your **APPLE II PLUS**. A neat and complete package.

- Model 600-1 Punch — 50cps, rugged
- Model 605 Reader — 150cps
- Parallel Interface Board/Cable
- Data Handling Program

Code conversion available. **TRS-80** package soon. **ADDMASTER CORP.** 416 Junipero Serra Dr., San Gabriel, CA 91776 \* 213/285-1121.

Circle 661 on inquiry card.

# \$POWER STOCKCRAFT

NEW  
Stockmarket Program for Apples & Compatibles

**Tax Strategy  
 Technical Analysis  
 Portfolio Management  
 Optimized Trading Strategy**

**\$11800** GET THE BEST AND PAY LESS!  
TAX DEDUCTIBLE Send '16 for Demo Disk

Call or send today for brochure!

**Decision Economics, Inc.**  
 14 Old Farm Road, Dept. BT Cedar Knolls, NJ 07927  
 (201) 539-6889

Circle 671 on inquiry card.

## RGB - APPLE IIC

The Colormaster IIC RGB Video Interface

Enjoy the brilliant, crisp, vivid displays of color graphics and text that are obtainable from the Apple IIC Computer when used with the Telemac Colormaster IIC. **Features:** A stand alone module, one end plugs into the Apple IIC Video Port, the other end plugs into your RGB Monitor. 14 combinations of foreground and background colors in text mode are user selectable. Text mode enhancement circuits improve resolution and readability of 80 column displays. Operation is software independent. A 3.5 ft. monitor cable is supplied. Comes ready to operate, with complete instructions. (Specify make and model monitor.) \$199. RGB Video Boards are also available for Apple IIe, II+II & Franklin ACE 1000, 1200, all revisions. **Apple:** The Colormaster, \$139.; The Kaleidoscope, \$199. **Franklin:** Colormaster, \$169.; Kaleidoscope, \$219., switchplate option \$30. For further information, contact your computer dealer/distributor or:

**TELEMAX, INC.**  
 Computer & Video Products  
 P.O. Box 339 • Warrington, PA 18976  
**(215) 343-3000**

Apple is the registered trademark of Apple Computer, Inc.

Circle 698 on inquiry card.

```

524A:B9 D3 52 62 LDA RMASKS,Y ; INDEX RMASKS TABLE FOR
524D:8D E4 52 63 STA RMASK ; IMAGE RIGHT BIT MASK.
5250: 64
5250:AC 02 52 65 LDY IBWIDTH ; IMAGE WIDTH IN BYTES
5253:8C E6 52 66 STY PITCH ; IS BITMAP PITCH
5256:88 67 DEY ; SUBTRACT 1 TO GET
5257:8C E7 52 68 STY SHFTINDX ; SHIFT START INDEX
525A: 69
525A:AD 03 52 70 LDA IBITS ; COPY IMAGE DATA ADDRESS
525D:8D 80 52 71 STA PATCH1 ; TO SHIFT ROUTINE PATCH1
5260:AD 04 52 72 LDA IBITS+1
5263:8D 81 52 73 STA PATCH1+1
5266: 74
5266: 75 ; MAIN DRAW LOOP STARTS HERE
5266: 76
5266:AE 06 52 77 LDX Y1 ; IMAGE TOP SCRIN ROW #
5269:BD 00 50 78 DRAW LDA ROWTBL,X ; SCREEN ROW ADDR LO-BYTE
526C:18 79 CLC
526D:6D E2 52 80 ADC LBYTE ; + LEFT IMAGE BYTE #
5270:85 40 81 STA BASE1 ; TO SCRIN ADDR POINTER
5272:BD C0 50 82 LDA ROWTBH,X ; SCREEN ROW ADDR HI-BYTE
5275:85 41 83 STA BASE1+1 ; TO POINTER HI-BYTE
5277:8E E8 52 84 STX TEMP ; SAVE CURRENT ROW #
527A: 85
527A: 86 ; BILL BUDGE'S SHIFT CODE STARTS HERE.
527A: 87 ; IT SHIFTS A ROW OF STORED BITMAP DATA INTO A
527A: 88 ; SINGLE-LINE BUFFER, WHICH CAN THEN BE DRAWN TO
527A: 89 ; THE SCREEN
527A: 90
527A:A9 00 91 LDA #0 ; SETUP FOR SHIFTING
527C:AC E7 52 92 LDY SHFTINDX
527F: 93
5280: 94 PATCH1 EQU *+1
527F:BE FF FF 95 SHFITIT LDX $FFFF,Y ; GET A BYTE OF IMAGE DATA
5284: 96 PATCH2 EQU *+2
5282:1D 00 47 97 ORA SHFITOUT,X ; LOOK UP SHIFTED OUT PART
5285:99 EB 52 98 STA BUFFER+1,Y ; AND STORE IN BUFFER
528A: 99 PATCH3 EQU *+2
5288:BD 00 40 100 LDA SHFTSTAY,X ; LOAD THE SHIFTED PART
528B:88 101 DEY ; DONE WITH ROW YET?
528C:10 F1 102 BPL SHFITIT ; LOOP BACK IF NOT
528E:8D EA 52 103 STA BUFFER ; STORE LAST SHIFTED PART
5291: 104
5291: 105 ; ACTUAL DRAW CODE STARTS HERE. NOTE THAT THE
5291: 106 ; RIGHTHAND AND LEFTHAND EDGE BYTES ARE TREATED
5291: 107 ; DIFFERENTLY BECAUSE THEY MAY BE PARTIAL-BYTE
5291: 108 ; WRITE OPERATIONS.
5291: 109
5291:AC E5 52 110 LDY SBWIDTH ; SHIFTED DATA BYTE WIDTH
5294:AE E8 52 111 LDX TEMP ; GET BACK THE ROW #
5297: 112
5297: 113 ; DO THE RIGHTHAND IMAGE BYTE
5297: 114
5297:B1 40 115 LDA (BASE1),Y ; GET A SCREEN BYTE
5299:59 EA 52 116 EOR BUFFER,Y ; XOR WITH IMAGE DATA
529C:2D E4 52 117 AND RMASK ; MASK UNWRITTEN AREA
529F:51 40 118 EOR (BASE1),Y ; RESTORE SCRIN AND IMAGE
52A1:4C A7 52 119 JMP DRAW2
52A4: 120
52A4: 121 ; FAST LOOP TO DRAW IN-BETWEEN BYTES
52A4: 122
52A4:B9 EA 52 123 DRAW1 LDA BUFFER,Y ; GET AN IMAGE BYTE
52A7:91 40 124 DRAW2 STA (BASE1),Y ; WRITE BYTE TO SCREEN
52A9:88 125 DEY ; DECREMENT COUNT
52AA:DO F8 126 BNE DRAW1 ; LOOP BACK IF NOT DONE
52AC: 127
52AC: 128 ; FINISH UP WITH LEFTHAND BYTE
52AC: 129
52AC:B1 40 130 DRAW3 LDA (BASE1),Y ; GET A SCREEN BYTE
52AE:59 EA 52 131 EOR BUFFER,Y ; XOR WITH IMAGE BYTE
52B1:2D E3 52 132 AND LMASK ; MASK UNWANTED PART

```

(continued)

## PRESHIFTTABLE GRAPHICS

```

52B4:51 40 133 EOR (BASE1),Y ; RESTORE SCRNB AND IMAGE
52B6:91 40 134 STA (BASE1),Y ; AND WRITE TO SCREEN
52B8: 135 ;
52B8: 136 ; TEST FOR LAST ROW COMPLETE
52B8: 137 ;
52B8:EC E1 52 138 CPX Y2 ; WAS LAST ROW DONE
52BB:F0 12 139 BEQ EXIT ; QUIT IF SO.
52BD: 140 ;
52BD:E8 141 INX ; MOVE TO NEXT ROW
52BE:18 142 CLC ; ADD THE BITMAP PITCH
52BF:AD 80 52 143 LDA PATCH1 ; TO THE SHIFT ROUTINE
52C2:6D E6 52 144 ADC PITCH ; POINTER TO MOVE TO
52C5:8D 80 52 145 STA PATCH1 ; THE NEXT BITMAP ROW.
52C8:90 9F 146 BCC DRAW ; LOOP AGAIN IF NO CARRY
52CA:EE 81 52 147 INC PATCH1$1
52CD:B0 9A 148 BCS DRAW ; LOOP AGAIN, ALWAYS
52CF:AE E9 52 149 EXIT LDX XSAVE
52D2:60 150 RTS ; EXIT HERE
52D3: 151 ;
52D3: 152 ; RIGHT AND LEFT BIT-MASKS TABLES
52D3: 153 ;
52D3:01 03 07 154 RMASKS DFB $01,$03,$07,$0F,$1F,$3F,$7F
52D6:0F 1F 3F
52D9:7F
52DA:7F 7E 7C 155 LMASKS DFB $7F,$7E,$7C,$78,$70,$60,$40
52DD:78 70 50
52E0:40
52E1: 156 ;
52E1: 157 ; PROGRAM VARIABLES
52E1: 158 ;
52E1:00 159 Y2 DFB 0 ; BOTTOM Y-COORD
52E2:00 160 LBYTE DFB 0 ; LEFT BYTE #
52E3:00 161 LMASK DFB 0 ; LEFT BIT MASK
52E4:00 162 RMASK DFB 0 ; RIGHT BIT MASK
52E5:00 163 SBWIDTH DFB 0 ; SHIFTED IMAGE BYTE WIDTH
52E6:00 164 PITCH DFB 0 ; BITMAP ROW PITCH
52E7:00 165 SHFTINDX DFB 0 ; BITMAP WIDTH
52E8:00 166 TEMP DFB 0 ; TEMP STORAGE
52E9:00 167 XSAVE DFB 0 ; FOR SAVED X-REG
52EA: 168 BUFFER DS 40,0 ; SHIFTED DATA ROW BUFFER

```

\*\*\* SUCCESSFUL ASSEMBLY: NO ERRORS

Listing 4: The DIV7 program creates two 256-byte tables that contain the integer quotient and remainder of the value n/7, respectively, for n=0 to 255. The resulting table is saved as DIV7 TABLE.

LIST

```

100 REM
110 REM DIVIDE-BY-7 QUOTIENT
120 REM AND REMAINDER TABLES
130 REM
140 REM BY GREGG WILLIAMS.
150 REM 24 APR 84
160 REM
200 QUOTBGN = 16384
210 REM --POINTS TO MEMORY AREA
220 REM --USED TO STORE TABLE
230 REM
240 RMDRBGN = QUOTBGN + 256
250 HOME : PRINT "CREATING DIV7 TABLE...."
300 FOR I = 0 TO 255
310 :QVL = INT (I / 7)
320 :RVL = I - QVL * 7
330 : POKE QUOTBGN + I,QVL
340 : POKE RMDRBGN + I,RVL
350 NEXT I
400 PRINT CHR$ (4);"BSAVE DIV7 TABLE,A";QUOTBGN;"",L512"
420 PRINT : PRINT "TABLE SAVED TO DISK"
500 END

```

(continued)

# LISA

No matter what they tell you  
or what you read,  
Desktop software  
**is**  
being developed!

**The  
Desktop Junction**  
Where Lisa Users Can  
Meet Lisa Developers

Call (206) 325-9670 for an informational  
packet or circle number on inquiry card.

The Desktop Junction is a new service from  
David D. Redhed of Clear Skies Consulting.

Lisa is a trademark of Apple Computer, Inc.

Circle 667 on inquiry card.

### EPSON + APPLE

Print style select program  
**JUST \$19.99 + \$2 handling**  
**DON'T PAY MORE!**  
Menu of print options  
Great Value!  
Copiable for your use  
Works with MX,RX,FX printers  
Send check or money order to:

**KELLER\*KELLER**  
Printer Program  
1035 Live Oak Dr  
Santa Clara, Ca 95051  
(408)984-5270

Apple is a registered trademark  
of Apple Computer, inc. Epson is  
a registered trademark of Epson  
America, Inc.

Circle 682 on inquiry card.

# McMill

**The affordable &  
expandable 68000  
software develop-  
ment system for  
your Apple II, IIe!**



P.O. Box 2342  
Santa Barbara, Ca. 93120  
(805) 569-3132 • Telex 658439

Circle 695 on inquiry card.



**This ad  
is for all those  
who ever wonder  
why your  
company runs  
a United Way  
campaign.**

When it comes right down to it, you're probably the best reason your company has for getting involved with the United Way.

You see, they know almost all of the money given to the United Way goes back out into the community to help people.

So if you, or the people you work with, should ever need any of our services, like day care, family counseling or health care, we'll be right there to help. In fact, there are tens of thousands of United Way-supported programs and services in cities and towns across the country. That means help is nearby wherever you are.

And your company knows that could mean the difference between keeping or losing a valuable employee.

That's why they give. And that's why they ask you to give. Because there may come a day when you need help yourself.



**United Way**

Thanks to you, it works for ALL OF US.



A Public Service of This Magazine & The Advertising Council

Listing 5: The Consolidate program loads the tables created by listings 1, 2, and 4, adds an image table, and stores the composite table in the file TABLPAK for later use.

```

100 REM
110 REM CONSOLIDATE-
120 REM TABLES PROGRAM
130 REM
140 REM BY GREGG WILLIAMS
150 REM 23 APR 84
160 REM
170 REM -----
180 REM
190 HOME : PRINT "CREATING TABLPAK..."
200 TBLSIZ = 32
236 REM
240 D$ = CHR$(4)
250 PRINT D$;"BLOAD PRESHIFT TABLE,A$4000"
260 PRINT D$;"BLOAD DIV7 TABLE,A$4E00"
270 PRINT D$;"BLOAD HIRES1 TABLE,DA$5000"
280 REM
290 REM --LOAD NEEDED TABLES
300 REM --INTO MEMORY
320 REM
330 REM
540 REM
550 QQ$ = "5180:0D 0D 02 00 00 00 00 7C 0F 7C 07 7C 03 7C 01 7C
 03 7C 07 5C 0F 0C 1F 04 0E 00 04 00 00 00 00"
560 GOSUB 63000
570 REM --PUT IMAGE INTO MEMORY
580 REM --USING MONITOR COMMANDS
590 REM
600 REM
610 PRINT D$;"BSAVE TABLPAK,A$4000,L";4480 + TBLSIZ
615 PRINT : PRINT "FILE SAVED TO DISK"
620 REM
630 END
640 REM
62975 REM -----
62980 REM
62985 REM --FAMOUS S. H. LAM
62990 REM --MONITOR ROUTINE FOR
62993 REM --EXECUTING MONITOR
62995 REM --COMMANDS FROM BASIC
62997 REM
63000 QQ$ = QQ$ + " ND9C6G"
63010 FOR QQ = 1 TO LEN (QQ$): POKE 511 + QQ,128 + ASC
 (MID$(QQ$,QQ,1)): NEXT
63020 POKE 72,0: CALL - 144
63030 RETURN

```

Table 1: Format for the image table. The BASIC demonstration program of listing 6 expects an image table in the format given by this table. Listing 3 expects this table at location 5180 hexadecimal (20864 decimal), but this can be easily changed by changing the value stored at 1Bits (location 5203 hexadecimal).

| Byte       | Contents                                                                          |
|------------|-----------------------------------------------------------------------------------|
| 0          | (number of rows in image) — 1                                                     |
| 1          | (number of dots in row ) — 1                                                      |
| 2          | number of bytes in one row of image                                               |
| 3, 4, 5... | successive bytes of image, starting with upper-left corner and proceeding by rows |

Listing 6: A program that demonstrates the preshift-table lookup method. This program uses joystick or paddle input to guide an arrow image across the high-resolution graphics screen. See text for details.

