

BYTE

the small systems journal

APRIL 1981 Vol. 6 No. 4
\$2.50 In USA/\$2.95 in Canada
A McGraw-Hill Publication



FUTURE COMPUTERS?

ROBERT
LINNEY



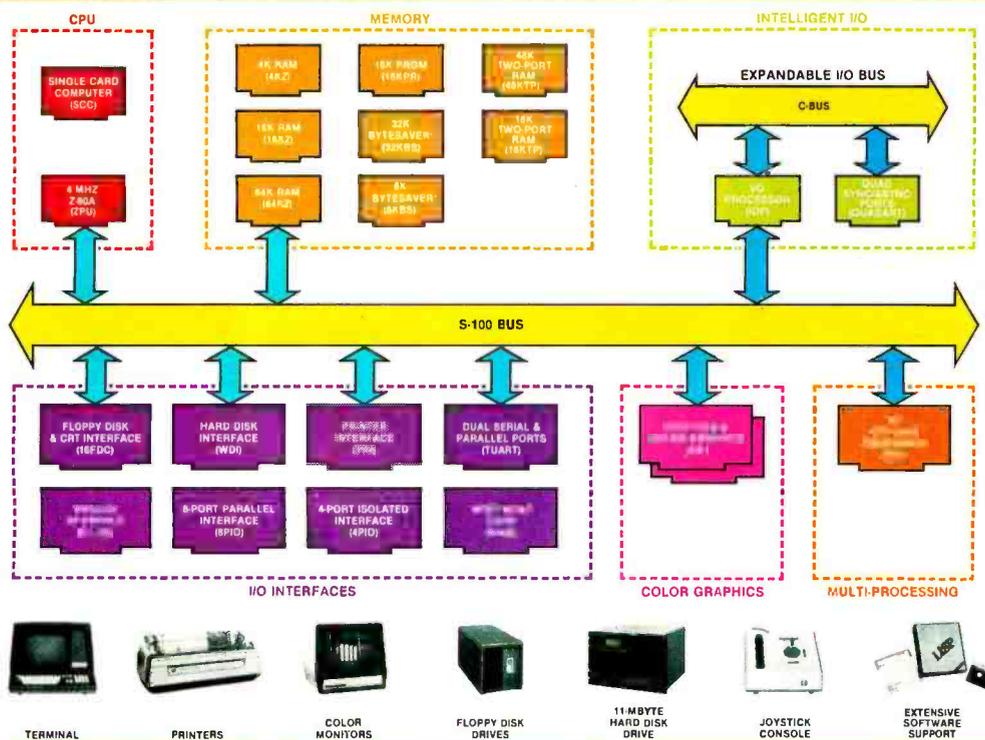
YOUR CHOICE-smart either way

- Over 140 software driven functions
- 82 x 24 or 82 x 20 screen format — software selectable
- High resolution 7 x 12 matrix characters — P-31 green phosphor
- Upper/lower case character set — plus graphics character set
- 56-key alphanumeric keyboard — plus 12-key cursor, numeric pad
- Internal editing functions — insert, delete, scroll, roll, slide, etc.
- Parallel printer I/O port
- 50 to 38,400 baud operation — programmable
- Cursor type, cursor position, print control characters, protected fields, shift inversion, dual intensity and many other features

8212 — twelve-inch diagonal screen or **8209** — nine-inch diagonal screen



SOUTHWEST TECHNICAL PRODUCTS CORPORATION
219 W. RHAPSODY
SAN ANTONIO, TEXAS 78216 (512) 344-0241



What Cromemco computer card capability can do for you

The above diagram shows in a functional way one of the most complete lines of computer cards in the industry.

Look it over carefully. It could be well worth your while.

These are all cards that plug into our S-100 bus microcomputers.

You can also assemble them into a custom system in convenient Cromemco card cages.

MULTI-PROCESSING AND INTELLIGENT I/O

The range of capabilities and versatility you can draw upon is enormous.

In processors, for example, you have a choice of CPU's including our extremely useful new I/O Processor. This can be used as a satellite processor to do off-line processing, multi-processing, and to form intelligent I/O. It opens the door to a whole new group of applications and tasks. Ask us about it.

HIGH RESOLUTION COLOR GRAPHICS

Again, you can have beautiful high-resolution color graphics with our color graphics interface. You can select from over 4000 colors and have a picture with a resolution at least equal to quality broadcast-TV pictures.



You have an unprecedented selection of memory including our unusual 48K and 16K two-port RAMs which allow high-speed color graphics.

LOTS OF STORAGE

These days you often want lots of disk storage. So you can select from our disk controller card which will operate our 5" and 8" floppy disk drives (up to 1.2 megabytes). Or select our WDI interface to operate our 11-megabyte hard disk drives.

POWERFUL SOFTWARE AND PERIPHERAL SUPPORT

There's much more yet you can do with our cards. And, of course, there's an easy way to put them to work in our 8-, 12-, and 21-slot card cages. Our PS8 power supply makes it simple to get the system into operation.

Finally, Cromemco offers you the strongest software support in the industry

with languages like FORTRAN, C, COBOL, ASSEMBLER, LISP, BASIC and others. There is also a wide choice from independent vendors.

To top it all off, you can draw from a substantial array of peripherals: terminals, printers, color monitors and disk drives.

CONTACT YOUR CROMEMCO REP

There is even more capability than we're able to describe here.

Contact your Cromemco rep now and get this capability working for you.

CROMEMCO COMPUTER CARDS

- PROCESSORS — 4 MHz Z-80 A CPU, single card computer, I/O processor
- MEMORY — up to 64K including special 48K and 16K two-port RAMs and our very well known BYTESAVERS® with PROM programming capability
- HIGH RESOLUTION COLOR GRAPHICS — our SDI offers up to 754 x 482 pixel resolution.
- GENERAL PURPOSE INTERFACES — QUADART four-channel serial communications, TU-ART two-channel parallel and two-channel serial, 8PIO 8-port parallel, 4PIO 4-port isolated parallel, D+7A 7-channel D/A and A/D converter, printer interface, floppy disk controller with RS-232 interface and system diagnostics, wire-wrap and extender cards for your development work.



Cromemco™
I n c o r p o r a t e d

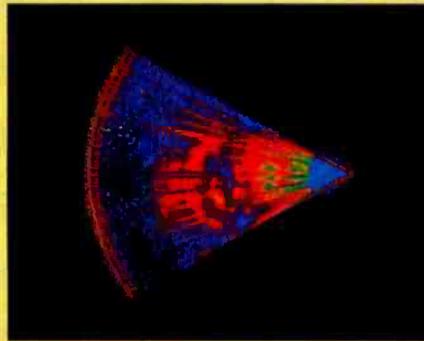
280 BERNARDO AVE., MOUNTAIN VIEW, CA 94040 • (415) 964-7400

Tomorrow's computers today

Circle 1 on Inquiry card.



Management Information Display



Ultrasonic heart sector scan



High-resolution display with alphanumerics

Get the professional color display that has BASIC/FORTRAN simplicity

LOW-PRICED, TOO

Here's a color display that has everything: professional-level resolution, enormous color range, easy software, NTSC conformance, and low price.

Basically, this new Cromemco Model SDI* is a two-board interface that plugs into any Cromemco computer.

The SDI then maps computer display memory content onto a convenient color monitor to give high-quality, high-resolution displays (756 H x 482 V pixels).