LIST

```

100 REM
110 REM BUDGE PRESHIFT
120 REM GRAPHICS DEMO
130 REM
140 REM BY BILL BUDGE,
150 REM GREGG WILLIAMS,
160 REM AND ROB MOORE
170 REM
180 REM -----
190 REM
200 REM INITIALIZATION
210 REM
220 GOSUB 3000
230 REM --LOAD FILES (NEEDS
240 REM --TO BE DONE ONLY ONCE)
250 REM
260 GOSUB 2000
270 REM --INITIALIZE TABLES
280 REM
480 REM
490 REM -----
500 REM
510 REM MAIN LOOP
520 REM
530 REM IFPEEK (- 16287) > 127 THEN
820
535 REM --WHILE LOOP: LOOP
540 REM --WHILE BUTTON 0
550 REM --NOT PRESSED
560 REM
570 XVLUE = PDL (0)
580 YVLUE = PDL (1)
590 REM --GET JOYSTICK OR
600 REM --PADDLE VALUES
610 REM
620 XINCR = - 1 * DOTSMOVE * (XVLUE < C1THRLO) + DOTS
MOVE * (XVLUE > C2THRH)
630 YINCR = - 1 * DOTSMOVE * (YVLUE < C1THRLO) + DOTS
MOVE * (YVLUE > C2THRH)
640 REM --CONVERT JOYSTICK
650 REM --INPUT TO -1,0, OR 1
660 REM
670 IF (XPSN + XINCR) > = C3XMIN AND (XPSN + XINCR) < =
C4XMAX THEN XPSN = XPSN + XINCR
680 IF (YPSN + YINCR) > = C5YMIN AND (YPSN + YINCR) < =
C6YMAX THEN YPSN = YPSN + YINCR
690 REM --MODIFY X, Y POSITIONS
700 REM --IF WITHIN BOUNDS
703 REM
706 POKE X1,XPSN
708 POKE Y1,YPSN
710 REM --POKE X & Y COORDS
712 REM --OF IMAGE INTO
714 REM --BYTES USED BY THE
716 REM --CODE SUBROUTINE
718 REM
720 CALL CODEADDR
730 REM --CALL MACHINE-LANG.
740 REM --BLOCK-MOVE ROUTINE
750 REM
760 GOTO 530
770 REM --END OF WHILE LOOP
780 REM
790 REM -----
800 REM
810 END
820 REM --END OF PGM
830 REM
1940 REM
1950 REM
1960 REM -----
1970 REM
1980 REM INITIALIZATION
1985 REM SUBROUTINE
1990 REM
2000 DOTSMOVE = 2
2010 REM --MAXIMUM INCREMENT
2020 REM --OF IMAGE
2030 REM
2040 XPSN = 100:YPSN = 100
2050 REM --POSITION OF IMAGE
2060 REM
2070 C1THRLO = 100:C2THRH = 150
2080 REM --THRESHOLD VALUES
2090 REM --FOR JOYSTICK INPUT
2100 REM
2110 C3XMIN = 5:C4XMAX = 235
2120 C5YMIN = 5:C6YMAX = 175
2130 REM --BOUNDARIES OF IMAGE
2140 REM --MOVEMENT ON SCREEN
2150 REM
2160 CODEADDR = 21008
2170 REM --ADDRESS OF MACHINE-
2180 REM --LANGUAGE SUBROUTINE
2190 REM
2200 IROWS = 20992
2210 IDOTS = IROWS + 1
2220 IWIDTH = IROWS + 2
2230 IBITS = IROWS + 3
2240 X1 = IROWS + 5
2250 Y1 = IROWS + 6
2260 REM --ADDRESSES OF DATA
2270 REM --NEEDED BY ASSBY-
2280 REM --LANGUAGE ROUTINE
2290 REM
2420 POKE IROWS, PEEK (IMAGTBL)
2430 POKE IDOTS, PEEK (IMAGTBL + 1)
2440 POKE IWIDTH, PEEK (IMAGTBL + 2)
2450 IP = IMAGTBL + 3
2460 C8IPLO = INT (IP / 256)
2470 C7IPHI = IP - 256 * C8IPLO
2480 POKE IBITS,C7IPLO
2490 POKE IBITS + 1,C8IPHI
2500 REM --SETUP VALUES NEEDED
2510 REM --BY ASSEMBLY-LANGUAGE
2520 REM --ROUTINE
2530 REM
2540 HGR : POKE - 16302,0
2550 REM --SWITCH TO HIRES PG1
2560 REM
2570 RETURN
2930 REM
2935 REM -----
2940 REM
2950 REM LOAD FILES
2960 REM SUBROUTINE
2970 REM
3000 IMAGTBL = 20864
3010 REM --ADDRESS OF TABLE
3020 REM --CONTAINING IMAGE
3030 REM --TO BE MOVED
3040 REM
3050 D$ = CHR$(4)
3060 PRINT D$:"BLOAD QD.DEMO.0"
3070 PRINT D$:"BLOAD TABLPAK,A$4000"
3080 PRINT D$:"BLOAD IMAGE,A";IMAGTBL
3090 REM --LOAD ASSBY-LANGUAGE
3100 REM --ROUTINE AND TABLES
3110 REM
3120 RETURN

```

(continued from page A27)

assembly-language routine of listing 3; it then uses joystick (or paddle) input to

move the image around the high-resolution graphics screen. This program uses an image that has two rows of un-

lighted dots on every edge (it is a 10 by 10 image centered in a 14 by 14 box). Because the program moves the image only two dots at a time, the arrow image erases itself as it moves and leaves no trail.

This program, like the others, was written with simplicity and clarity in mind rather than speed or program features. The fact that the program moves the arrow slowly across the screen is the fault of BASIC, not the assembly-language program. To make this demo run faster, you can "tighten up" the main loop in lines 530-760 or incorporate some of the joystick decoding and boundary checking in another assembly-language program that, in turn, calls listing 3.

The preshift-table lookup method is a compromise between utility and ease of comprehension. Although this technique is not as fast as the preshifted-shapes method often used for animation, it is a general-purpose method that will probably find a number of uses. ■

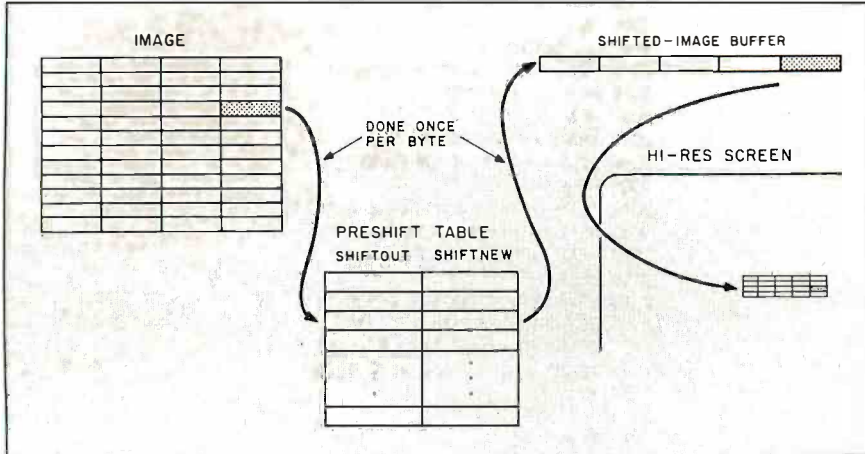


Figure 7: Moving a rectangular image. In the example subroutine of listing 3, the routine takes the image a line at a time, uses the preshift table to shift it, puts it in a single-line buffer, then transfers it to the high-resolution screen. This is only one possible subroutine that implements the routine in figure 6.

# SAVINGS BONDS DON'T COME IN THE WRONG SIZE OR COLOR.



**Give Bonds for Christmas.**



U.S. SAVINGS BONDS DIVISION  
DEPARTMENT OF THE TREASURY



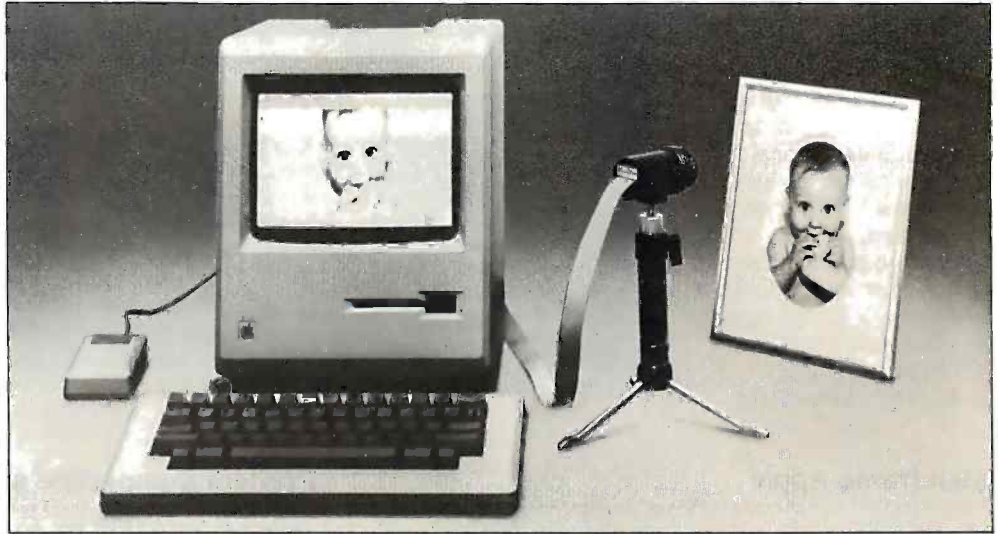
## The Photographic Mac

An image reader that enables the Macintosh to produce a digital image of a photograph or object. MicronEye comes with a lens, tripod, software, and users guide. You can print a picture or save it to disk. The results are compatible with MacPaint.

The MicronEye uses pull-down menus, and its software contains several built-in image enhancers.

The MicronEye is available for \$395 from Micron Technology Inc., Vision Systems Group, 2805 E. Columbia Rd., Boise, ID 83706, (208) 383-4106.

Circle 772 on inquiry card.



MicronEye enables the Mac to read photographs.

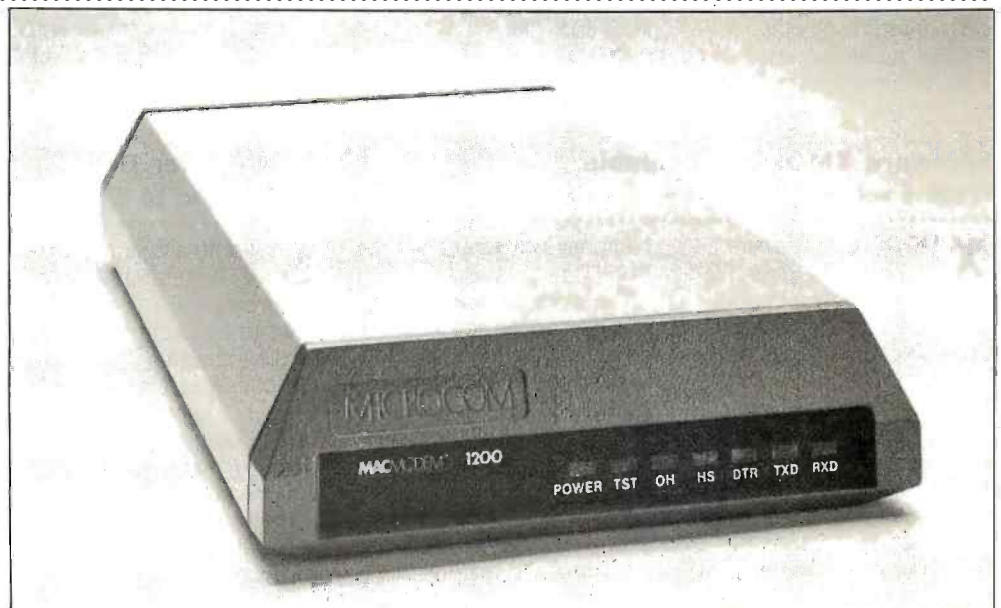
## New Auto-Dial Modem for Mac

MacModem from Microcom is a 300- to 1200-bps auto-dial and auto-answer modem for the Macintosh. If you need to operate at a higher level, the MacModem can be upgraded to 2400 bps.

The Microcom modem will transfer files between two Macs or a Mac and an IBM PC, PCjr, Apple IIe, or Apple III. The MacModem offers both tone and pulse dialing and call progress monitoring.

The MacModem uses the "point and click" mouse technology. You can store phone numbers, communications parameters, and log-on sequences.

MacModem also supports Microcom's Networking Protocol. MNP finds and corrects line noises before data is sent to the display or



Microcom's new modem can be upgraded to 2400 bps.

stored on disk.

MacModem and its communications software are

available from Microcom Inc., 1400A Providence Highway, Norwood, MA 02062.

(617) 762-9310.

Circle 771 on inquiry card.

(continued)

All products mentioned in this section are described by manufacturers' specifications, and their publication in BYTE does not constitute an endorsement.

## High-Speed Dot Matrix

**C**omriter 420 boasts 420 characters per second in draft mode and 104 characters per second in correspondence-quality mode.

The newest Epson dot-matrix printer features an 18K-byte buffer and a built-in panel of control keys that lets you choose type styles and form length.

Equipped with selectable serial or parallel interfaces and eight international language fonts, the Comrite 420 comes with friction or tractor feed.

For more information, contact Comrex International, a subsidiary of Epson America Inc., Torrance, CA (213) 373-0280.

Circle **795** on inquiry card.



The ComRiter 420 dot-matrix printer features an 18K-byte buffer.

## Mainframe Apple

**A**pple-Bisync, a hardware/software system, turns the Apple II or IIe into a remote terminal for IBM mainframes. It can also connect Apples to scanners, cash registers, or other Apples. It can automatically transfer a number of files to

mainframes and can save files from mainframes on disk.

Apple-Bisync costs \$750. For more information, contact Urgeo Software Inc., POB 305, Cheney, WA 99004, (509) 838-6058. Circle **789** on inquiry card.

## Freeware XMODEM Available from Exec Software

**X**MODEM, a freeware program that does file transfers with error-checking protocol, is available from Exec Software for the Apple II and IIe.

XMODEM will let you transfer BASIC and binary code between Apples without translating the files to text format. Users will need the Hayes MicroModem.

The program can be downloaded from Exec Software Customer Support Bulletin Board at (617) 863-0282. The company asks that people who find the program useful send \$15 to the programmer. The

company will send disks for \$10.

The price for the freeware can be applied to the purchase of TermExec, an auto-answer communications package for the Apple II, IIe, and II+, which allows you to catalog, copy, delete and rename.

The latest version, TermExec 1.2, works at up to 1200 bps and features an improved screen editor. It includes the freeware and costs \$79.95.

Write Exec Software, 201 Waltham St., Lexington, MA 02173 or call (617) 862-3170. Circle **777** on inquiry card.

## Printers Compatible with Mac

**M**icroline 92 and 93 dot-matrix printers are now compatible with the Apple family of computers, including Macintosh and Lisa. The ML 92 and 93 emulate Apple's Imagewriter, allowing you to print graphics screens. They also allow

correspondence-quality printing from the Apple IIe and II+.

The printers are available through authorized Okidata dealers, 532 Fellowship Rd., Mt. Laurel, NJ 08054, (609) 235-2600.

Circle **796** on inquiry card.

## New Printer Driver Links Mac to Epson

**S**oftstyle allows MacWrite, MacPaint, and all Macintosh-compatible programs to print to an Epson. The conversion program needs to be loaded and run only once, but users can reconvert to their original printer driver by executing a few commands.

The program requires a cable and a serial interface card for the Epson FX-80, sold separately from a variety of manufacturers.

Softstyle costs \$29.95 and is available from Softstyle, a Honolulu company, or through any Epson dealer. Circle **776** on inquiry card.

## Adds Printers to your Mac

**T**he Printer Optimizer is a 64K- to 256K-byte spooler that allows you to use your Mac while printing. At the same time, the spooler can accommodate as many as three printers or plotters. The peripherals can be a mix of serial or parallel devices. The Printer Optimizer has three ports: two RS-232C serial ports and a Centronics parallel port.

Printer Optimizer is from Applied Creative Technology Inc., 2156 W. Northwest Highway, Suite 303, Dallas, TX 75220, (800) 433-5373, in Texas (214) 556-2916. Circle **773** on inquiry card.

### Apple Music Board

The Digital Sound Sampling Sequencer (DS3) imported from England is available as an add-on board to the Apple II and IIe. The 64K bytes of memory on an Apple yield approximately 2½ seconds of sample time at a rate of 30 kHz. You can create any percussive sound, and complete concerts can be stored to Apple disks. You can enter sequences from the keyboard or from a digitally scanned music keyboard. Four-voice polyphonics are available for multitracking.

The DS3 includes three disks together with a starter kit of sounds. The manual includes instructions for installation and advanced instructions on sequence building, sound editing at the screen, and external sync techniques.

The DS3, priced at \$1200, is available from British Imports Limited, 2410 N. Hathaway, Santa Ana, CA 92701, (714) 542-9178. Circle 775 on inquiry card.

### Speech Synthesizer and Software

SynPhonix 100 for the Apple II, IIe, and II+ is a speech synthesizer board with the SSI263 phoneme chip. It plugs into slots 1 through 7 and includes an amplifier, volume control, and a jack for an external speaker. It can also be purchased with an on-board speaker. The board has a socket for a second voice, but the second voice is not available yet.

Sonix-65, a speech operating system on disk, comes with it. SynPhonix 100 costs \$125 or \$135 with the on-board speaker. Contact Artic Technologies, 2234 Star Court, Auburn Heights, MI 48057, (313) 852-8344. Circle 784 on inquiry card.

### Social Programs

A series of young people's programs on social and personal health issues is available from Marshware for the Apple computer. The programs include software about good health, teenage drinking, reasoning skills and sexual abuse awareness. Biology programs on the respiratory system, the digestive system, bones and muscles, and the heart are available for \$39.95 each.

Programs entitled Alcohol and Keeping Safe are available for \$49.95 each.

Write Marshware, POB 8082, Shawnee Mission, KS 66208, (800) 821-3303. Circle 778 on inquiry card.

### Disk-Head Accessory

The Disk Drive Analyzer for the Apple II series and the Apple III checks the alignment of the heads, their speed, and how well they clamp disks—conditions that affect accuracy. It costs \$39.95.

The same company makes the Diskette Head Cleaning Kit for the Macintosh. It comes with a software tutorial, two cleaning disks, and a spray cleanser. The kit costs \$39.95. The software by itself costs \$29.99.

Contact Nortronics Computer Inc., Recorder Care Division, 8101 Tenth Ave. N., Minneapolis, MN 55427, (612) 545-0401. Circle 781 on inquiry card.

### Template Summaries

Kleertex templates summarize Apple software commands for several popular programs. They fit over Apple keyboards to provide "at-a-glance" help to users looking for the right command.

The templates are made of durable molded plastic, color-coordinated to each personal computer.

Kleertex templates cost \$19.95 each. They are made and sold by Creative Computer Products, POB 85152-MB134, San Diego, CA 92138. The firm takes orders over toll-free lines: 1-800-231-5413 or, for California residents, 1-800-523-5441. Circle 780 on inquiry card.

### Five-inch Screen for the IIc

The XVU 5-inch screen for the Apple IIc makes the computer even more portable.

This is the same screen that is used for the XCalibur

Portable; it weighs 2.2 pounds or 1 kilogram. A single plug connects the video and power. For more information, contact XCalibur Computers Ltd.,

Spencer House, 3 Spencer Parade, Northampton, England NN1 5AB or call (0604) 21051/4. Circle 782 on inquiry card.

(continued)



The 5-inch XVU for the IIc.

## Modem and Software

The single-board, 300/110-bps MultiModem IIe automatically answers and dials telephone calls. The board and software for the Apple II, II+, and IIe work with push-button and rotary-dial telephones. The product is compatible with the Hayes MicroModem II and, therefore, with nearly all communications software

written for Apple II computers.

MultiModem's menu-driven firmware allows the user to leave an application program and enter the on-line communications mode with a single keystroke.

The MultiCom II software included with the modem lets users automatically log on to networks and copy

data to screen or disk. Free time from CompuServe and NewsNet comes with the package.

The \$329 price includes a two-year warranty. MultiModem IIe is made by Multi-Tech Systems Inc., 82 Second Ave. SE, New Brighton, MN 55112, (612) 631-3550.

Circle 793 on inquiry card.



New single-board modem from Multi-Tech Systems features auto-dial.

## Three from Penguin

Graphics Magician Picture Painter uses less memory than most graphics programs because it stores the directions to redraw pictures rather than the pictures. The program can now be used with double-high-resolution Apples. You can use a joystick, mouse, touch tablet, the Apple Graphics Tablet, or Houston Instruments' HiPad to draw or color. The program lets you use 16 solid colors or 256 blends. It costs \$49.95 from Penguin Software.

Expedition Amazon is a new fantasy game. The player leads an expedition of four specialists into the Amazon rain forest to find the ruins of a fabled Inca stronghold that harbors a great secret. The game has dozens of high-resolution graphics and nine levels of difficulty. Its complexities take up both sides of a 48K-byte disk. Expedition Amazon costs \$34.95.

Penguin Software is also selling a new Disk arRanger for the 48K-byte Apple II, IIe, and II+. It lets you arrange disks alphabetically or by topic. You can label them by using control characters or graphics signals such as flashing. If you have 64K bytes of RAM, the program also lets you move files from disk to disk quickly. It costs \$29.95.

Contact Penguin Software, POB 311, Geneva, IL 60134, (312) 232-1984. Circle 786 on inquiry card.

## Alternative Keyboard

Sure-Stroke is an alternative keyboard similar to the IBM Selectric typewriter keyboard. Function keys run across the top, and it has a separate numeric keypad. Sure-Stroke costs \$199.95 and comes with a one-year warranty. Contact Titan Data Systems Inc., POB 2095, Santa Ana, CA 92707, (714) 546-6467. Circle 783 on inquiry card.

## Print Your Graphics from a IIc

Printographer, a program that allows you to print or save graphics, can now be used with the Apple IIc. It is compatible with more than 50 printers, prints low- or high-resolution graphics, and prints in color or black and white.

It can magnify pictures or parts of pictures and print negative black-and-white images. Printographer is also

available through Apple dealers for the Apple II, IIe, and II+.

Combined with The Write Choice, the manufacturer's word processor, Printographer can print text with pictures.

Printographer costs \$39.95, from Roger Wagner Publishing, POB 582, Santee, CA 92071, (619) 562-3670. Circle 788 on inquiry card.

## Technical Design Kit for the Professional

Cad-2 firmware for the Apple II+ and IIe does technical drafting and designing by combining joystick drawing and measurements entered from the keyboard. The user can see dimensions changing and shapes rotating on the

screen.

Cad-2 lets you enter line lengths, angles, arc radii, and arch sweeps from the keyboard to do scaled drawings in English or metric measures.

The Cad-2 package includes the software, the joy-

stick, a 128K-byte RAM board that fits into an I/O slot on the motherboard, a library disk, and detailed instructions and explanations of the system. No knowledge of computers is necessary to use Cad-2.

It costs \$1790. Cad-1 can

be upgraded to Cad-2 for \$695. Cad-1 and 2 are made by Robo Systems of Chessell-Robocom Corporation, 111 Pheasant Run, Newtown, PA 18940, (215) 968-4422.

Circle 792 on inquiry card.

(continued)

# ADVANCED COMPUTER PRODUCTS

SEND \$2.00 for 1988 CATALOG

## 64K RAMS Set of 9 \$50.00

### Apple Compatible Software BUSINESS

| APPLIED SOFTWARE                      | Versalform | ACP PRICE |
|---------------------------------------|------------|-----------|
| Versalform Hard Disk                  |            | \$299.00  |
| ARTISO Magic Window II                |            | 95.00     |
| MagiCtion                             |            | 89.00     |
| ASHTON-TATE dBASE II (CPM)            |            | 385.00    |
| Friday (CP/M)                         |            | 198.00    |
| BPI (GL, AR, AP, Pay, Inv)            | ea.        | 299.00    |
| BRODERBUND Bank Street Writer         |            | 49.00     |
| BUSINESS SOLUTIONS The Incred Jack    |            | 149.00    |
| CONTINENTAL (GL, AR, AP, Pay)         | ea.        | 89.00     |
| Home Accountant                       |            | 49.00     |
| DATAMOST Real Estate Inv.             |            | 99.00     |
| DOW JONES Market Manager              |            | 229.00    |
| Market Analyzer                       |            | 269.00    |
| Market Microscope                     |            | 499.00    |
| EAGLE Money Decisions Vol. I          |            | 179.00    |
| FOX & GELLER Quickdocs                |            | 199.00    |
| d Utility                             |            | 69.00     |
| d Graph                               |            | 199.00    |
| HAYDEN Pie Writer                     |            | 99.00     |
| Complier Plus                         |            | 79.00     |
| Basic Compile                         |            | 45.95     |
| HOWARDSOFT Tax Preparer               |            | 199.00    |
| Real Estate Analyzer                  |            | 139.00    |
| KENSINGTON Format II                  |            | 99.00     |
| LIGHTNING Mastertype                  |            | 35.00     |
| LIVING VIDEOTEXT Think Tank (II, III) |            | 119.00    |
| MICROPRO Wordstar                     |            | 179.00    |
| Maimerge or Speller                   |            | 139.00    |
| Wordstar Prof. 4 Pak                  |            | 449.00    |
| Info Pak or InfoStar                  |            | Call      |
| MICROSOFT Multiplan                   |            | 179.00    |
| Multitool Financial                   |            | 79.00     |
| Multitool Budget                      |            | 119.00    |
| MEGAHAUS Megawriter                   |            | 69.00     |
| PEACHTREE Series 40 (GL, AR, AP)      |            | 379.00    |
| Series 9 (Text, Spoel, Mail)          |            | 239.00    |
| PERFECT SOFTWARE                      |            | Call      |
| QUARK Word Juggler (Ile)              |            | 199.00    |
| Lexichex (Ile)                        |            | 99.00     |
| Call for Apple III                    |            |           |
| SIERRA ON-LINE                        |            |           |
| Screenwriter II                       |            | 99.00     |
| Screenwriter Professional             |            | 149.00    |
| General Manager II                    |            | 169.00    |
| Dictionary                            |            | 79.00     |
| SOFTWARE PUBLISHING PFS File          |            | 249.00    |
| PFS Graph or PFS Report               |            | 89.00     |
| STATE OF THE ART                      |            | Call      |
| STONEWARE DB Master 4.0               |            | 249.00    |
| OB8 Utility I or 2                    |            | 89.00     |
| SYSTEMS PLUS Act Plus (GL, AR, AP)    | Set        | 599.00    |
| VISCOSYS Viscalc 3.3                  |            | 39.00     |
| Viscalc Enhanced                      |            | 199.00    |
| Visifile or Visidex                   |            | 179.00    |

### HOME & EDUCATION

|                                      |  |          |
|--------------------------------------|--|----------|
| BRODERBUND Chopitler                 |  | \$28.00  |
| Drol or Loderunner                   |  | 28.00    |
| Arcade Machine                       |  | 44.95    |
| Apple Panic                          |  | 24.00    |
| BUDGECO Raster Blaster               |  | 24.00    |
| Pinball Construction Set             |  | 29.00    |
| COUNTERTOP SOFTWARE                  |  |          |
| Early Games for Young Children       |  | 26.00    |
| DARTSOFT Aztec                       |  | 23.00    |
| Plg Pen or Shark Attack              |  | 23.00    |
| DATASOFT Zaxxon (II - e.c)           |  | 31.00    |
| EDU-WARE Compuath                    |  | 37.00    |
| Algebra I, II or III                 |  | 30.00    |
| Compuared or CompuSpell              |  | 23.00    |
| ENSTEIN Memory Trainer               |  | 79.00    |
| ELECT. ARTS Music Construction       |  | Call     |
| HARCOURT Computer SAT                |  | Call     |
| HAYDEN Sargon II                     |  | 29.00    |
| INFOCOM Zork I, II or III            |  | 29.00    |
| Deadline                             |  | 36.00    |
| KOALA Modules (8 available)          |  | Call     |
| LEARNING COMPANY                     |  |          |
| Juggles Rainbow                      |  | 30.00    |
| Bumble Games                         |  | 40.00    |
| Gertrude's Secrets                   |  | 45.00    |
| L & S Crossword Magic                |  | 41.00    |
| MICROFUN Miner 2049er                |  | Call     |
| MICROCAL                             |  | Call     |
| MICROSOFT Decathlon                  |  | 25.00    |
| Typing Tutor II                      |  | 19.00    |
| MONOGRAM Dollars & Sense             |  | 74.95    |
| ORIGIN Exodus: Ultima III            |  | 41.95    |
| PENQUIN The Quest                    |  | 16.00    |
| SENSIBLE Sensible Speller            |  | 99.00    |
| SIERRA ON-LINE Frogger               |  | 28.00    |
| SIRTECH Legacy of Llylgarny          |  | 29.00    |
| Knight of Diamonds                   |  | 29.00    |
| SOUTHEASTERN Data Capture 4.0        |  | 54.95    |
| SPINNAKER Alphabet Zoo               |  | 20.00    |
| Delta Drawing                        |  | 35.00    |
| Fracton Fever                        |  | 23.00    |
| Kindercomp                           |  | 21.00    |
| Facemaker                            |  | 28.00    |
| SUBLOGIC Flight Simulator or Pinball |  | 40.00    |
| SUNDEX no 1 Rated Home Finance       |  | 74.95    |
| CPA Personal Accountant              |  | 74.95    |
| CPA Personal Investor                |  | 74.95    |
| Personal Payables                    |  | 42.95    |
| TERRAPIN Logo                        |  | \$119.00 |
| TRANSEND Transend I                  |  | 75.00    |
| VIRTUAL Micro Cookbook (II, e.c)     |  | 29.00    |
| UTILITIES SYSTEM                     |  |          |
| BEAGLE Apple Mechanic                |  | \$30.00  |
| Apple Plot or Pronto DOS             |  | 30.00    |
| Beagle Basic                         |  | 30.00    |
| DOS Boss                             |  | 20.00    |
| Double Take or Utility City          |  | 30.00    |
| CENTRAL POINT Flier                  |  | 19.00    |
| Copy II Plus                         |  | 31.00    |
| LOCKSMITH                            |  | 79.00    |
| MICROSOFT A.L.D.S (Req. Softcard)    |  | 85.00    |
| Cobol 80 (Req. Softcard)             |  | 575.00   |
| Fortran 80                           |  | 155.00   |
| PENQUIN CCS System                   |  | 65.00    |
| PHOENIX Zoom Graphix                 |  | 31.00    |
| SOUTHWEST Merlin                     |  | 49.95    |

Send for Complete Catalog of Software

## IBM PC MULTICARD II™

"MULTICARD II" multifunction card for the IBM PC & XT expandable to 384K. Thousands of this popular card have already been shipped by ACP.