When we say the SDI results in a high-quality professional display, we mean **you can't get higher resolution than this system offers in an NTSC-conforming display.**

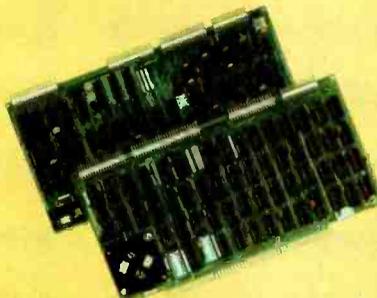
The resolution surpasses that of a color TV picture.

BASIC/FORTRAN programming

Besides its high resolution and low price, the new SDI lets you control with optional Cromemco software packages that use simple BASIC- and FORTRAN-like commands.

Pick any of 16 colors (from a 4096-color palette) with instructions like DEFCLR (c, R, G, B). Or obtain a circle of specified size, location, and color with XCIRC (x, y, r, c).

*U.S. Pat. No. 4121283



Model SDI High-Resolution Color Graphics Interface

HIGH RESOLUTION

The SDI's high resolution gives a professional-quality display that strictly meets NTSC requirements. You get 756 pixels on every visible line of the NTSC standard display of 482 image lines. Vertical line spacing is 1 pixel.

To achieve the high-quality display, a separate output signal is produced for each of the three component colors (red, green, blue). This yields a sharper image than is possible using an NTSC-composite video signal and color TV set. Full image quality is readily realized with our high-quality RGB Monitor or any conventional red/green/blue monitor common in TV work.



Model SDI plugs into Z-2H 11-megabyte hard disk computer or any Cromemco computer

DISPLAY MEMORY

Along with the SDI we also offer an optional fast and novel **two-port** memory that gives independent high-speed access to the computer memory. The two-port memory stores one full display, permitting fast computer operation even during display.

CONTACT YOUR REP NOW

The Model SDI has been used in scientific work, engineering, business, TV, color graphics, and other areas. It's a good example of how Cromemco keeps computers in the field up to date, since it turns any Cromemco computer into an up-to-date color display computer.

The SDI has still more features that you should be informed about. So contact your Cromemco representative now and see all that the SDI will do for you.

Cromemco
i n c o r p o r a t e d
280 BERNARDO AVE., MOUNTAIN VIEW, CA 94043 • (415) 964-7400
Tomorrow's computers today

Circle 1 on inquiry card.

Features

20 **Recurrence In Numerical Analysis** by James J Davidson / Recurrence can be used to simplify the calculation of Bessel functions.

36 **Build a Low-Cost Logic Analyzer** by Steve Ciarcia / Turn your computer into a powerful diagnostic tool.

64 **A-L BYTE Guide to The National Computer Conference and Chicago** / Up-to-date information on the conference, the city, and much more.

66 **Digital Minicassette Controller** by James Kahn / Use an intelligent peripheral controller to lighten the load on your computer system.

102 **Programming the Game of Go** by Jonathan K Millen / Even though Go is much harder than chess, a microcomputer Go program can produce surprisingly good play.

122 **Build Your Own Turing Machine** by James Willis / Three different practical versions of this theoretical tool produce the same output.

150 **A Closer Look at the TI Speak & Spell** by Peter Vernon / The author expands on Michael Rigby's September 1980 BYTE article.

218 **An Introduction to Data Compression** by Harold Corbin / Information can be transmitted and stored using fewer data bits by appropriate techniques.

252 **Build an Intercomputer Data Link** by Mike Wingfield / Using this software, systems based on the 6800 microprocessor can communicate with other systems.

290 **Three-Dimensional Computer Graphics, Part 2** by Franklin C Crow / Software to display solid objects without hidden lines and surfaces.

348 **PADDLES: Interfacing with Modular Breadboards** by Roger J Combs and Paul Field / Designing and implementing breadboard circuits is greatly eased with the use of these standardized modules.

Reviews

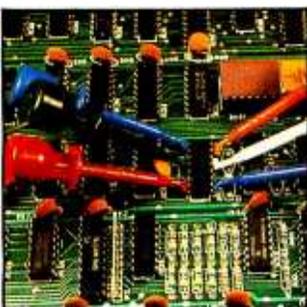
46 **The MicroAce Computer** by Delmar Searls
94 **A Reformatter for CP/M and IBM Floppy Disks** by John Lehman

188 **Three Versions of APL** by Gregg Williams

Nucleus

- 6** Editorial: Future Trends in Personal Computing
- 10, 302** BYTE's Bugs
- 12** Letters
- 32, 34** Programming Quickies: Apple Name-Address; A Graphic Execution Display
- 98, 304, 310, 314** Technical Forum: MicroShakespeare Revisited or Kilobard; An ADM-3 Emulator for the Hazeltine 1500; Challenger Writes on Comprint; On the Use of Fourier Transforms to Explore Biological Rhythms
- 148** System Notes: A Relocatable Bootstrap for the Tarbell Disk Controller
- 158** Clubs and Newsletters
- 186** Cartoon
- 212** BYTELINES
- 328** Ask BYTE
- 332** Event Queue
- 338** Books Received
- 344** Software Received
- 345** BYTE's Bits
- 359** What's New?
- 414** Unclassified Ads
- 415** BOMB, BOMB Results
- 416** Reader Service

BYTE



Page 36



Page 46



Page 186



Page 302



Editor in Chief
Christopher Morgan

Managing Editor

Mark Haas

Technical Editors

Gregg Williams, Senior Editor;
Richard S Shuford; Curtis P Feigel;
Harold Nelson; Stan Miastkowski;
Kevin Cohan; Bruce Roberts;
Charles Freiberg, New Products Editor;
Steve Ciarcia, Mark Dahmke,
Consulting Editors;
Jon Swanson, Draftsman

Copy Editors

Richard Friedman, Chief; Faith Hanson;
Warren Williamson; Anthony J Lockwood;
Ann Graves

Assistants

Faith Ferry; Debe Wheeler;
Karen A Cilley

Production

Nancy Estle, Director; Christine Dixon,
Asst Director; Wai Chiu Li;
Jonathan M Graves; Deborah Porter;
Sherry McCarthy, Chief Typographer;
Debi Fredericks; Donna Sweeney;
Valerie Horn

Advertising

Thomas Harvey, Director; Marion Gagnon;
Barbara J Greene; Rob Hannings

Circulation

Gregory Splitzfaden, Manager;
Andrew Jackson, Asst Manager;
Agnes E Perry; Barbara Varnum;
Louise Menegus; Bill Watson;
Dealer Sales: Melanie Bertoni

Marketing

Jill E Callihan, Special Projects;
Laura Hanson

Controller's Office

Daniel Rodrigues, Controller; Mary E Fluhr,
Asst Controller; Karen Burgess; Jeanne Cilley

Traffic

N Scott Gagnon; Robert A Fiske

Receptionist

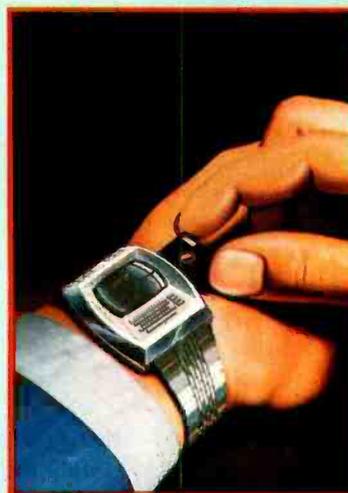
Jacqueline Earnshaw

Publishers

Virginia Londoner; Gordon R Williamson;
John E Hayes, Associate Publisher;
Cheryl A Hurd, Publisher's Assistant

Officers of McGraw-Hill Publications Company: Paul F McPherson, President; Executive Vice Presidents: James E Boddorf, Gene W Simpson; Group Vice President: Daniel A McMillan; Senior Vice President-Editorial: Ralph R Schulz; Vice Presidents: Kemp Anderson, Business Systems Development; Robert B Doll, Circulation; James E Hackett, Controller; Eric B Herr, Planning and Development; H John Sweger, Marketing.