- 64-384K
- Parallel Port
- Serial/Game Port
- 1 Year Warranty
- Disk Emulator Software
- Printer Spooler Software
- Clock/Calendar
- Clock Software

\$229.00 w/OK \$229.00

## S-100 64K "CMOS" RAMCARD



Unbelievable Price!

\$249.00

Assembled and Tested

- ACP has sold over 1000 of these IEEE compatible, low-priced, high-reliability 64K Static RAM Cards.
- Single 5-Volt operation.

## SIEMEN'S SALE



You can now purchase Shugart compatible 8" Disk Drives below your existing factory direct pricing! These Prices are the lowest ever published.

\*Siemens's DSDD FDD200-8... \$199.00

Also, with purchase of Disk Drives you can buy the Vista V-1000 Dual Case with Power Supply and Cable for only \$375.00... Regular Price \$495.00 Offer Limited! Factory Warranty 90 Days! Shipped Immediately from Stock! OEM Quantities

8" Disk Drives \$139.00

## DOT MATRIX PRINTER COEX 80-FT

- 9x7 Dot Matrix, 80 CPS, Bi-Directional Printing
- 2K Buffered Memory
- 80, 96, 132 Columns, Graphics and Block Printing
- Selectable Char Pitch, Line Spacing and Feed



\$169.00

COEX Interface Card to Apple... \$49.95

## ACP HAS DISK DRIVES

### APPLE II™ COMPATIBLE

Thin Line Drive \$179.00

APPLE COMPATIBLE DISK DRIVES STANDARD HEIGHTS

|                            |          |
|----------------------------|----------|
| VISTA Solo 5 1/4" Std.     | \$199.00 |
| FOURTH DIMENSION           | 199.00   |
| QUENTIN                    | 209.00   |
| Compatible Disk Controller | 49.95    |

### TANDON 100-2

PC Compatible • Double Sided



\$199.00

TM100-1... \$169.00

Mounting Kit for IBM PC \$4.95

### TOSHIBA Half-High

PC Compatible • Double Sided

\$169.00



OTHER DRIVES WE STOCK

|                        |          |                          |          |
|------------------------|----------|--------------------------|----------|
| TANDON 848-2 Thinline  | \$479.00 | SHUGART 801R             | \$299.00 |
| TEAC FD558             | 179.00   | ODC DataLtrack 8         | 449.00   |
| SEAGATE 10Mb Hard Disk | 499.00   | CD 1800 DS (320K)        | 224.00   |
| MPI 852                | 239.00   | SEAGATE ST506 (6MB Win.) | 349.00   |

## APPLE™ COMPATIBLE



DISK CONTROLLER Only \$49.95

## Apple Compatible Printer Interface \$49.95

w/Apple to Epson Cable

## Apple IIe Compatible 80 Column Card w/64K \$99.95

## APPLE COOLING FAN



with Surge Suppression \$49.95

## QUENTIN/FORTH DIMENSION



Apple II/Ile Compatible Disk Drive

Totally compatible to Apple Drives.

Only \$199.95

Controller... \$49.95

Just plug in and run.



## Apple II 16K RAM CARD

Compatible with Z80 Softcard™. PASCAL CP/M™

Full 1 year Warranty. Top Quality by COEX

NEW LOW ACP PRICE \$49.95

Also from COEX. NEW EPSON Parallel Interface for Apple. With cable... \$49.95

## CLEARANCE SALE



## RAINBOW 100A MODEL CLEARANCE

CPU SYSTEM UNIT RAINBOW 100A w/64K of Main Memory, 800Kb Dual Floppy Disk Drive, Keyboard plus User Kit, Serial Printer Port and Modem Port built-in.

Retail \$2995 ACP \$1995

VR201 MONOCHROME MONITOR Retail \$325 ACP \$259

CPM/86/80 and MS-DOS Retail \$250 ACP \$195

5Mb WINCHESTER HARD DISK w/CONTROLLER (While Supplies Last) (128Kb Min. Memory Req.) ACP \$780

192Kb Memory Retail \$650 ACP \$521

Call for Special Rainbow 100+ Pricing!

Mail Order: P.O. Box 17329 Irvine, CA 92713 Retail: 1310B E. Edinger, Santa Ana, CA 92705 (714) 558-8813

542 W. Trimble, San Jose, CA 95131 (408) 946-7010

## apple computer Authorized Dealer

Complete Apple Support Facility Complete Apple Service Center We service most Floppy Disk Drives



|                                                                                             |                    |
|---------------------------------------------------------------------------------------------|--------------------|
| Apple IIe w/64K                                                                             | ACP PRICE \$895.00 |
| Apple IIe Business System                                                                   | 2995.00            |
| Includes: Apple IIe w/128K, Dual Disk, 80 Column Card, Monitor II, Profile Extension Option |                    |
| Apple IIe Entry System                                                                      | 995.00             |
| Includes: Apple IIe w/64K, Disk II w/Controller                                             |                    |
| Apple IIe Professional System                                                               | 1795.00            |
| Includes: Apple IIe w/128K, Dual Disk, 80 Column Card, Monitor II                           |                    |
| Imagewriter Dot Matrix Printer                                                              | 545.00             |
| Apple Color Plotter                                                                         | 779.00             |
| Apple Modem 200                                                                             | 495.00             |
| Apple III 256K System                                                                       | 2695.00            |
| Apple III Plus 256K System                                                                  | 2995.00            |
| Apple III Plus Business System                                                              | 4495.00            |
| Lisa 2                                                                                      | 3495.00            |
| Macintosh System                                                                            | 2495.00            |
| Apple IIe System                                                                            | 1295.00            |

\*Apple Products Available In-store Only\*

## Apple Compatible Hardware

| ALS CP M 3.0 Plus Card             | LIST \$399.00 | ACP \$299.00 |
|------------------------------------|---------------|--------------|
| COMPUTER ACCESSORIES               |               |              |
| Power Control Center P12           |               | 149.00       |
| COEX 16K Ram Card                  | 99.00         | 49.95        |
| Parallel Printercard w/Cable       | 29.00         | 20.00        |
| Apple II Prototype Card            | 29.00         | 20.00        |
| Apple I Extender Card              | 29.00         | 20.00        |
| 64K Extended 80 Column             | 199.00        | 99.95        |
| CORVUS Hard Disk Omnimat           |               | Call         |
| EASTSIDE Wildcard (11 - w/64)      |               | 89.00        |
| Wildcard 2 (Ile)                   |               | 119.00       |
| Wildcard 2 Plus (64K in 10 sec)    |               | 149.00       |
| FINGERPRINT Epson Enhancer         |               | 59.00        |
| GIBSON Light Pen (new Improved)    |               | Call         |
| IS PKASO Interface (II, Ile)       | 199.00        | 139.00       |
| PKASO Interface (III)              | 199.00        | 159.00       |
| KENSINGTON System Saver            | 89.95         | 69.95        |
| PC Saver                           | 49.95         | 39.95        |
| KEYTRONICS Keyboard II - Keypad    | 298.00        | 295.00       |
| KOALA Graphics Pad                 | 125.00        | 95.00        |
| KRAFT Joystick                     | 49.00         | 36.00        |
| Game Paddles                       | 49.00         | 36.00        |
| MCT Speed Demon                    | 295.00        | 249.00       |
| MPC 128K Bubble Memory             | 875.00        | 699.00       |
| M&R Supr Mod II RF Modulator       | 69.00         | 49.00        |
| Supr Fan                           | 50.00         | 38.00        |
| MICROPRO 6MHz Applicard - Word     |               | Call         |
| MICROSOFT Z-80 Softcard            | 395.00        | 249.00       |
| Z-80 Softcard Plus                 | 645.00        | 479.00       |
| Softcard Premium Pak (II - I)      | 695.00        | 499.00       |
| Softcard Premium Pak (Ile)         | 495.00        | 395.00       |
| MOUNTAIN COMPUTER                  |               |              |
| MUSIC System                       | 395.00        | 335.00       |
| A/D Plus D                         | 350.00        | 299.00       |
| MICROTEK Dumping Buf. w/64K        | 349.00        | 285.00       |
| ORANGE MICRO                       |               |              |
| Grappler Plus                      | 175.00        | 129.00       |
| 16K Bufferboard                    | 175.00        | 129.00       |
| Grappler Buffered w/16K            | 245.00        | 199.00       |
| PCPI Applicard w/128K, 6MHz        | 595.00        | 499.00       |
| 8088 Coprocessor                   | 595.00        | 499.00       |
| Applicard w/128K, 4MHz             | 495.00        | 429.00       |
| PERISOFT (All w/1 Year Warranty)   |               |              |
| Printerlink Intel. Printer I/O     | 99.00         | 79.00        |
| Messenger Univ. Serial I/O         | 135.00        | 109.00       |
| Timeclock Realtime Clock           | 110.00        | 99.00        |
| Gratlink Graphics I/O              | 175.00        | 139.00       |
| Bufferlink w/16K Buffer            | 189.00        | 159.00       |
| PRACTICAL PERIPHERALS              |               |              |
| Microbuffer 16K (Epson Parallel)   | 159.00        | 149.00       |
| Microbuffer 32K (Epson Parallel)   | 159.00        | 179.00       |
| Microbuffer 16K (Epson Serial)     | 179.00        | 159.00       |
| Microbuffer 32K (Epson Serial)     | 219.00        | 199.00       |
| Microbuffer In-line 64K (Parallel) | 349.00        | 279.00       |
| Microbuffer In-line 64K (Serial)   | 349.00        | 279.00       |
| PROMETHEUS Versacard 4 in 1        | 199.00        | 165.00       |
| QUADRAM                            |               |              |
| Quadlink (IBM to Apple)            | 680.00        | 499.00       |
| Microfazer 16K (Parallel)          | 189.00        | 169.00       |
| Microfazer 16K (Serial)            | 220.00        | 195.00       |
| Microfazer 32K (Parallel)          | 225.00        | 199.00       |
| SATURIN TITAN                      |               |              |
| 32K Ramcard                        | 219.00        | 189.00       |
| 64K Ramcard                        | 349.00        | 289.00       |
| 128K Ramcard                       | 499.00        | 429.00       |
| Accelerator II Card (2.2e.2+)      | 599.00        | 449.00       |
| Neptune 64K - 80                   | 199.00        |              |
| Neptune 128K - 80                  | 299.00        |              |
| Neptune 192K - 80                  | 389.00        |              |
| STREET Echo I (Apple)              | 1             |              |

## Drawings and Data Files Linked

**F**ilevision for the Macintosh links drawings with data files.

The program allows you to draw directly on the Mac screen with a mouse label, highlight sections of the drawing, and store both the text and the drawing on a disk.

Filevision is mouse-driven. You can even select certain

information to be highlighted when your drawing and text are printed.

An editor allows you to create your own symbols in addition to the 20 supplied with the Filevision palette.

Filevision costs \$195. Write Telos Corp., 3420 Ocean Park Blvd., Santa Monica, CA 90405.

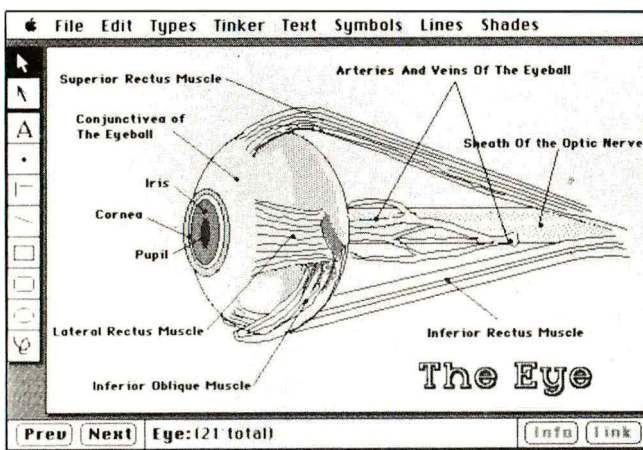
Circle **785** on inquiry card.

## Digital Images on Your Apple

**C**omputereyes for 48K-byte Apple II computers transposes video images to Apple's high-resolution display. It connects to the Apple's game I/O port and to video cameras, disks, or recorders. Pictures appear on the screen within 5 seconds and can be saved on disk. Computereyes software is not copy-protected and

will run on any 48K-byte Apple that has Applesoft and DOS 3.3.

The package costs \$129.95 or \$349.95 with a video camera. It comes with a one-year warranty. Contact Digital Vision Inc., 14 Oak St., Suite 2, Needham, MA 02192, (617) 444-9040. Circle **779** on inquiry card.



Filevision lets you store both information and a drawing.

## Waterproof Bag

**T**he PC-3004 Macintosh Bag is custom-designed luggage made from a material called Cellular Armor, which is waterproof and flexible. It can be purchased with a zip-on section for the keyboard and modem and printer. With the zip-on compartment, it costs \$199.95. Without it, it costs \$129.95. Contact Kiwi, 6721 NW 36th Ave., Miami, FL 33174, (305) 835-8228. Circle **790** on inquiry card.

## Repair Kit

**A**pple Patch for the Apple II and II+ is a hardware repair kit. It includes a chip puller, duplicates of all the Apple II chips except ROMs, and a detailed manual, especially written for the amateur repairperson.

Apple Patch costs \$89.95. It is made by Ivie Computer Corp., 460 N. University Ave., Suite 204, Provo, UT 84601, (801) 373-1313. Circle **794** on inquiry card.

## Apple Music Board

**P**C to Mac and Back is a communications package that allows a Macintosh and an IBM PC to communicate.

The package, complete with a book and two disks, enables a Macintosh or IBM PC to communicate with almost any other computer equipped with an RS-232C serial port and its own communications software. The package transfers both text and binary files.

PC to Mac and Back allows direct communication using a null modem or the phones.

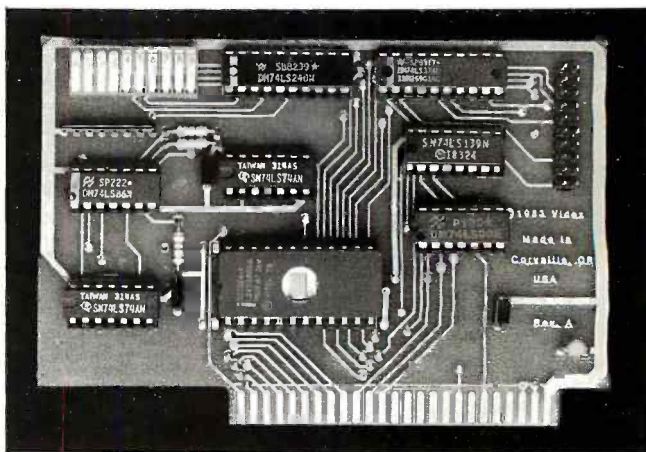
The product sells for less than \$100 from Dilithium Press, Suite 151, 8285 SW Nimbus, Beaverton, OR 97005, (800) 547-1842, in Oregon (503) 646-2713. Circle **774** on inquiry card.

## Lisa and Mac Programs, Apple II Boards from Videx

**D**esktop Calendar for the Lisa 2 and Macintosh is an appointment book and notepad on a calendar display. The calendar's alarm will interrupt other programming to remind you of an appointment. Desktop for the Lisa costs \$295 and for the Macintosh costs \$89.

Uniprint is an interface for the Apple II and IIe to parallel printers. The documentation includes switch configurations for 25 popular printers and comes with Centronics-compatible cable. The Uniprint transfers high-resolution and double-high-resolution graphics to a printer and shrinks, expands, or rotates (90 degrees) an image. It costs \$89.

Ultraterm, an 80-column card for the Apple II, IIe, and II+, can also display 96.



The Uniprint interface for the Apple.

128, 132, or 160 columns across an Apple screen. The firmware and manual costs \$379.

All of the above products

are available from Videx, 1105 NE Circle Blvd., Corvallis, OR 97330, (503) 758-0521.

Circle **787** on inquiry card.

# Do Kay

COMPUTER PRODUCTS, Inc.

ORDER TOLL FREE

(800) 538-8800

(CALIFORNIA RESIDENTS)

(800) 848-8008



## STATIC RAMS

|            |                              |       |
|------------|------------------------------|-------|
| 101        | 256 x 4 (450ns)              | 1.90  |
| 101        | 256 x 4 (450ns) (cmos)       | 3.90  |
| 102-1      | 1024 x 1 (450ns)             | .66   |
| 102L-4     | 1024 x 1 (450ns) (LP)        | .98   |
| 102L-2     | 1024 x 1 (250ns) (LP)        | 1.45  |
| 111        | 256 x 4 (450ns)              | 2.45  |
| 112        | 256 x 4 (450ns)              | 2.95  |
| 114        | 1024 x 4 (450ns)             | .99   |
| 114-25     | 1024 x 4 (250ns)             | 1.10  |
| 114L-4     | 1024 x 4 (450ns) (LP)        | 1.20  |
| 114L-3     | 1024 x 4 (300ns) (LP)        | 1.30  |
| 114L-2     | 1024 x 4 (200ns) (LP)        | 1.40  |
| 125        | 1024 x 1                     | 2.49  |
| 147        | 4096 x 1 (55ns)              | 4.90  |
| M34044-4   | 4096 x 1 (450ns)             | 3.45  |
| M34044-3   | 4096 x 1 (300ns)             | 3.95  |
| M34044-2   | 4096 x 1 (200ns)             | 4.45  |
| MK4118     | 1024 x 8 (250ns)             | 9.90  |
| MM2016-200 | 2048 x 8 (200ns)             | 4.10  |
| MM2016-150 | 2048 x 8 (150ns)             | 4.90  |
| MM2016-100 | 2048 x 8 (100ns)             | 6.10  |
| M6116-4    | 2048 x 8 (200ns) (cmos)      | 4.70  |
| M6116-3    | 2048 x 8 (150ns) (cmos)      | 4.90  |
| M6116-2    | 2048 x 8 (120ns) (cmos)      | 8.90  |
| M6116LP-4  | 2048 x 8 (200ns) (cmos)      | 5.90  |
| M6116LP-3  | 2048 x 8 (150ns) (cmos) (LP) | 6.90  |
| M6116LP-2  | 2048 x 8 (120ns) (cmos) (LP) | 9.95  |
| -6132      | 4096 x 8 (300ns) (Qatal)     | 33.95 |
| M6264P-15  | 8192 x 8 (150ns) (cmos)      | 38.95 |
| M6264LP-15 | 8192 x 8 (150ns) (cmos)      | 48.95 |

LP = Low Power Qatal = Quasi-Static

## DYNAMIC RAMS

|         |                        |      |
|---------|------------------------|------|
| M34027  | 4096 x 1 (250ns)       | 1.95 |
| 1P0411  | 4096 x 1 (300ns)       | 1.95 |
| M5280   | 4096 x 1 (300ns)       | 1.95 |
| MK4108  | 8192 x 1 (200ns)       | 1.90 |
| M5298   | 8192 x 1 (250ns)       | 1.80 |
| 116-200 | 16384 x 1 (200ns)      | .79  |
| 116-150 | 16384 x 1 (150ns)      | 1.20 |
| 118     | 16384 x 1 (150ns) (5v) | 4.90 |
| 184-250 | 85536 x 1 (250ns)      | 4.45 |
| 184-200 | 85536 x 1 (200ns) (5v) | 5.00 |
| 184-150 | 85536 x 1 (150ns) (5v) | 5.00 |

5V = Single 5 Volt Supply

## EPROMS

|         |                                |       |
|---------|--------------------------------|-------|
| 702     | 256 x 8 (1 us)                 | 4.45  |
| 708     | 1024 x 8 (450ns)               | 2.49  |
| 758     | 1024 x 8 (450ns) (5v)          | 5.90  |
| 716     | 2048 x 8 (450ns) (5v)          | 2.95  |
| 716-1   | 2048 x 8 (350ns) (5v)          | 5.90  |
| M32516  | 2048 x 8 (450ns) (5v)          | 5.45  |
| M32716  | 2048 x 8 (450ns)               | 6.95  |
| M82532  | 4096 x 8 (450ns) (5v)          | 5.90  |
| 732     | 4096 x 8 (450ns) (5v)          | 4.45  |
| 732-250 | 4096 x 8 (250ns) (5v)          | 8.90  |
| 732-200 | 4096 x 8 (200ns) (5v)          | 10.95 |
| 784     | 8192 x 8 (450ns) (5v)          | 6.45  |
| 784-250 | 8192 x 8 (250ns) (5v)          | 7.45  |
| 784-200 | 8192 x 8 (200ns) (5v)          | 16.45 |
| M32564  | 8192 x 8 (450ns) (5v)          | 18.95 |
| C68764  | 8192 x 8 (450ns) (5v) (24 pin) | 38.95 |
| 7128    | 16384 x 8 Cell                 | 24.95 |

5v = Single 5 Volt Supply

# APPLE ACCESSORIES

## MICROMAX

INNOVATORS IN MICRO-COMPUTER TECHNOLOGY

### VIEWMAX-80 149.95

80-Column card for Apple II series

- Video Soft Switch
- Inverse Video
- VIDEX's Videoterm compatible



### VIEWMAX-80e 119.95

80-Column extended video card for Apple IIe

- 64K RAM, expandable to 128K
- Double High-resolution circuit
- Compatible with Pascal & CP/M



### PRINTMAX 59.95

Parallel printer card, Apple II series

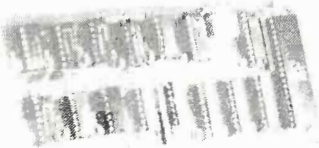
- Centronics compatible
- Variable print widths
- Up to 5000 characters/second



### Z-MAX-80 89.00

Z-80 card for CP/M on Apple II series

- Softcard and Z-Card compatible
- Full interrupt and DMA operation



### GRAPHMAX 99.95

Dual High-Res graphics printer card for Apple II series

- Grappler+ compatible
- Color and Zoom magnification
- Inverse graphics
- 90-degrees Rotation
- Pascal and CP/M compatible

|                     |        |
|---------------------|--------|
| 80 Column Apple II+ | 149.95 |
| 80 Column Apple IIe | 129.95 |
| Z80 Apple II+       | 89.00  |
| Z80 Apple IIe       | 89.00  |
| 16K Card            | 39.95  |
| Cooling Fan         | 38.95  |
| Power Supply        | 74.95  |
| Joystick            | 29.95  |
| RF Modulator        | 13.95  |
| Disk Drive          | 199.00 |
| Controller Card     | 59.95  |
| Paddles             | 7.95   |

## COOLING FAN

38.95



## APPLE COMPATIBLE POWER SUPPLY

74.95



- Powers Apple type systems
- +5V @ 5A +12V @ 3A  
-5V @ .5A -12V @ .5A
- Includes instructions

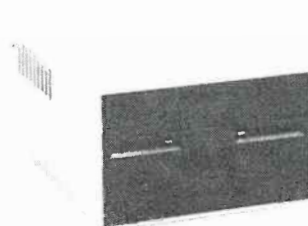
## 16K RAM Card - Apple II+

- 2-Year Warranty



Assembled & Tested .... 39.95

## APPLE COMPATIBLE DISK DRIVE



199.00

- Shugart mechanism, made in U.S.A
- Directly replaces Apple Disk II
- Fully compatible with Apple Controller or other Apple compatible controllers.
- One Year Warranty

## APPLE COMPATIBLE JOYSTICK

29.95



## MULTIVIEW 80/160 249.00

80-160 columns with any monitor!

- Screens: 80x24, 80x32, 80x48, 96x24, 132x24, 132x30, 160x24
- On-screen BOLD and Underline
- Reverse scrolling
- Easy-to-read Wide-angle mode
- Apple II and IIe compatible
- Prompt lines
- Upper & lowercase letters



## MEMORY EXPANSION KIT



4164 150ns  
9 for \$45.00

TERMS: Minimum order \$10.00.

For shipping and handling, include \$2.50 for UPS ground or \$3.50 for UPS Blue (air). For each additional air pound, add \$1 for UPS Blue shipping and handling. California residents must include 6% sales tax. Bay area and LA residents include 6 1/2% sales tax. Prices are subject to change without notice. We are not responsible for typographical errors. We reserve the right to limit quantities and to substitute manufacturers. All merchandise subject to prior sale.

CALL for VOLUME Quotes

HOURS: Mon. - Fri. 7:30 to 5:00  
Saturdays 10:00 to 3:00

VISIT OUR RETAIL STORE

2100 De La Cruz Blvd.  
Santa Clara, CA 95050  
(408) 988-0697

ALL MERCHANDISE IS  
100% GUARANTEED

Telex: 756440

# Do Kay

**ORDER  
TOLL FREE**

**800-345-7100**

**ORDERS INSIDE CALIF. 213-675-2115**  
**CUSTOMER SERVICE and TECHNICAL HELP [ask for Martin] 213-675-2382**

**\$av-On Computers, Inc.**

Circle 692 on inquiry card.

**MERRY CHRISTMAS FROM THE STAFF AT \$AV-ON COMPUTERS**

**COMPUTERS**

**SANYO**

- 550 ..... **\$699**
- 550-2 ..... **799**
- 555 [2 Single Sided Drives] ..... **Call**
- 555-2 [2 Double Sided Drives] ..... **Call**

**COMPAQ**

- PORTABLE [2 Dr. & 256K] ..... **\$2190**
- DESK TOP ..... **Call**

**KAYPRO**

- KAYPRO II ..... **\$1129**
- KAYPRO II+ ..... **1399**
- KAYPRO 4 ..... **1729**
- KAYPRO 4+88 ..... **1995**
- KAYPRO 10 ..... **2399**

**TAVA**

- ..... **Call**

**ZENITH**

- ..... **Call**

**APPLE**

- APPLE IIc ..... **\$949**
- APPLE IIe ..... **749**
- STARTER SYSTEM ..... **1399**

CALL FOR PRICING ON EPSON, NEC  
 COLUMBIA AND OTHERS FOR  
 LOWEST PRICE AROUND

**DISK DRIVES**

**TANDON**

- 100-2 ..... **\$149**
- 101-4 ..... **Call**

**TEAC**

- 55B ..... **\$139**
- 55A ..... **Call**
- 55F ..... **199**
- BRACKETS ..... **5**

**CDC**

- ..... **Call**

**MPI**

- B52 ..... **\$149**

**DISK DRIVES**

**MICRO SCI**

- A-2 ..... **\$189**

**RANA SYSTEMS**

- ELITE I ..... **Call**
- ELITE II ..... **Call**
- ELITE III ..... **Call**

**FOURTH DIMENSION**

- APPLE DRIVE ..... **\$189**

**DRIVE CONTROLLERS**

- VISTA ..... **Call**
- RANA [Controls 4] ..... **\$89**
- MAYNARD ..... **160**
- MAYNARD [w/Parallel Port] ..... **199**
- MAYNARD [w/Serial Port] ..... **199**
- IBM CONTROLLER ..... **129**

**MONITORS**

**PRINCETON GRAPHICS**

- HX12 ..... **\$459**
- SR12 ..... **Call**
- MAX12 ..... **179**
- SCAN DOPLER ..... **Call**

**AMDEK**

- 300G 12" Green ..... **\$139**
- 300A 12" Amber ..... **139**
- 310A 12" Amber [Monochrome] ..... **163**
- COLOR I [Composite Video] ..... **299**
- COLOR II+ [RGB Video] ..... **409**

**ZENITH**

- ZVM122 ..... **\$109**
- ZVM123 ..... **109**

**SAMWOO**

- IBM Compatible, [Monochrome] ..... **\$99**

**LEADING EDGE**

- GORILLA [Green] ..... **\$89**
- GORILLA [Amber] ..... **109**

**ELKA**

- SAME AS USI P13 ..... **\$119**

**TAXAN Will Beat Any Price ..... Call**

**SPECIALS  
THIS MONTH ONLY**

**\$av-On System 3**

Includes: IBM PC  
 128K and 2 1/2 High Drives

**Only \$1495**

**TEAK 55B**

Buy Two [2] This Month

WOW! Only **\$260.00**

**MEMORY UPGRADE**

"64K" [200nS] ..... **\$36.00**

**HAYES 1200B  
MODEM**

Now Only ..... **\$375.00**

**SAMWOO MONITOR**

Monochrome  
 22 MHz • 100% IBM

**\$89.00**

**MATH COPROCESSOR**

INTEL 8087-3  
**\$134.00**

**APPLE ADD-ONS**

**TG**

- JOY STICK ..... **\$39**
- SELECT PORT ..... **39**
- PADDLES ..... **39**

**MICROMAX**

- VIEWMAX 80 ..... **\$129**
- VIEWMAX 80e ..... **119**

**ALS**

- Z-CARD ..... **\$119**
- CPM 3.0 ..... **Call**

**KOALA**

- GRAPHICS TABLET ..... **\$89**
- MORE AVAILABLE ..... **Call**



# WE WILL BEAT ANY ADVERTISED PRICE!!

## IBM PRODUCTS

### IBM CPU

|                                    |        |
|------------------------------------|--------|
| PC 64K 1 DRIVE                     | \$1379 |
| PC 256K 2 DRIVES                   | 1699   |
| PC XT 128K 10Mb                    | Call   |
| AT BASE MODEL                      | Call   |
| AT ENHANCED MODEL                  | Call   |
| (IBM Quantity Discounts Available) | Call   |