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



In This Issue

"Future Computers" is our cover theme this month and the subject of the editorial. Before you write to comment on our cover's "unusual" design approach (created by artist Robert Tinney), keep in mind the proximity of April 1.

Elsewhere in this issue we describe Steve Ciarcia's latest project, a low-cost logic analyzer, and tell how to build your own Turing machine. Other articles include: a follow-up to our earlier review of the Sinclair computer, this time a description of the MicroAce kit version; a reformatter for CP/M and IBM-format floppy disks; a closer look at the TI Speak & Spell; a fascinating review of three different APL packages for the patient (but eager) APL fans in our audience; details about data compression; all about intercomputer data links and the game of Go; and the conclusion of an article from last month about 3-D computer graphics.

BYTE is published monthly by BYTE Publications Inc, 70 Main St, Peterborough NH 03458, phone (603) 924-9281, a wholly-owned subsidiary of McGraw-Hill, Inc. Address subscriptions, change of address, USPS Form 3579, and fulfillment questions to BYTE Subscriptions, POB 590, Martinsville NJ 08836. Controlled circulation postage paid at Waseca, Minnesota 56093 - USPS Publication No. 528890 (ISSN 0360-5280). Canadian second class registration number 9321. Subscriptions are \$19 for one year, \$34 for two years, and \$49 for three years in the USA and its possessions. In Canada and Mexico, \$21 for one year, \$38 for two years, \$55 for three years. \$43 for one year air delivery to Europe; \$35 surface delivery elsewhere. Air delivery to selected areas at additional rates upon request. Single copy price is \$2.50 in the USA and its possessions, \$2.95 in Canada and Mexico, \$4.00 in Europe, and \$4.50 elsewhere. Foreign subscriptions and sales should be remitted in United States funds drawn on a US bank. Printed In United States of America.

Address all editorial correspondence to the editor at 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. Entire contents copyright © 1981 by BYTE Publications Inc. All rights reserved. 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 base fee of \$1.00 per copy of the article or item plus 25 cents per page. Payment should be sent directly to the CCC, 21 Congress St, Salem MA 01970. Copying done for other than personal or internal reference use without the permission of McGraw-Hill 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 N Zeeb Rd, Dept PR, Ann Arbor MI 48106 USA or 18 Bedford Row, Dept PR, London WC1R 4EJ England.

Subscription WATS Line: (800) 258-5485

Office hours: Mon-Thur 8:30 AM - 4:30 PM, Friday 8:30 AM - Noon, Eastern Time



NATIONAL ADVERTISING SALES REPRESENTATIVES:

NORTHEAST (617) 444-3946
Hajar Associates
280 Hillside Ave
Needham Heights MA 02194

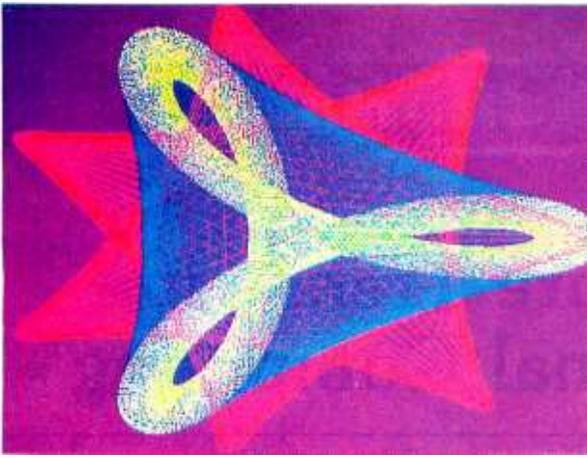
MIDWEST (312) 966-0160
Hajar Associates
5225 Old Orchard Dr
Skokie IL 60076

MID ATLANTIC (212) 682-5844
Hajar Associates
521 Fifth Ave
New York NY 10017

NORTHWEST (415) 964-0706
Hajar Associates
1000 Elwell Ct, Suite 227
Palo Alto CA 94303

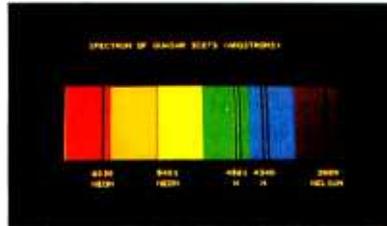
SOUTHWEST (714) 540-3554
Hajar Associates
3303 Harbor Blvd
Suite K-4
Costa Mesa CA 92626

SOUTHEAST (305) 886-7210
Hajar Associates
1220 Prairie Lane
Apopka FL 32703



"...stands well above other S-100 graphics displays in its price and performance range."

BYTE, Product Review



"...better monochromatic display..."

ELECTRONIC DESIGN, 1981 Technology Forecast

MICROANGELO

HIGH RESOLUTION GRAPHICS SINGLE BOARD COMPUTER
512 x 480 resolution black and white and vivid color displays

RS-170 composite or direct drive output

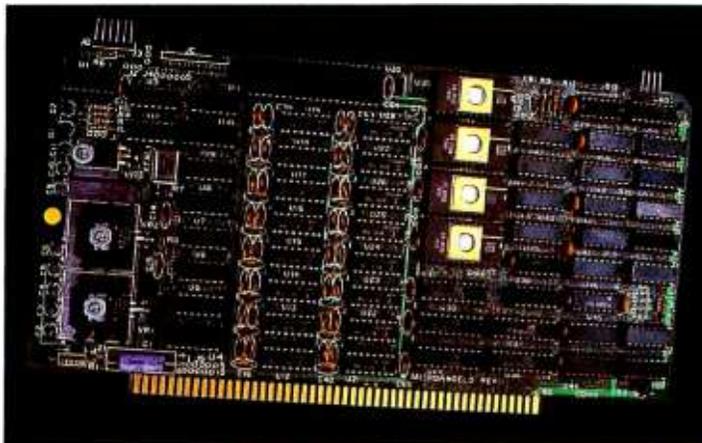
Local or external sync generation

4 Mhz Z80 microprocessor

60 hertz real-time clock

8 level interrupt tie-in

IEEE S100 bus compatible



Light pen interface

Time multiplexed refresh

4K resident Screenware™ Pak I operating system

32K RAM isolated from host address space

High speed communications over parallel bus ports

Screenware™ Pak I

A 4K byte operating system resident in PROM on MicroAngelo™. Pak I emulates an 85 character by 40 line graphics terminal and provides over 40 graphics commands. Provisions exist for user defined character sets and directly callable user extensions to Screenware™ Pak I.

Screenware™ Pak II

An optional software superset of Pak I which adds circle generation, polygon flood, programmable split screen for separate graphics and terminal I/O, relative coordinates, faster vector and character plotting, a macro facility, full UCSD Pascal compatibility, and more.

And now...COLOR!!

The new MicroAngelo™ Palette board treats from 2 to 8 MicroAngelos as "bit planes" at a full 512 x 480 resolution. Up to 256 colors may be chosen from 16.8 million through the programmable color lookup table. Overlays, bit plane precedence, fade-in, fade-out, gray levels, blinking bit plane, and a highly visual color editor are standard.

Circle 2 on inquiry card.

SCION

8455-D Tyco Road • Vienna, Virginia 22180 • TWX: 710-831-9087 • (703) 827-0888

UCSD* PASCAL FORTRAN

PORTABLE

Develop on a Z-80†, run on LSI-11‡, T. I. 990, 6800 or vice versa

EFFICIENT

Structured, readable
Speeds development X5
Easy maintenance

POWERFUL

Full standard Pascal plus extensions
ANSI '77 Fortran Subset

COST EFFECTIVE

Complete system including interpreter, screen editor, utilities, flier, assembler, and compiler.
with Pascal \$400
with Fortran \$450
with Both \$600

APPLICATIONS

PFAS

(Pascal File Access System)
Keyed-ISAM in 6K user memory \$200

INTELLECT UL VI.2

A full range LISP interpreter for UCSD p-systems \$200

MEDOFFICE

Professional medical office software for 1 to 5 doctors. Call for pricing.

DATEBOOK

Appointment scheduling on your micro \$295

READY TO RUN ON DEC PDP-11‡ or TRS-80 MODEL 11§

PCD SYSTEMS

P. O. Box 143
Penn Yan, NY 14527
315-536-3734

*TM Univ. of Calif.
†TM of Zilog
‡TM of Digital Equipment
§TM of Tandy Corp.

Editorial

Future Trends in Personal Computing

Chris Morgan, Editor in Chief

Future Computers—what will they be like?

Some exciting developments have been occurring in the industry lately that should give us some clues. I attended the Consumer Electronics Show in Las Vegas this past January, where Toshiba introduced what could be the most significant product of the year for the personal-computing market: a pocket-size flat-screen television set. While no specific mention was made of its possible use with a personal computer, it takes only a moment's thought to see the

potential of this engineering marvel.

First introduced in Japan some months ago, the Toshiba television has a 4.1 by 3.1 cm (1½ by 1½ inch) LCD (liquid-crystal display) screen housed in a case measuring 17.3 by 8.2 by 1.8 cm (6½ by 3½ by ¾ inches)! It has only half the resolution of a standard CRT (cathode-ray tube) display, but its small size masks that fact effectively. Toshiba has also solved the problem of liquid-crystal "overhang," the slow-fade effect that plagues LCDs in electronic games. The response time of this particular design is fast enough to handle the 1/30 of a second television-frame refresh rate. Although the screen is dimmer than a CRT display (the im-

age is formed from reflected rather than transmitted light), it has acceptable contrast and sharpness. The screen is fed by a bank of shift registers; it would be an easy task to display computer graphics and characters on it.

The Toshiba flat-screen unit is still in the prototype phase and will probably not be available for a year or so, retailing for approximately \$600. I predict that within two years the market will be flooded with portable computers having built-in screens of every size and shape.

Sony has introduced a new electronic "typewriter" that fits in a briefcase and lets you enter, store, and edit up to 200 pages of text using a built-in microcassette recorder. Text is displayed on a one-line liquid-crystal display. Combine such a device with a flat-screen multiline video display and you have a very attractive concept, indeed.

Another Sony breakthrough is a new miniature floppy-disk system (see photo 3, page 10). Each disk measures 8.9 cm (3½ inches) in diameter and holds over 800,000 bytes! The disk resides in a rigid housing for protection. Sony plans to introduce the disk as part of a new, miniature word-processing system.



Photo 1: Toshiba's new pocket-size television prototype. A built-in zoom feature is available that enlarges any one of the four screen quadrants for close-up viewing. Photo by Stan Miastkowski.

Percom Mini-Disk Drive Systems for TRS-80* Computers...

Now! Add-On and Add-In Mini-Disk Storage for your Model III.



The industry leader in microcomputer peripherals, Percom not only gives you better design, better quality and first-rate service, but you pay less to boot.

New for the TRS-80* Model III

Patterned after our fast-selling TFD Model I drives. And subjected to the same reliability controls. These new TFD mini-disk systems for the Model III provide more features than Tandy drives, yet cost far less.

- **Flippy Capability:** Both internal (add-in) and external (add-on) drives permit recording on either side of a diskette.
- **Greater Storage Capacity:** Available with either 40- or 80-track drive mechanisms, Percom TFD mini-disk systems store more. A 40-track drive stores up to 180 Kbytes — formatted — on one side of a 5-inch diskette. An 80-track drive stores a whopping 364 Kbytes.
- **1.5 Mbyte On-line:** The Percom drive controller (included with the initial drive) handles up to four drives. With four 80-track mini-disk drives you can access over 1.5 million bytes of on-line file data. Moreover, the initial drive may be either an internal add-in drive or an external add-on drive. And whichever configuration you get, the initial drive kit comes complete with our advanced 4-drive controller, interconnecting cables, power supplies, installation hardware, a DOS and of course the drive mechanism itself.
- **First Drive Includes DOS:** OS-80™, Percom's fast extendable BASIC-language disk operating system, is included on diskette when you purchase an initial drive kit. Originally called MicroDOS, OS-80 was favorably reviewed in the June 1980 issue of Creative Computing magazine.
- **Works with Model III TRSDOS:** Besides being fully hardware compatible, Percom's Model III 40-track drive systems may be operated with Tandy's Model III TRSDOS — without any modifications whatsoever. And, TRSDOS may be easily upgraded with simple software patches for operating 80-track drives.

Percom TFD add-on drives start at only \$399. Model III Drive kits start at only \$749.95.

Quality Percom products are available at authorized dealers. Call toll free 1-800-527-1592 for the address of your nearest dealer or to order direct from Percom.

Still #1 for Model I

As if greater storage capacities, exceptional quality control measures and lower prices aren't reasons enough to make Percom your first choice for Model I add-on drives, all Percom Model I drives are also rated for double-density operation.

Add our innovative DOUBLER™ adapter to your Model I Expansion Interface, and with Percom drive systems you can enjoy the same double-density storage capability as Model III owners.

The DOUBLER includes a TRSDOS*-like double-density disk operating system called DBLDOS™

We also offer a double-density Model I version of OS-80 as well as DOUBLEZAP programs for modifying NEWDOS/80 and VTOS 4.0† for DOUBLER compatibility.

Of course you don't have to upgrade your computer for double-density operation to use Percom mini-disk drive systems. In single-density operation, our TRS-80* Model I compatible 40-track drives store 102 Kbytes of formatted data on one side of a diskette, and our 80-track drives store 205 Kbytes. By comparison, Tandy's standard drive for the Model I stores just 86 Kbytes.

And like our Model III drives, Model I add-on drives are optionally available with "flippy" storage capability.

System Requirements:

Model III: 16-Kbyte system (min) and Model III BASIC. The second internal drive may be installed after the first internal drive kit is installed, and external drives #2, #3 and #4 may be added if either an internal or external first-drive kit has been installed. External drives #3 and #4 require an optional interconnecting cable.