### PC DISK DRIVES

|                        |       |
|------------------------|-------|
| IBM LOGO Drive DSDD    | \$199 |
| TEAK 55B 1/2 High      | 137   |
| TANDON 100-2 320K DSDD | 159   |

### MICROSOFT

|              |            |
|--------------|------------|
| WORD & MOUSE | Low Priced |
|--------------|------------|

### L.D.C.

|           |         |
|-----------|---------|
| LOTUS 123 | Low Low |
| SYMPHONY  | Priced  |
| DOS 2.1   | \$55    |

### AST

|                         |       |
|-------------------------|-------|
| SIX PAC PLUS (0 memory) | \$229 |
| SIX PAC PLUS (64K)      | 259   |
| I/O PLUS                | 123   |
| MEGA PLUS (64K)         | 279   |
| MEGA PAC (128K)         | 229   |
| MEGA PAC (256K)         | 269   |
| OTHER AST AVAILABLE     | Call  |

### IBM

|               |       |
|---------------|-------|
| MONO CARD     | \$239 |
| COLOR CARD    | 209   |
| MONO MONITOR  | 299   |
| COLOR MONITOR | 649   |

### IBM

|               |      |
|---------------|------|
| PRINTER       | Call |
| PRINTER CABLE | \$20 |

### COMPUTER PERIPHERALS

|                                                                         |       |
|-------------------------------------------------------------------------|-------|
| PCM-1 (PC Exp. Board to 256K)                                           | \$149 |
| DUAL I/O (w/2 print ports, 2 IBM ASYNC, Clk Cal & Print Cable Included) | 189   |

### MEMORY UPGRADES

|                |      |
|----------------|------|
| 4164 (9 CHIPS) | \$36 |
|----------------|------|

### MATH COPROCESSOR

|              |       |
|--------------|-------|
| INTEL 8087-3 | \$139 |
|--------------|-------|

### KEYTRONICS KEYBOARDS

|      |              |
|------|--------------|
| 5150 | Priced Too   |
| 5151 | Low Too List |

### IBM

|            |      |
|------------|------|
| PC-J-STICK | \$39 |
|------------|------|

## QUADBOARDS

|                       |       |
|-----------------------|-------|
| QUADBOARD (No Memory) | \$229 |
| QUADBOARD (64K)       | 269   |
| QUADCOLOR 1           | 209   |
| QUADCOLOR 2           | 209   |
| QUADLINK              | 449   |

## TELEX SYSTEM

|            |      |
|------------|------|
| 3M MODEL C | Call |
|------------|------|

## VIDEO BOARDS FOR IBM

|                        |       |
|------------------------|-------|
| HERCULES COLOR         | \$189 |
| HERCULES GRAPHICS      | 339   |
| PLANTRONICS COLOR PLUS | 369   |
| USI PARADISE SYSTEMS   | 325   |
| PC PEACOCK             | 219   |
| PERSYST BOARDS         | Call  |
| TECHMAR                | Call  |
| STB GRAPHICS PLUS      | 359   |
| OTHERS AVAILABLE       | Call  |

## MODEMS

### HAYES

|       |       |
|-------|-------|
| 300   | \$199 |
| 1200  | 479   |
| 1200B | 379   |

### NOVATION

|            |       |
|------------|-------|
| ACCESS 123 | \$375 |
| J-CAT      | 99    |
| SMART CAT  | Call  |

### RIXON

|        |       |
|--------|-------|
| PC212A | \$399 |
| P212   | 399   |

### ANCHOR

|               |      |
|---------------|------|
| MARK VII 300  | \$94 |
| MARK XII 1200 | 259  |

### BIZZ COMP

|                                  |       |
|----------------------------------|-------|
| 1200 INTERNET                    | \$399 |
| CALL FOR PRICING ON OTHER MODEMS |       |

## FINANCING AVAILABLE

with Approved Credit.

## PRINTERS

### DYNAX

|            |      |
|------------|------|
| DYNAX DX15 | Call |
|------------|------|

### STAR MICRONICS

|                                   |       |
|-----------------------------------|-------|
| GEMINI 10X (120cps)               | \$259 |
| GEMINI 15X (120cps, 15" carriage) | 380   |
| POWERTYPE                         | 380   |

### OKIDATA

|                            |          |
|----------------------------|----------|
| 82A (120cps par. & ser.)   | Priced   |
| 92P (160cps)               | Too Low  |
| 93P (160cps, 15" carriage) | Too List |
| OKI—Plug + Play + Tractor  | Call     |

### EPSON

|                          |       |
|--------------------------|-------|
| RX80 (120cps)            | Call  |
| FX80 (160cps)            | \$429 |
| FX100 (160cps, 15" car.) | 669   |

### BROTHER

|      |       |
|------|-------|
| HR15 | \$379 |
| HR25 | 299   |

### JUKI

|                             |       |
|-----------------------------|-------|
| 6100 (18cps & let. quality) | \$399 |
|-----------------------------|-------|

### NEC

|  |      |
|--|------|
|  | Call |
|--|------|

## PRINTER INTERFACE and PERIPHERALS

### PRINT CABLES

|                    |      |
|--------------------|------|
| ALL MAKES (6 foot) | \$20 |
|--------------------|------|

### FOURTH DEMINSION

|                         |      |
|-------------------------|------|
| CARD to CABLE for Apple | \$47 |
|-------------------------|------|

### IBM

|               |      |
|---------------|------|
| PARALLEL PORT | \$93 |
|---------------|------|

### ORANGE MICRO

|                   |       |
|-------------------|-------|
| GRAPPLER +        | \$109 |
| GRAPPLER +, w/16K | 169   |

**WE CARRY MUCH MORE THAN ADVERTISED — PLEASE CALL!**

**Sav-On Computers, Inc.**  
12595 Crenshaw Blvd., Hawthorne, CA 90250

OPEN: 7:30am till 6:00pm Mon.-Fri.  
9:00am till 2:00pm Sat.

TERMS: We accept Visa, MasterCard, COD's, and Wire Transfers.  
No surcharge for Credit Cards. UPS, Federal Express and  
Emergency shipping available. Calif. residents please add  
6 1/2% sales tax to order. Prices subject to  
change without notice. Not responsible  
for typographical errors.  
Circle 692 on inquiry card.



# COMPUTER DISCOUNT PRODUCTS

Stocking **HUGE** Inventories of APPLE & IBM Products SINCE 1977

★ **GUARANTEED Fair Pricing** Is Our Policy ★



## Ultraterm 244.99

|                                |                                  |        |
|--------------------------------|----------------------------------|--------|
| T. M.                          | Enhancer II                      | 99.99  |
|                                | Function Strip                   | 31.99  |
|                                | Hardswitch                       | 14.99  |
|                                | Micromodem Chip                  | 24.99  |
|                                | PSIO                             | 169.99 |
|                                | Softswitch                       | 25.99  |
|                                | UltraPlan                        | 129.99 |
|                                | Videoterm w/Softswitch & Inverse | 219.99 |
| PRE-BOOTS: Apple Writer        | 14.99                            |        |
| Apple Writer for Ultraterm     | 23.99                            |        |
| Vis/calc                       | 39.99                            |        |
| Vis/calc with Memory Expansion | 66.99                            |        |
| Vis/calc for Ultraterm         | 54.99                            |        |

## ACCESSORIES & PERIPHERALS

|                           |        |                              |        |
|---------------------------|--------|------------------------------|--------|
| MONITORS: Amdk 300A-Ap    | 159.99 | PRINTERS: C-I/OH8510         | 379.99 |
| Amdk 310A-IBM             | 179.99 | EpsonFX80                    | 429.99 |
| PrincetonHX-12RGB-IBM     | 459.99 | Okidata92P w/Plug n Play-IBM | SCALL  |
| PrincetonMax-12 Amber-IBM | 189.99 | DRIVES: 1/2 Height-Ap        | 189.99 |
| Quadram QuadchromeRGB-IBM | 529.99 | MicroSci A-2-Ap              | 209.99 |
| Taxan 420 RGB-Ap/IBM      | 439.99 | Teac 1/2 Height-IBM          | 179.99 |
| Taxan 12" Amber-IBM       | 169.99 | RIBBONS: Brother             | SCALL  |
| Taxan 12" Amber20mhz-Ap   | 139.99 | MX & FX80                    | 4.99   |
|                           |        | MX & FX100                   | 7.99   |
|                           |        | OKI82. 83. 92. 93 & Gemini   | 2.99   |

Other Monitors & Printers - SCALL

## MicroPro

### FOR APPLE & IBM

|                  |        |
|------------------|--------|
| Infostar         | 259.99 |
| Mailmerge        | 139.99 |
| Spellstar        | 139.99 |
| Wordstar         | 239.99 |
| Wordstar Pro     | 349.99 |
| Pro Options Pack | 181.99 |

**CHARTSTAR - NEW**  
Business Graphics Package  
For IBM 319.99

## DISKETTES & STORAGE

|                                      |    |       |     |        |
|--------------------------------------|----|-------|-----|--------|
| Dysan 5 1/4" SS/DD                   | 10 | 29.99 | 100 | 279.99 |
| Dysan 5 1/4" DS/DD                   |    | 38.99 |     | 369.99 |
| Maxell 5 1/4" SS/DD                  |    | 24.99 |     | 229.99 |
| Maxell 5 1/4" DS/DD                  |    | 34.99 |     | 329.99 |
| Memorex 3 1/2" SS/DD                 |    | 41.99 |     | 399.99 |
| Memorex 3 1/2" DS/DD                 |    | 19.99 |     | 189.99 |
| Memorex 3 1/2" DS/DD                 |    | 26.99 |     | 259.99 |
| Flip n File w/Locktray Holds 25 3/4" |    |       |     | 17.99  |
| Flip n File w/Locktray Holds 50 5/4" |    |       |     | 27.99  |
| Library Case (Assorted Colors)       |    |       |     | 1.99   |
| Media Mate Holds 50 3/4" Diskettes   |    |       |     | 12.99  |
| Media Mate Holds 30 3/4" Diskettes   |    |       |     | 11.99  |
| Printer Stand-Large (Plexiglass)     |    |       |     | 29.99  |
| Printer Stand-Small (Plexiglass)     |    |       |     | 24.99  |

## HARDWARE

|                                   |        |
|-----------------------------------|--------|
| Ap ALS Z-Engine (Replaces Z-Card) | 159.99 |
| Ap DANPAYMIA/FlowCase 1, Rev 1-6  | 25.99  |
| Ap Lower Case 2, Rev 7            | 19.99  |
| Ap JOYSTICK Kraftor TG            | 39.99  |
| Ap MICROSOFT Softcard             | 229.99 |
| Ap Ram Card                       | 74.99  |
| Ap ORANGE MICRO Grappler +        | 114.99 |
| Ap Bufferboard                    | 119.99 |
| Ap Buffered Grappler              | 179.99 |
| Ap TITAN Accelerator Ite          | 449.99 |
| Ap Neplune64K                     | 199.99 |
| Ap Saturn 64K Ram                 | 279.99 |
| IBM AST I/O Plus                  | SCALL  |
| IBM Mega Plus                     | 289.99 |
| IBM Six Pack Plus                 | 279.99 |
| IBM JOYSTICK Kraftor TG           | 44.99  |
| IBM PLANTRONICS Color Plus Board  | 375.99 |
| IBM TITAN 64K Board               | 499.99 |
| Ap/IBM KRAFT Paddles              | 31.99  |
| Ap/IBM TG Paddles                 | 27.99  |

**KENSINGTON**  
System Saver-AP 65.00  
PC Saver-IBM 29.99

## MAIL AND PHONE ORDERS

Inquiries Welcome!  
**(408) 985-0400**  
MAIL, PHONE, WILL-CALL  
SERVICE FROM 6 AM (PST)

## COMMUNICATIONS



### CONNECT!

|                                   |        |
|-----------------------------------|--------|
| ASCII EXPRESS-Ap                  | 109.99 |
| CROSS-TALK-IBM                    | 139.99 |
| HAYES MODEMS: 300 Baud Smartmodem | 209.99 |
| 1200Baud Smartmodem               | 479.99 |
| 1200B-IBM                         | 409.99 |
| Micromodem Ite                    | 239.99 |
| SOFTERM2-Ap                       | 149.99 |
| NOVATION MODEMS: J Cat            | 109.99 |
| 103SmanCat                        | 169.99 |
| 103:212 AutoCat                   | 399.99 |
| Cat                               | 135.99 |
| Applecat II 300 Baud              | 249.99 |
| Applecat Upgrade to 1200 Baud     | 309.99 |
| Expansion Module                  | 29.99  |



**TELMERGE - IBM 119.99**  
New Telecommunications  
Program From MicroPro

## EDUCATIONAL

### BASIC SKILLS

|                                        |         |
|----------------------------------------|---------|
| Ap DLM School Versions Available       | SCALL   |
| Ap Alien Addition/Alligator Mix        | ea22.99 |
| Ap Demolition Division/Dragon Mix      | ea22.99 |
| Ap Minus Mission/Multiplication        | ea22.99 |
| Ap Spelling Wiz/Verb Viper             | ea31.99 |
| Ap Word Invasion/Word Radar            | ea31.99 |
| Ap LEARNING COMPANY Juggles Rainbow    | 21.99   |
| Ap Gertrudes Puzzle/Secret             | ea29.99 |
| Ap Magic Spell Bumble Plot             | ea29.99 |
| Ap Number Slumper                      | 26.99   |
| Ap Rocky's Boots                       | 34.99   |
| Ap PEACH TREE Algebra I-III            | ea31.99 |
| Ap Counting Bee                        | 23.99   |
| Ap Decimals-Fractions 3 0              | ea33.99 |
| IBM LEARNING COMPANY Addition Magician | 26.99   |
| IBM Magic Spells                       | 27.99   |
| IBM PEACH TREE Algebra I               | 34.99   |
| Ap/IBM SPINNAKER Alphabet Zoo          | 21.99   |
| Ap/IBM Delta Drawing                   | 32.99   |
| Ap/IBM Facemaker-Fraction Fever        | ea23.99 |
| Ap/IBM Hey Diddle/Kindercomp           | ea21.99 |
| Ap/IBM Snooper Troops I-II             | ea29.99 |
| Ap/IBM Story Machine                   | 23.99   |
| Ap/IBM LEARNING COMPANY Reader Rabbit  | 26.99   |
| Ap/IBM Moptown Hotel/Parade            | 26.99   |
| Ap/IBM Word Spinner                    | 26.99   |