Model I: 16-Kbyte system (min), Level II BASIC, Expansion Interface, disk operating system and an interconnecting cable. For double-density storage, a Percom DOUBLER must be installed in the Expansion Interface and DBLDOS (comes with the DOUBLER) or other double-density DOS must be used. For single-density operation, a Percom SEPARATOR™ adapter, installed in the Expansion Interface, will virtually eliminate "CRC ERROR — TRACK LOCKED OUT" read errors. Prices and specifications subject to change without notice.

PERCOM

PERCOM DATA COMPANY, INC.
211 N. KIRBY GARLAND, TEXAS 75042
(214) 272-3421

*Trademark of Tandy Radio Shack Corporation which has no relationship to Percom Data Company.
™DOUBLER, DBLDOS, OS-80 and SEPARATOR are trademarks of Percom Data Company, Inc.
†Trademark of Virtual Technology Corporation.



Photo 2: The Osborne I personal computer. This new 64 K, Z80A machine has two floppy-disk drives and fits under an airline seat. Price: \$1795. Photo by Elliot Varner Smith.

Although no official word has come from the company, we have learned that it is developing a complete personal-computer system. Fujitsu and Seiko are also developing personal computers for the U.S. market.

New Trends in Portability: The Osborne I

This month Adam Osborne introduced a new personal computer, called the Osborne I, at the West Coast Computer Faire in San Francisco. Its features include: a Z80A processor; 64 K bytes of dynamic programmable memory (60 K bytes are available to the programmer; the remaining 4 K bytes are used by the display screen); IEEE and RS-232C interfaces; modem electronics; a 5-inch video monitor with 24 rows of 50 characters, upper- and lowercase, two display intensities, and underlining for all characters; two 5-inch single-density, single-sided floppy-disk drives; standard typewriter keyboard; 10-key numeric pad; two pockets for storing floppy disks; and the following software: the CP/M operating system, CBASIC, WordStar, Mailmerge, and a CP/M-compatible spread sheet program that resembles VisiCalc.

There are two particularly interesting points about this computer: (1) it will cost \$1795, and (2) it's portable! An optional battery pack will be sold with the unit. Also optional are a 9-inch monitor, an acoustic coupler, and double-density, double-sided floppy-disk drives. The \$1795 price tag (which includes all the software) is remarkably low. It remains to be seen if the company can turn a profit at this price. I recently had an opportunity to see the Osborne I in action. I was impressed with its compactness: it will fit under an airplane seat. (Adam



PASCAL/Z™ - Q.E.D.

Ithaca Intersystems PASCAL/Z is the most powerful CP/M™ compatible Z-80™ Pascal compiler ever . . . and here's why:

PASCAL/Z generates true Z-80 native code — ROMable and re-entrant — 5-10X faster than P-code interpreters; permits separate compilation; supports Direct File Access and variable length STRINGS; utilizes fast one-pass recursive descent organization; the macro-assembler generates relocatable object modules; and much, much more.

Complete package includes compiler, macro-assembler, linker/loader and source for the full library on one disk; with free copy of Jensen/Wirth book and complete documentation. Only \$395.00.

IT'S DEMONSTRABLE!

Don't just take our word for it. Ask for a demonstration of these features and more today at Computerland® and other full-service computer stores.

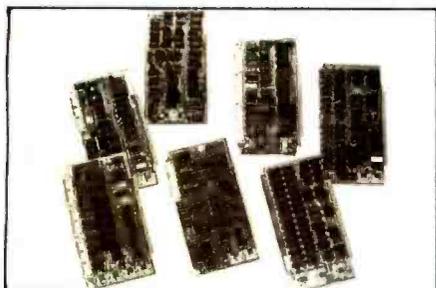
Ithaca Intersystems Inc., 1650 Hanshaw Road
P.O. Box 91, Ithaca, N.Y. 14850. Phone (607) 257-0190

Computerland is a registered trademark of Computerland Corporation.
CP/M and Z-80 are trademarks of Digital Research Corp. and Zilog, Inc. respectively.
PASCAL/Z and InterSystems are trademarks of Ithaca Intersystems Inc.

InterSystems™
Ithaca Intersystems Inc.

Micros for bigger ideas.

The Intersystems price-performance-reliability story now has three versions.



While everyone's been busy trying to convince you that large buses housed in strong metal boxes will guarantee versatility and ward off obsolescence, we've been busy with something better. Solving the *real* problem with the first line of computer products built from the ground up to conform to the new IEEE S-100 Bus Standard. Offering you extra versatility in 8-bit applications today. And a full 16 bits tomorrow.

We call our new line Series II. And even if you don't need the full 24-bit address for up to 16 megabytes (!) of memory right now, they're something to think about. Because of all the performance, flexibility and economy

they offer. Whether you're looking at one of our three mainframes, at a new mainframe, expanding your present one or upgrading your system with an eye to the future. (Series II boards are compatible with most existing S-100 systems and all IEEE S-100 Standard cards as other manufacturers get around to building them.)

Consider some of the features: Reliable operation to 4MHz and beyond. Full compatibility with 8- and 16-bit CPUs, peripherals and other devices. Eight levels of prioritized interrupts. Up to 16 individually-addressable DMA devices, with IEEE Standard overlapped operation. User-selectable functions addressed by DIP-switch or jumpers, eliminating soldering. And that's just for openers.

The best part is that all this heady stuff is available *now!* In our advanced processor—a full IEEE Bus Master featuring Memory Map addressing to a full megabyte. Our fast, flexible 16K Static RAM and 64K Dynamic RAM boards. An incredibly versatile and

economical 2-serial, 4-parallel Multiple I/O board. Our 6-serial I/O board. Our Double-Density High-Speed Disk Controller. And what is undoubtedly the most flexible front panel in the business. Everything you need for a complete IEEE S-100 system. Available separately, or all together in your choice of DPS-1 mainframe styles.

Whatever your needs, why dump your money into obsolete products labelled "IEEE timing compatible" or other words people use to make up for a lack of product. See the future now, at your Intersystems dealer or call/write for our new catalog. We'll tell you all about Series II and the new IEEE S-100 Bus we helped pioneer. Because it doesn't make sense to buy yesterday's products when tomorrow's are already here.

Ithaca Intersystems Inc.,
1650 Hanshaw Road/P.O. Box 91,
Ithaca, NY 14850
607-257-0190/TWX: 510 255 4346

InterSystems™
Ithaca Intersystems Inc.

Circle 6 on inquiry card.

Micros for bigger ideas.