### ADVANCED SKILLS

|                              |         |
|------------------------------|---------|
| Ap MASTERTYPE                | 31.99   |
| Ap MICROSOFT Typing Tutor II | 19.99   |
| Ap PEACH TREE FSAT or SAT    | ea33.99 |
| IBM CAI Masters              | ea31.99 |
| IBM Subjects                 | ea16.99 |
| IBM MASTERTYPE               | 34.99   |
| Muppet Learning Keys - NEW   | 59.99   |

## ADVENTURE & GAMES

|                                         |         |
|-----------------------------------------|---------|
| Ap BRODERBUND Gumbat                    | 21.99   |
| Ap Choptail/Dial                        | ea24.99 |
| Ap MICROLAB Crises Mountain/Dno Eggs    | ea27.99 |
| Ap ODESTA Chess                         | 45.99   |
| Ap SIERRA ON-LINE Frogger               | 21.99   |
| Ap SIR TECH Knight of Diamonds          | 27.99   |
| Ap Legacy of Llylgamyn                  | 37.99   |
| Ap Wizardry                             | 19.99   |
| Ap SUBL LOGIC Flight Simulator II       | 37.99   |
| Ap ULTIMA III                           | 39.99   |
| IBM BRODERBUND Serpentine               | 26.99   |
| IBM MICROSOFT Flight Simulator II       | 39.99   |
| IBM SIERRA ON-LINE Crossfire            | 26.99   |
| IBM SIR TECH Wizardry                   | 44.99   |
| Ap/IBM BRODERBUND Loderunner            | 24.99   |
| Ap/IBM ApplePanic                       | 22.99   |
| Ap/IBM MICROLAB Miner 20-49er           | 27.99   |
| Ap/IBM SIERRA ON-LINE Ultima II         | 36.99   |
| Ap/IBM SUBL LOGIC Night Mission Pinball | 32.99   |

**TRILLIUM & WINDHAM CLASSICS**  
NEW Text Adventure Games  
by Famous Authors  
- SCALL -

## APPLICATIONS SOFTWARE

### FOR THE HOME

|                                   |        |
|-----------------------------------|--------|
| Ap BRODERBUND Bank Street Writer  | 44.99  |
| Ap Bank Street Speller            | 49.99  |
| Ap CONTINENTAL Tax Advantage      | 39.99  |
| Ap Home Accountant                | 44.99  |
| Ap Home Accountant (Mac)          | 75.99  |
| Ap SIERRA ON-LINE Homeworld       | 45.99  |
| Ap MONOGRAM Dollars & Sense       | 69.99  |
| IBM BRODERBUND Bank Street Writer | 59.99  |
| IBM CONTINENTAL Home Accountant   | 84.99  |
| IBM Tax Advantage                 | 49.99  |
| IBM MONOGRAM Dollars & Sense      | 109.99 |

### FOR THE BUSINESS

|                                      |          |
|--------------------------------------|----------|
| Ap BPI (GL, AP, AR, PAY)             | ea275.99 |
| Ap CONTINENTAL FCM-First Class Mail  | 59.99    |
| Ap KENSINGTON Format II              | 109.99   |
| Ap PFS Report                        | 79.99    |
| Ap File Graph/Write                  | ea89.99  |
| Ap RESPONSIBLE SPELLER               | 79.99    |
| Ap SIERRA ON-LINE Screenwriter II    | 81.99    |
| IBM ASHTON/TATEDBASE II              | 299.99   |
| IBM dBASE III                        | 474.99   |
| IBM Encyclopedia                     | 59.99    |
| IBM FrameWork                        | 474.99   |
| IBM Friday                           | 184.99   |
| IBM CONTINENTAL FCM-First Class Mail | 71.99    |
| IBM Ultrafile                        | 119.99   |
| IBM LIFETREE Volkswriter Deluxe      | 219.99   |
| IBM LOTUS Symphony                   | 499.99   |
| IBM MULTIMATE                        | 379.99   |
| IBM PFS Report                       | 89.99    |
| IBM File Graph/Write                 | ea99.99  |

### MICRO COOKBOOK

For Apple & IBM  
Includes Recipes 31.99

## QUADRAM

### FOR IBM

|                                 |        |
|---------------------------------|--------|
| Microfazer (All Configurations) | 149.99 |
| Quad 5 1/2" + 64K               | 229.99 |
| Quadboard I or II No K          | 219.99 |
| Quadboard I or II 64K           | 269.99 |
| Quadcolor I                     | 205.99 |
| Quadcolor I Upgrade             | 209.99 |

**MEMORY CHIPS**  
Top Quality for  
Best Performance SCALL

## INFOCOM

### FOR APPLE & IBM

|                                  |                                 |       |
|----------------------------------|---------------------------------|-------|
| CUTTHROATS                       | Underwater Treasure Hunt! - NEW | 27.99 |
| DEADLINE                         | Detective Case and YOU'RE IT    | 34.99 |
| ENCHANTER                        | Beginning Magician Mission      | 27.99 |
| INFIDEL                          | Enter The Lost Pyramid          | 31.99 |
| PLANETFALL                       | Investigate a Wild New World    | 27.99 |
| SEASTALKER                       | Junior Level Rescue Mission     | 27.99 |
| SORCERER                         | Mystic Clues & Magic Encounters | 31.99 |
| STARCROSS                        | Sci-Fi Adventure, 2188 A.O.     | 34.99 |
| SUSPENDED                        | 3 Levels and Custom Options     | 34.99 |
| WITNESS                          | Classic Murder Mystery          | 27.99 |
| ZORK I                           | All-Time Most Popular           | 27.99 |
| ZORK II-III                      | Advanced Levels                 | 31.99 |
| Hitchhiker's Guide to the Galaxy |                                 | 27.99 |
| Suspect                          |                                 | 34.99 |

## UTILITIES & ENHANCEMENTS

|                                      |         |
|--------------------------------------|---------|
| Ap BEAGLE Apple Mechanic/Beagle Bag  | ea19.99 |
| Ap Beagle Basic/Double Take          | ea23.99 |
| Ap Dos Bos Silicon Salad             | ea17.99 |
| Ap Fat Cat                           | 26.99   |
| Ap GPLE                              | 32.99   |
| Ap Pronto Dos/Frame Up/Utility City  | ea19.99 |
| Ap EASTSIDE Wildcard II              | 111.99  |
| Ap FINGERPRINT Epson Enhancement     | 44.99   |
| Ap KOALA Touch Pad                   | 85.99   |
| Ap MOCKINGBOARD - Speech Chips SCALL | 109.99  |
| Ap THUNDER LOCK                      | 99.99   |
| Ap KOALA Speed Key                   | 79.99   |
| IBM Speed Key System                 | 159.99  |
| IBM Touch Pad                        | 95.99   |
| IBM Touch Pad PCir                   | 89.99   |
| IBM NORTON UTILITIES                 | 55.99   |
| IBM SIDWAYS                          | 44.99   |
| Ap/IBM CENTRAL POINT Copy II + PC    | 25.99   |

### GRAPHICS SOFTWARE

|                                     |       |
|-------------------------------------|-------|
| Ap BEAGLE Typelaces                 | 15.99 |
| Ap Graphics - NEW                   | 44.99 |
| Ap Alpha Plot                       | 25.99 |
| Ap Triple Dump - NEW                | 31.99 |
| Ap Flex Text                        | 19.99 |
| Ap BRODERBUND Print Shop            | 39.99 |
| Ap PENQUIN Complete Graphics System | 44.99 |
| Ap Graphics Magician                | 37.99 |

## COMPUTER DISCOUNT PRODUCTS

860 So. Winchester Bl., San Jose, CA 95128

**- CALL (408) 985-0400 -**

Retail Showrooms In California  
San Jose • San Mateo • San Francisco

- No Charge For Credit Cards
- Prices Subject To Change
- Software Sales Are Final
- International Orders Welcome
- Min. UPS Chg. \$4 + Ins.
- Min. US Postal Chg. \$10
- P.O.'s Welcome - SCALL



# B·O·M·B

## BYTE'S ONGOING MONITOR BOX

| ARTICLE# | PAGE | ARTICLE                                          | AUTHOR(S)                    |
|----------|------|--------------------------------------------------|------------------------------|
| 1        | A8   | Artistic Tools for the Apple II Family . . . . . | Eldred                       |
| 2        | A18  | Appleworks: An Integrated Office Product.        | Cmar                         |
| 3        | A23  | Preshift-Table Graphics on your Apple . . . . .  | Budge,<br>Williams,<br>Moore |
| 4        | A30  | Low-Cost Word Processing on the Apple . . . . .  | Gingras                      |
| 5        | A38  | Alf's 8088 Coprocessor for your Apple . . . . .  | Morganstein                  |
| 6        | A45  | Expanding your Apple's Applications . . . . .    | Peck                         |
| 7        | A48  | The Search for Speech . . . . .                  | Lazzaro                      |
| 8        | A58  | Apple's New Modem and Access II . . . . .        | Brugsch                      |
| 9        | A67  | An Interview with Steve Wozniak . . . . .        | Williams,<br>Moore           |
| 10       | A75  | An Interview with Peter Quinn . . . . .          | Williams                     |
| 11       | A80  | Extra Storage on the Mac . . . . .               | Smith                        |
| 12       | A85  | Multiplan/Chart on the Macintosh . . . . .       | Trachtenberg                 |
| 13       | A94  | Evaluating the Macintosh Finder . . . . .        | Jennings                     |
| 14       | A102 | Habadex on Apple's Macintosh . . . . .           | Laporte                      |
| 15       | A106 | The Lisa 2: Apple's Ablest Computer . . . . .    | Redhed                       |
| 16       | A115 | The First Look at FORTH on the Mac . . . . .     | Williams                     |

### Apple Guide BOMB Card

Just as with your regular issues of BYTE, the editors would like to survey how effectively each article in our BYTE Guide to the Apple serves our audience. Fill out the card opposite the Apple Advertisers' Index, mail it in and look for the tabulation of your votes in the March issue of BYTE.

First-place winner will receive a bonus of \$100. Second-place author will receive \$50, and the article that scores third will be mentioned in these pages.

### BYTE ADVERTISING SALES STAFF:

**J. Peter Huestis, Advertising Sales Manager, 70 M in Street, Peterborough, NH 03458, tel. (603) 924-9281**

#### NEW ENGLAND

ME, NH, VT, MA, RI  
Paul McPherson Jr. (617) 262-1160  
McGraw-Hill Publications  
575 Boylston Street  
Boston, MA 02116

#### SOUTHEAST

NC, SC, GA, FL, AL, TN  
Maggie M. Dorvee (404) 252-0626  
McGraw-Hill Publications  
4170 Ashford-Dunwoody Road—Ste. 420  
Atlanta, GA 30319

#### SOUTHWEST, ROCKY MOUNTAIN

UT, CO, WY, OK, TX, AR, MS, LA  
Dennis Riley (214) 458-2400  
McGraw-Hill Publications  
Prestonwood Tower—Suite 907  
5151 Beltline  
Dallas, TX 75240

#### NORTH PACIFIC

HI, WA, OR, ID, MT, NORTHERN CA,  
NV (except LAS VEGAS), W. CANADA  
David Jern (415) 362-4600  
McGraw-Hill Publications  
425 Battery Street  
San Francisco, CA 94111

#### ATLANTIC

NY, NYC, CT  
Dick McGurk (212) 512-3588  
Leah Goldman (212) 512-2096  
McGraw-Hill Publications  
1221 Avenue of the Americas—39th Fl.  
New York, NY 10020

#### MIDWEST

IL, MO, KS, IA, ND, SD, MN, WI, NB  
Bob Denmead (312) 751-3740  
McGraw-Hill Publications  
Blair Building  
645 North Michigan Ave.  
Chicago, IL 60611

#### SOUTH PACIFIC

SOUTHERN CA, AZ, NM, LAS VEGAS  
Jack Anderson (714) 557-6292  
McGraw-Hill Publications  
3001 Red Hill Ave.  
Building #1—Suite 222  
Costa Mesa, CA 92626

Bill McAfee (415) 964-0624  
McGraw-Hill Publications  
1000 Elwell Court—Suite 225  
Palo Alto, CA 94303

#### EAST

PA (EAST), NJ (SOUTH),  
MD, VA, W.VA, DE, D.C.  
Daniel Ferro (215) 496-3833  
McGraw-Hill Publications  
Three Parkway  
Philadelphia, PA 19102

#### GREAT LAKES, OHIO REGION

MI, OH, PA (ALLEGHENY), KY, IN,  
EASTERN CANADA  
Mike Kisseberth (313) 352-9760  
McGraw-Hill Publications  
4000 Town Center—Suite 770  
Southfield, MI 48075

Karen Niles (213) 480-5243, 487-1160  
McGraw-Hill Publications  
3333 Wilshire Boulevard #407  
Los Angeles, CA 90010

#### WEST COAST SURPLUS AND RETAIL ACCOUNTS

Tom Harvey (805) 964-8577  
3463 State Street—Suite 256  
Santa Barbara, CA 93105

#### Post Card Mailings National

Bradley Browne (603) 924-6166  
BYTE Publications  
70 Main Street  
Peterborough, NH 03458

### International Advertising Sales Representatives:

Mr. Hans Csokor  
Publimedia  
Reisnerstrasse 61  
A-1037 Vienna, Austria

Mrs. Maria Sarmiento  
Pedro Teixeira 8, Off. 320  
Iberia Mart I  
Madrid 4, Spain  
45 52 891

Mr. Arthur Scheffer  
McGraw-Hill Publishing Co.  
34 Dover St.  
London W1X 3RA  
England 01 493 1451

Seavex Ltd.  
503 Wilson House  
19-27 Wyndham St.  
Central, Hong Kong  
Tel: 5-260149  
Telex: 60904 SEVEX HX

Mrs. Gurit Gepner  
McGraw-Hill Publishing Co.  
PO Box 2156  
Bat Yam, 59121 Israel  
866 561 321 39

Mr. Andrew Karnig  
Andrew Karnig & Associates  
Finnbodavagen  
S-131 31 Nacka, Sweden  
46-8-44 0005

Mr. Savio Pesavento  
McGraw-Hill Publishing Co.  
Via Flavio Baracchini 1  
20123 Milan, Italy  
86 90 656

Hiro Morita  
McGraw-Hill Publishing Co.  
Overseas Corp.  
Room 1528  
Kasumigaseki Bldg.  
3-2-5 Kasumigaseki,  
Chiyoda-Ku  
Tokyo 100, Japan  
581 9811

Mr. Fritz Krusebecker  
McGraw-Hill Publishing Co.  
Liebigstrasse 19  
D-6000 Frankfurt/Main 1  
West Germany  
72 01 81

Mr. Jean Christian Acis  
McGraw-Hill Publishing Co.  
17 rue Georges Bizet  
F 75116 Paris  
France  
720 33 42

Seavex Ltd.  
400 Orchard Road, #10-01  
Singapore 0923  
Republic of Singapore  
Tel: 734-9790  
Telex: RS35539 SEAVEX



# BYTE READER SERVICE



For fastest service transfer mailer label from wrapper to coupon provided at the right. Requests cannot be honored unless zip code is given. This card valid for 12 months from cover date. **NOTE**—If label is missing or defaced fill out coupon carefully—**PLEASE PRINT**—this is the only way to get requested material to you.

Name \_\_\_\_\_ APPLE GUIDE  
 (Title) \_\_\_\_\_ (Company) \_\_\_\_\_  
 Address \_\_\_\_\_ Telephone \_\_\_\_\_  
 City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

I purchased this copy by  Subscription  Newsstand, computer store, or bookstore

|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 661 | 683 | 705 | 727 | 749 | 771 | 793 |
| 662 | 684 | 706 | 728 | 750 | 772 | 794 |
| 663 | 685 | 707 | 729 | 751 | 773 | 795 |
| 664 | 686 | 708 | 730 | 752 | 774 | 796 |
| 665 | 687 | 709 | 731 | 753 | 775 | 797 |
| 666 | 688 | 710 | 732 | 754 | 776 | 798 |
| 667 | 689 | 711 | 733 | 755 | 777 | 799 |
| 668 | 690 | 712 | 734 | 756 | 778 | 800 |
| 669 | 691 | 713 | 735 | 757 | 779 | 801 |
| 670 | 692 | 714 | 736 | 758 | 780 | 802 |
| 671 | 693 | 715 | 737 | 759 | 781 | 803 |
| 672 | 694 | 716 | 738 | 760 | 782 | 804 |
| 673 | 695 | 717 | 739 | 761 | 783 | 805 |
| 674 | 696 | 718 | 740 | 762 | 784 | 806 |
| 675 | 697 | 719 | 741 | 763 | 785 | 807 |
| 676 | 698 | 720 | 742 | 764 | 786 | 808 |
| 677 | 699 | 721 | 743 | 765 | 787 | 809 |
| 678 | 700 | 722 | 744 | 766 | 788 | 810 |
| 679 | 701 | 723 | 745 | 767 | 789 | 811 |
| 680 | 702 | 724 | 746 | 768 | 790 | 812 |
| 681 | 703 | 725 | 747 | 769 | 791 | 813 |
| 682 | 704 | 726 | 748 | 770 | 792 | 814 |

**BYTE's BOMB** is your direct line to the editor's desk. Each month, the two top-rated authors receive bonuses based on your evaluation. First look at the list of this month's articles and corresponding article numbers (located on the page preceding the Reader Service list), then rate each article you've read as **Excellent**, **Good**, **Fair**, or **Poor**, based on your overall impression of the article, by circling the appropriate number in each column below. Your feedback helps us produce the best possible magazine each month.

| Article No. | 1 | 2 | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25  |
|-------------|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|
| Excellent   | 1 | 5 | 9  | 13 | 17 | 21 | 25 | 29 | 33 | 37 | 41 | 45 | 49 | 53 | 57 | 61 | 65 | 69 | 73 | 77 | 81 | 85 | 89 | 93 | 97  |
| Good        | 2 | 6 | 10 | 14 | 18 | 22 | 26 | 30 | 34 | 38 | 42 | 46 | 50 | 54 | 58 | 62 | 66 | 70 | 74 | 78 | 82 | 86 | 90 | 94 | 98  |
| Fair        | 3 | 7 | 11 | 15 | 19 | 23 | 27 | 31 | 35 | 39 | 43 | 47 | 51 | 55 | 59 | 63 | 67 | 71 | 75 | 79 | 83 | 87 | 91 | 95 | 99  |
| Poor        | 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 | 40 | 44 | 48 | 52 | 56 | 60 | 64 | 68 | 72 | 76 | 80 | 84 | 88 | 92 | 96 | 100 |

| Article No. | 26  | 27  | 28  | 29  | 30  | 31  | 32  | 33  | 34  | 35  | 36  | 37  | 38  | 39  | 40  | 41  | 42  | 43  | 44  | 45  | 46  | 47  | 48  | 49  | 50  |
|-------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Excellent   | 101 | 105 | 109 | 113 | 117 | 121 | 125 | 129 | 133 | 137 | 141 | 145 | 149 | 153 | 157 | 161 | 165 | 169 | 173 | 177 | 181 | 185 | 189 | 193 | 197 |
| Good        | 102 | 106 | 110 | 114 | 118 | 122 | 126 | 130 | 134 | 138 | 142 | 146 | 150 | 154 | 158 | 162 | 166 | 170 | 174 | 178 | 182 | 186 | 190 | 194 | 198 |
| Fair        | 103 | 107 | 111 | 115 | 119 | 123 | 127 | 131 | 135 | 139 | 143 | 147 | 151 | 155 | 159 | 163 | 167 | 171 | 175 | 179 | 183 | 187 | 191 | 195 | 199 |
| Poor        | 104 | 108 | 112 | 116 | 120 | 124 | 128 | 132 | 136 | 140 | 144 | 148 | 152 | 156 | 160 | 164 | 168 | 172 | 176 | 180 | 184 | 188 | 192 | 196 | 200 |

# BYTE READER SERVICE



For fastest service transfer mailer label from wrapper to coupon provided at the right. Requests cannot be honored unless zip code is given. This card valid for 12 months from cover date. **NOTE**—If label is missing or defaced fill out coupon carefully—**PLEASE PRINT**—this is the only way to get requested material to you.

Name \_\_\_\_\_ APPLE GUIDE  
 (Title) \_\_\_\_\_ (Company) \_\_\_\_\_  
 Address \_\_\_\_\_ Telephone \_\_\_\_\_  
 City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

I purchased this copy by  Subscription  Newsstand, computer store, or bookstore

|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 661 | 683 | 705 | 727 | 749 | 771 | 793 |
| 662 | 684 | 706 | 728 | 750 | 772 | 794 |
| 663 | 685 | 707 | 729 | 751 | 773 | 795 |
| 664 | 686 | 708 | 730 | 752 | 774 | 796 |
| 665 | 687 | 709 | 731 | 753 | 775 | 797 |
| 666 | 688 | 710 | 732 | 754 | 776 | 798 |
| 667 | 689 | 711 | 733 | 755 | 777 | 799 |
| 668 | 690 | 712 | 734 | 756 | 778 | 800 |
| 669 | 691 | 713 | 735 | 757 | 779 | 801 |
| 670 | 692 | 714 | 736 | 758 | 780 | 802 |
| 671 | 693 | 715 | 737 | 759 | 781 | 803 |
| 672 | 694 | 716 | 738 | 760 | 782 | 804 |
| 673 | 695 | 717 | 739 | 761 | 783 | 805 |
| 674 | 696 | 718 | 740 | 762 | 784 | 806 |
| 675 | 697 | 719 | 741 | 763 | 785 | 807 |
| 676 | 698 | 720 | 742 | 764 | 786 | 808 |
| 677 | 699 | 721 | 743 | 765 | 787 | 809 |
| 678 | 700 | 722 | 744 | 766 | 788 | 810 |
| 679 | 701 | 723 | 745 | 767 | 789 | 811 |
| 680 | 702 | 724 | 746 | 768 | 790 | 812 |
| 681 | 703 | 725 | 747 | 769 | 791 | 813 |
| 682 | 704 | 726 | 748 | 770 | 792 | 814 |

To get further information on the products advertised in BYTE, fill out the reader service card with your name and address. Then circle the appropriate numbers for the advertisers you select from the list. Add a 20-cent stamp to the card, then drop it in the mail. Not only do you gain information, but our advertisers are encouraged to use the marketplace provided by BYTE. This helps us bring you a bigger BYTE. The index is provided as an additional service by the publisher, who assumes no liability for errors or omissions.

PLACE  
20c POSTAGE  
HERE

**BYTE**

READER SERVICE  
PO BOX 298  
DALTON, MA 01227-0298  
USA

PLACE  
20c POSTAGE  
HERE

**BYTE**

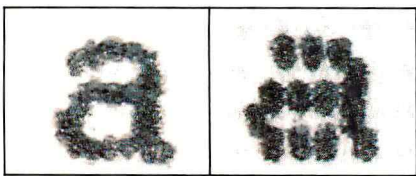
READER SERVICE  
PO BOX 298  
DALTON, MA 01227-0298  
USA

# INTRODUCING PINWRITER DOT MATRIX PRINTERS. AND A HEAD TO HEAD COMPARISON OF WHY THEY'RE BETTER.

Our new multi-mode Pinwriter® dot matrix printers have a lot in common with our Spinwriter® letter-quality printers. Designed and manufactured with the same quality and reliability that has made our Spinwriters the best selling letter-quality printers to PC users. We also gave them many unique capabilities you won't find on other dot matrix printers. Especially at such an affordable price.

## More dots, more fonts, more versatility.

One thing that makes Pinwriters stand out from other



*Our exclusive 18-pin print head is graphically sharper than a 9-pin printer, as this unretouched photo shows.*

dot matrix printers is our printhead. It has 18 pins. Compared to the usual nine. It also has true dual-pass printing. The result: an amazing 240x240 dots per inch.

The quick brown fox

The quicker brown fox

The quickest brown fox.

*Three speeds cover all your printing needs.*

That's why the print is as close to letter quality as you can get without getting a

Spinwriter. And why charts, illustrations and graphics look so crisp.



*Our new P2 and P3 dot matrix printers give you everything our Spinwriter letter-quality printers are famous for, including forms handlers.*

Pinwriters have something else no other dot matrix printers have. Eight operator-selectable print styles, plus as many as 11 international character sets. And an LED display to tell you which style has been selected.

What else? Three printing speeds. 300, 900 or 1800 words per minute to handle all your printing needs from word processing to data processing.

Plus, a variety of forms handlers to speed up all your paperwork. All made and designed by NEC. And all easily installed and changed by the operator.

**For the final word, see your NEC dealer.**

Only a demonstration can

Pinwriter and Spinwriter are registered trademarks of NEC Corporation.

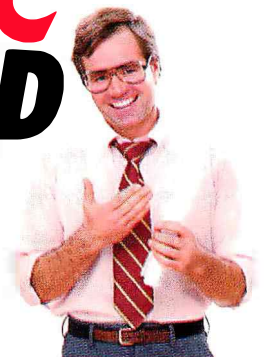
show you how clearly superior the Pinwriter is compared to other dot matrix printers. And how versatile it is.

For the Pinwriter retailer nearest you, call 1-800-343-4419. In Massachusetts call 617-264-8635.

And find out why more and more PC users are saying, "NEC and me."

# NEC AND ME

NEC Information Systems, Inc.  
1414 Mass. Ave.  
Boxborough, MA  
01719



Circle 283 on inquiry card.

# “Designing a revolutionary concept in software demanded a computer with extraordinary performance. The Tandy 2000 delivered.”

—Bill Gates  
Chairman of the Board,  
Microsoft

Bill Gates has been at the leading edge of personal computing from the very beginning. His company is a leading producer of microcomputer software.

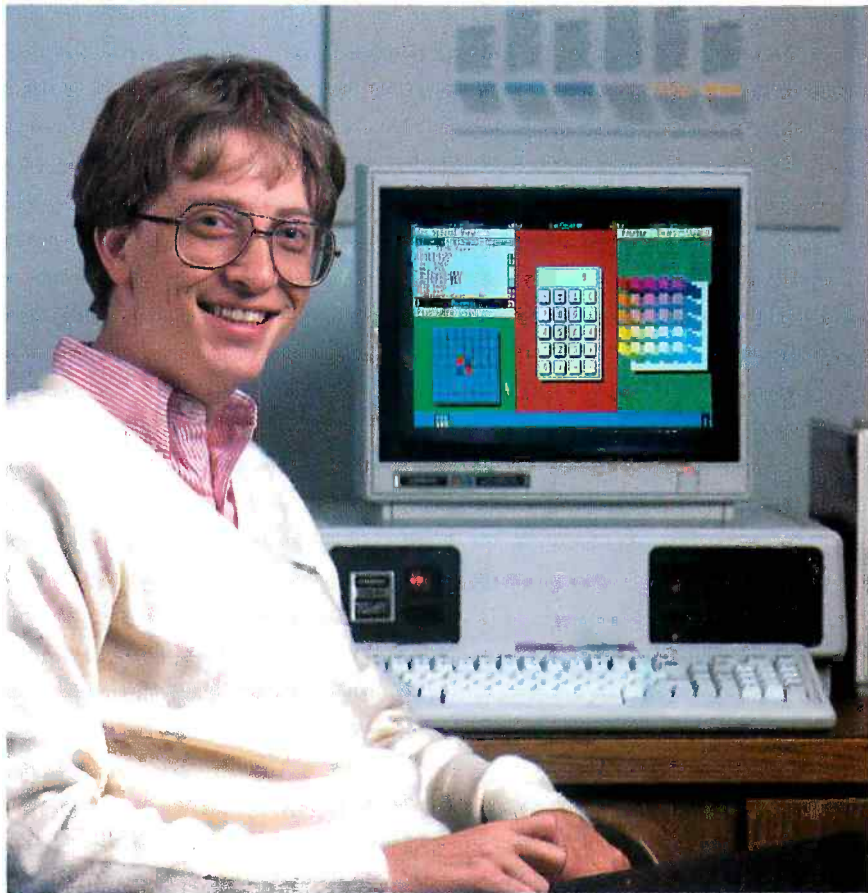
“Our newest software product, MS-Windows, is an integrated windowing environment. It will let personal computer users combine individual programs into a powerful, integrated system.

“When we set out to design MS-Windows in color, we knew that the Tandy 2000 computer would let us turn an extraordinary product into a work of art. The graphics are sharp and crisp, and gave us a degree of creativity like nothing before.

“Our engineers were quite impressed with the processing speed of the Tandy 2000's 80186 microprocessor, too. And while the finished product will utilize the 2000's Digi-Mouse, the well-laid out keyboard has helped us speed through the design stage.

“We're proud of our work. So when we want to show someone how great MS-Windows really is, we give them a demonstration. On the Tandy 2000.”

Isn't it time you enjoyed peak performance from a



personal computer? Go ahead, watch how much faster today's most sophisticated programs run on the high-technology Tandy 2000.

You can choose from the hottest programs around, too, with our exclusive Express Order Software service.

Tandy 2000 systems start at \$2999, and can be leased for only \$105 per month\*. Come in today and see what you've been missing.

Our new 1985 computer catalog is yours for the asking at any Radio Shack Computer Center or participating Radio Shack store or dealer. Check out our complete line of microcomputers—from pocket models to lap-size portables, from powerful desktop computers to multi-user office systems. We have it all. That's why we invite comparison!

Available at over 1200  
Radio Shack Computer Centers and at  
participating Radio Shack stores and dealers.

## Radio Shack<sup>®</sup> COMPUTER CENTERS

A DIVISION OF TANDY CORPORATION

Circle 324 on inquiry card.

\*Plus applicable use/sales tax. Prices apply at Radio Shack Computer Centers and participating stores and dealers. MS is a trademark of Microsoft Corporation.



### Engineered for Excellence!

We've introduced the latest in technology for over 60 years. The Tandy 2000 offers twice the speed, graphics resolution and disk storage of other MS-DOS systems.