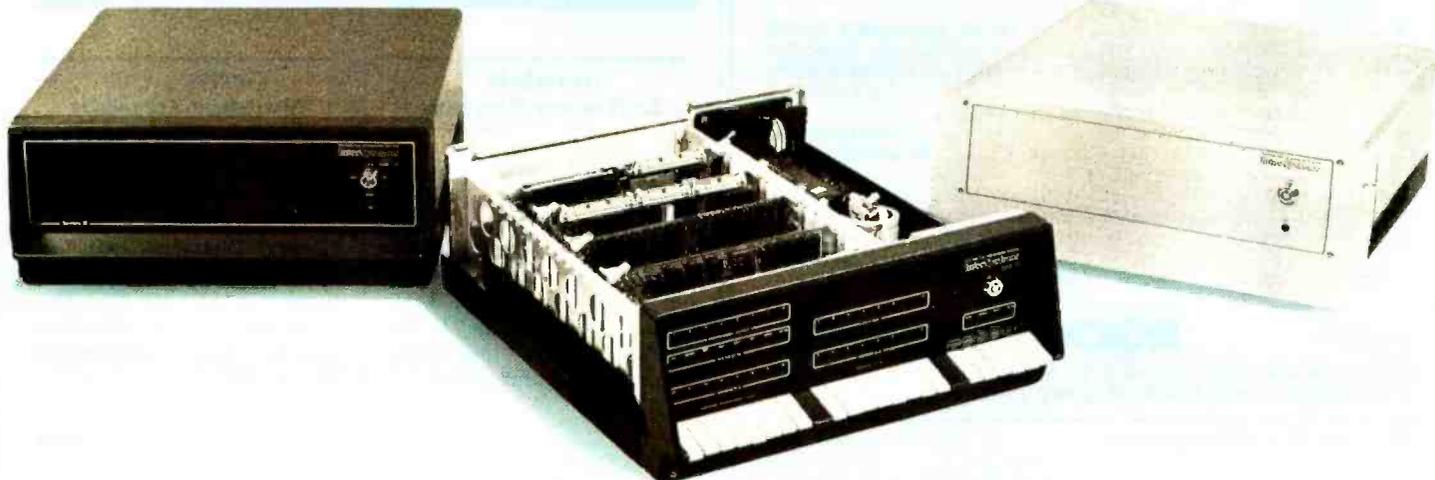




Photo 3: Sony's new 3 1/2-inch floppy disk and drive. Each double-sided floppy disk can hold up to 875 K bytes of information, unformatted. The recording density is 1.47 times that of the 5-inch disk.

Osborne is currently seeking approval from the FAA to operate the unit on board a plane.) One quibble: the screen may be too small for some people's taste. Consulting Editor Mark Dahmke is preparing a full test report on this computer for an upcoming issue of BYTE.

* * *

Update

We have received numerous requests for more information on the Microterminal described in the January editorial. We cannot divulge any more information at this time, but watch for a complete report coming soon.

Also in the works: full reports on the Commodore VIC-20 color computer; the TRS-80 color computer hires (high-resolution) graphics; a special issue on local networks; reviews of three LISP packages; the new spelling-correction programs; Logo for the Apple II and TI 99/4; and our annual August language issue, this year on Smalltalk, one of the most exciting languages in the computer field today. Watch our upcoming editorials for further information about future computers. ■

The Carl Helmers Newsletter

Readers of recent issues of BYTE are probably aware that Carl Helmers, former Editorial Director of BYTE, is now working on projects outside of McGraw-Hill. One of Carl's new undertakings is the Carl Helmers Personal Computer Newsletter, which will cover the present state of personal computing, future developments in hardware and software, artificial intelligence, mass storage, and many other topics. The newsletter will contain no advertising, cost \$200 per year, and will appear monthly. Carl is also considering a free "personal computer industry conference call," which would be made available via a toll-free 800 number if interest among subscribers is high enough. The setup would enable up to twenty people to participate in a regularly scheduled monthly "roundtable" discussion.

For more information about subscribing to the newsletter, write to North American Technology Inc, Strand Building, Suite 23, 174 Concord St, Peterborough, NH 03458, or call 603-924-6048. We wish Carl luck in his new venture...CM

At last --- the DYNATYPER TYPEWRITER INTERFACE!™



Turn your electric typewriter into a low cost, high quality hard copy printer. 1 year warranty

DYNATYPER - Rochester Data's patented* Computer/Typewriter Interface is the industry standard for typewriter output.

- 2 minutes to initially install and 5 seconds to remove or replace.
- You do not have to modify your typewriter. All factory warranties and maintenance agreements on your typewriter will be honored.
- Compatible with all power carriage return typewriters having standard U.S. keyboard. The Dynatyper works with Selectrics (model 1) and most non-Selectrics (model 2). Please specify. Typewriter conversion between models takes 2 minutes and the kit (17 plungers) is available for a nominal fee.
- The Dynatyper is compatible with all major word processing software. (Scripsit, Pencil, Applewriter, Easywriter, Magic Window, Visi-calc CCADB, Supertext, Write-On)
- Interfaces available for TRS-80, APPLE, PET/CBM, OSI, Northstar, HP-85, H-89. Weight Only 3 lbs. Extremely portable.
- Delivery: Stock to two weeks. Price \$499 for complete system. F.O.B. Rochester, Domestic. VISA and Master Card accepted. Call Ken Valicky at 716-244-7804

ROCHESTER DATA

THIS is a registered trademark of Rochester Data Incorporated
3000 Winton Road South, Rochester, N.Y. 14623

BYTE's Bugs

Invisible Software Review

Because of a last-minute scheduling change, the product review by BYTE editor Gregg Williams, "The muSIMP/muMATH-79 Symbolic Math System" (November 1980 BYTE, page 324), did not appear on the "In the Queue" page for that issue. We regret the omission.

Getting the Number Straight

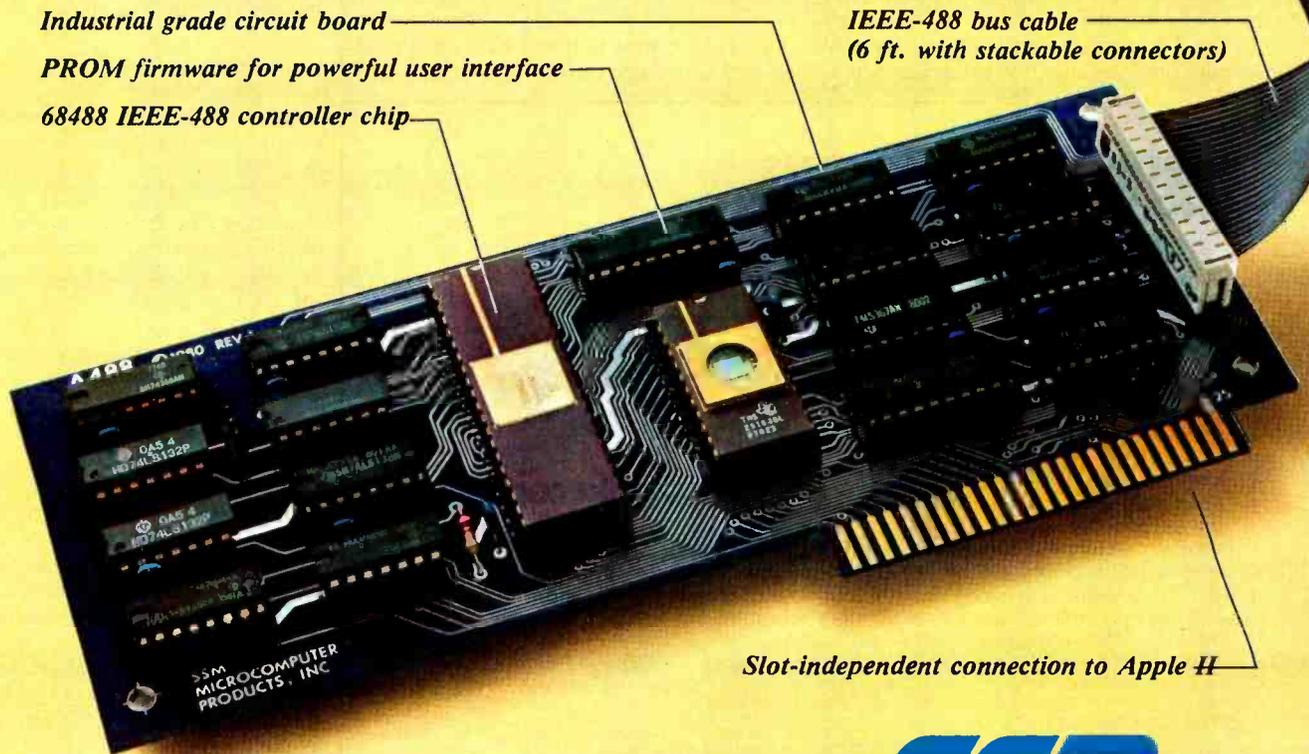
In the February 1981 BYTE, on page 345 of the "What's New?" section, the telephone number given for General Digital Corporation was incorrect. The correct number is (203) 289-7391. We apologize for any difficulties that may have arisen due to the error. ■

Make the Apple II* a powerful IEEE-488 Controller in a snap.

Just plug the SSM A488 board into any Apple II* expansion slot for a low-cost, full-featured instrumentation interface. SSM gives the Apple II the power and versatility of a \$9,000 IEEE-488 controller. At a fraction of the price. Our board converts the Apple II into a truly sophisticated controller that programs and controls up to 15 different instruments connected together on the 488 bus.

We make programming easy. The 68488 chip, designed by Motorola, forms the heart of our A488. We back this chip with powerful on-board firmware to give you system control via simple string commands. The only software you need is easy-to-program Applesoft* Basic. To develop special purpose firmware, simply replace our PROM with a RAM. With the A488, bus communications operate at top speed—without depending on software loops for timing. And like the more expensive IEEE-488 controllers, this system interfaces with more than 1200 instruments and peripherals.

Suitable for OEMs as well as end users. Whether you make test/measurement systems for resale, or simply for yourself, the SSM/Apple combo gives you top performance. As it cuts your costs. Call your local dealer or SSM today for complete details.



SSM's A488 board expands the Apple II to a high-performance IEEE-488 controller.

*Registered trademarks of Apple Computer Inc.



SSM Microcomputer Products, Inc.
2190 Paragon Drive
San Jose, CA 95131
(408)946-7400 Telex: 171171
TWX: 910-338-2077

Computers and Trees: The HHC Forest

I read Gregg Williams and Rick Meyer's article about the Panasonic/Quasar hand-held computers (January 1981 BYTE, page 34), and I could hardly contain my excitement over the potential use for these devices in my field: forest measurements and statistics.

Forest inventory and survey work typically involves many man-hours in the forest collecting information on tree size, species, sawtimber quality and value, growth, etc. This information is normally hand-written on tally sheets in the field, and either hand-tabulated in an office or key-encoded for statistical summary and analysis by computer. Forest scientists and practicing foresters are continually looking for more economical methods of obtaining resource information at the level of precision required for complex management planning and decision-making.

The HHCs (hand-held computers) appear to have the capability of being used in the field as data-entry devices, thereby eliminating the need for subsequent key-

encoding of hand-written information. With their alphanumeric capability, they should be able to store and manipulate descriptive text as well as numeric information. With suitable applications programs, I would think they are also capable of handling a fairly large repertoire of forestry problems (eg: compiling tables describing timber volumes by species, log grade, and size class; estimating stumpage values for timber sales, etc). For larger data-processing requirements, they could transmit their data, through the modem attachment, to a host computer. In short, I see in these devices a potential for greatly reducing the man-hours required for routine data-entry and processing applications in forestry.

George L Martin Jr
Assistant Professor of Forest Biometry
Department of Forestry
College of Agricultural and Life Sciences
University of Wisconsin
1630 Linden Dr
Madison WI 53706

The advent of HHCs will be a boon to many who must perform data entry and sophisticated calculations in the field. Un-

fortunately, neither the price nor the availability date of the Panasonic/Quasar unit was announced at the CES (Consumer Electronics Show), as I had originally hoped. As an educated guess, I would place the price in the \$400 to \$650 range, with the units possibly being available as early as mid-1981....GW

Oddest Programming Language of Them All

In the December 1980 BYTE, Mr Daniel Weise presented a version of a self-reproducing program. (See "Thief-Reproducing Programth," page 16.) The following version of the same fundamental algorithm is written in my favorite programming language—English:

Replace every occurrence of "x" in "x 'x'." by "Replace every occurrence of 'x' in 'x "x".'" by ".

Which executes as follows:

Unquote "x 'x'." to obtain the form x "x".

Replace "x" by the quoted substitute to obtain x "Replace every occurrence of 'x' in 'x "x".'" by ".

Replacing x by the unquoted substitute we obtain Replace every occurrence of "x" in "x 'x'." by "Replace every occurrence of 'x' in 'x "x".'" by ".

The operations quote and unquote work as follows:

Quote text = "text*"
Unquote "text*" = text.

where text* is a faithful copy of text, except for the replacement of each quote mark, single or double, by its complement. This transformation is idempotent. This is a time-honored syntactic device of English.

I leave it to you, dear reader, to judge the relative perspicuity of this English version and the LISP version provided by Mr Weise.

James P Corbett
24 Sheffield Lane
Florence MA 01060

Readers should note that they may not be able to get this program to run on every model of the human brain—which is probably just as well, since once running, it would use up all available processing time and memory space....CPF

FINDING SOLUTIONS AND BEING COMPETITIVE IS OUR BUSINESS.

Having problems and looking for a computer to help solve them? Are you finding computer dealers come in one of two ways? Either Full system support with Full price or Take it or Leave it with Low price. At Omega we don't believe that you should have to make a choice. Yes, we're in business to sell products but also, to solve your problems. Our prices will be the lowest possible. Our support and product quality will be second to none. Check out our Mail Order prices in this ad (our retail prices will be higher). See if you don't agree with our first claim. For our second claim, call us with your data processing needs and problems. Better yet, come in and see us. Finding solutions and being competitive is our business. We never forget either of them.

APPLE III	SCALL
APPLE II PLUS 48K	\$ 1169.95
HEWLETT PACKARD 85 or 83	\$ CALL
APPLE II ACCESSORIES:	
Disk II with controller	\$ 535.00
Disk II 2nd drive	455.00
Graphics Tablet	665.00
Language System with PASCAL	395.00
Silentype Printer W/int	526.00
Integer Firmware Card	152.00
Microsoft Z-80 Softcard	259.00
Videx videoterm 80 col Card	279.00
Sanyo 12" Green Monitor	269.00



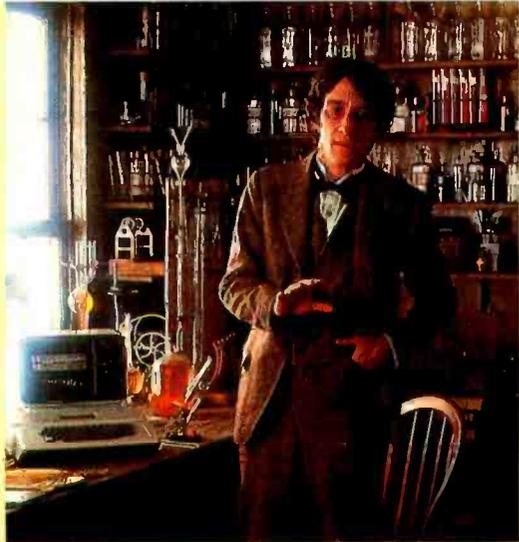
Supplies:	
Scotch Diskettes • Best of Quality!	
price per box of (10)	
744-0, 10, 32	\$ 27.00
740-0 SS/SD 0 Sector	31.00
741-0 SS/DD 0 Sector	37.00
743-0 DS/DD No Format	44.00
New Products:	
Videx L/C Adapter	110.00
Microsoft 16K RAM Card	169.00
D.C. Hayes Micromodem II	315.00
Novation DCAT Modem	195.00
EPSON MX-80	CALL

Mail Order Terms of Sales: Price based on prepaid orders. NO COD's. Visa or Master Charge orders add 3% to purchase price. Allow 14 working days for personal and company checks to clear. Order under \$100.00 add \$3.00 for shipping and handling. All orders (unless specified in ad) within Continental U.S. shipped U.P.S. no charge. APO or out of Continental U.S. write or call for shipping charges. All prices subject to change and all offers subject to withdrawal without notice. CA residents add 6% sales tax.

OMEGA MICRO COMPUTERS

The Problem Solving Company

3447 Torrance Boulevard • Torrance, California 90503 • (213) 370-9456



Edison had over 1,800 patents in his name, but you can be just as inventive with an Apple.

Apple is the company with the brightest ideas in hardware and software *and* the best support — so you can be as creative with a personal computer system as Edison was with the incandescent bulb.

How Apple grows with you.

With Apple's reliable product family, the possibilities of creating your own system are endless. Have expansion capabilities of 4 or 8 accessory slots with your choice of system.

Expand memory to 64K bytes or 128K bytes. Add an A to D conversion board. Plug into time sharing, news and electronic mail services. Use an IEEE 488 bus to monitor lab instruments. Add 4 or 6 disk drives — the 5¼", 143K bytes, high-speed, low-cost drive that's the most popular on the market.

Apple speaks many languages.

Since more than 100 companies create software for Apple, you'll have the most extensive library in the personal

computer world. Want to write your own programs? Apple is fluent in BASIC, Pascal, FORTRAN, PILOT and 6502 assembly language.

There's even a series of utility programs called the DOS Tool Kit that not only lets you design high-resolution graphic displays, but lets you work wonders with creative animation.

More illuminating experiences in store.

You won't want to miss all the Apple products being introduced at your computer store all the time. Don't let



history pass you by. Visit your nearest Apple dealer or call 800-538-9696. In California, 800-662-9238. Or write: Apple Computer, 10260 Bandley Drive, Cupertino, CA 95014.

apple® computer inc.



Vive la Guerre

I have a few comments on Bruce Carbrey's article "A Pocket Computer? Sizing up the HP-41C." (See the December 1980 BYTE, page 244.) The article was very interesting, since I use both an HP-41C and a TI-59 frequently. Mr Carbrey did a comparison that I had planned but had never done.

On page 246, he states that storing a number in a register on a TI-59 requires three lines. This applied to the earlier SR-52, but only two lines are needed with a TI-59. Two is better than three, but the

one-line approach of the HP-41C is better. It makes editing a program without a printer much easier, especially since you don't have to remember key codes.

Mr Carbrey's benchmark test program does not, however, use the TI-59's strengths well. A major difference between the calculators is that both label and absolute addressing exist on the TI-59, while the HP-41C uses only labels. Since the HP-41C program is compiled, it is not penalized. Using absolute addressing in the TI-59 program cuts run time by 3 seconds and saves a step.

Listing 1 is a benchmark program that

uses the TI-59's parenthesis feature. This seemed especially apt considering Hewlett-Packard's and Texas Instruments' battle over Reverse Polish Notation vs Algebraic Operating System. My program is 10 steps shorter, uses 4 data registers, and runs in 33 seconds. This improved performance is achieved by reducing the number of relatively slow memory arithmetic operations and utilizing the TI-59's stack. (Also note that the correct answer in Mr Carbrey's table 1, on page 254, is \$17553.30, not \$17533.30.)

Listing 1

000	76	LBL
001	11	A
002	58	FIX
003	02	02
004	42	STO
005	01	01
006	91	R/S
007	42	STO
008	02	02
009	91	R/S
010	42	STO
011	03	03
012	91	R/S
013	55	+
014	01	1
015	00	0
016	00	0
017	85	+
018	01	1
019	95	=
020	42	STO
021	04	04
022	45	Y*
023	43	RCL
024	02	02
025	94	+/-
026	65	x
027	43	RCL
028	01	01
029	85	+
030	53	(
031	00	0
032	85	+
033	43	RCL
034	04	04
035	45	Y*
036	43	RCL
037	02	02
038	94	+/-
039	97	DSZ
040	02	02
041	00	00
042	32	32
043	54)
044	65	x
045	43	RCL
046	03	03
047	95	=
048	91	R/S

Much has been made of the HP-41C's plug-in accessories, but I wonder if they are really a major design change. They obviously follow TI's development of the printer attachment and Solid State Software. The HP printer has excellent print quality and features, but it is very slow. The Bar-Code reading "Wand" is the only significant advance in my opinion.

The capacities of the two calculators are about equal in my experience. Most users want both a printer and a card

YOU THINK YOU'VE SEEN WORD PROCESSING SOFTWARE?

The **MAGIC WAND**TM Word Processing System offers you the best features of any system in the micro market

Version 1.1 is now available

FEATURES INCLUDE:

- Full-screen text editor
 - Simple, control key operation
- Edit programs as well as text
 - Assemble, compile or run programs without modification
- Files larger than memory
 - Files up to 256K
- Library files
 - Merge part or all of one file with another
- Spool printing
 - Print a file while editing another
- Easy page formatting
 - Simple commands set margins, page length, etc.
- Override commands at run-time
 - Give any command from the keyboard as well as in file
- Variable pitch control
 - Change pitch in mid-line, even mid-word
- Up to 128 user-defined variables
 - String, numeric or dollar format
- Form letter generation from external data files
 - Compatible with both sequential and fixed-record files
- Conditional commands
 - Any command may be conditional
- Print to disk and/or printer
 - Save all or part of output on disk
- Switch from specialty printer to CP/M list device
 - Print the same file on either specialty or standard printer

EASE OF OPERATION

With all its power, the MAGIC WAND is remarkably easy to use. This is no accident. The command structure is designed to be flexible and logical so that you can perform basic functions with a minimum of commands.

We have included in the manual a step-by-step instructional program, for the person who has never used a word-processor before. The trainee uses sample files from the system disk and compares his work to simulated screens and printouts.

In addition to the lessons, the manual has a complete documentation of the command structure, special notes for programmers, an introduction to CP/M for non-programmers and a glossary. The manual is typeset, rather than typewritten, for greater legibility.

We have written the manual in non-technical English, because we want you to read it. We don't overload you with a bunch of jargon that could confuse even a PhD in Computer Sciences.

We send out newsletters so that users of the MAGIC WAND can learn special applications of the print commands. For example, we might show you how to create a mailing list or set up an index for a file.

In short, we've done everything we can to make things easy for you. Because the best software in the world is just a bunch of code if you can't use it.

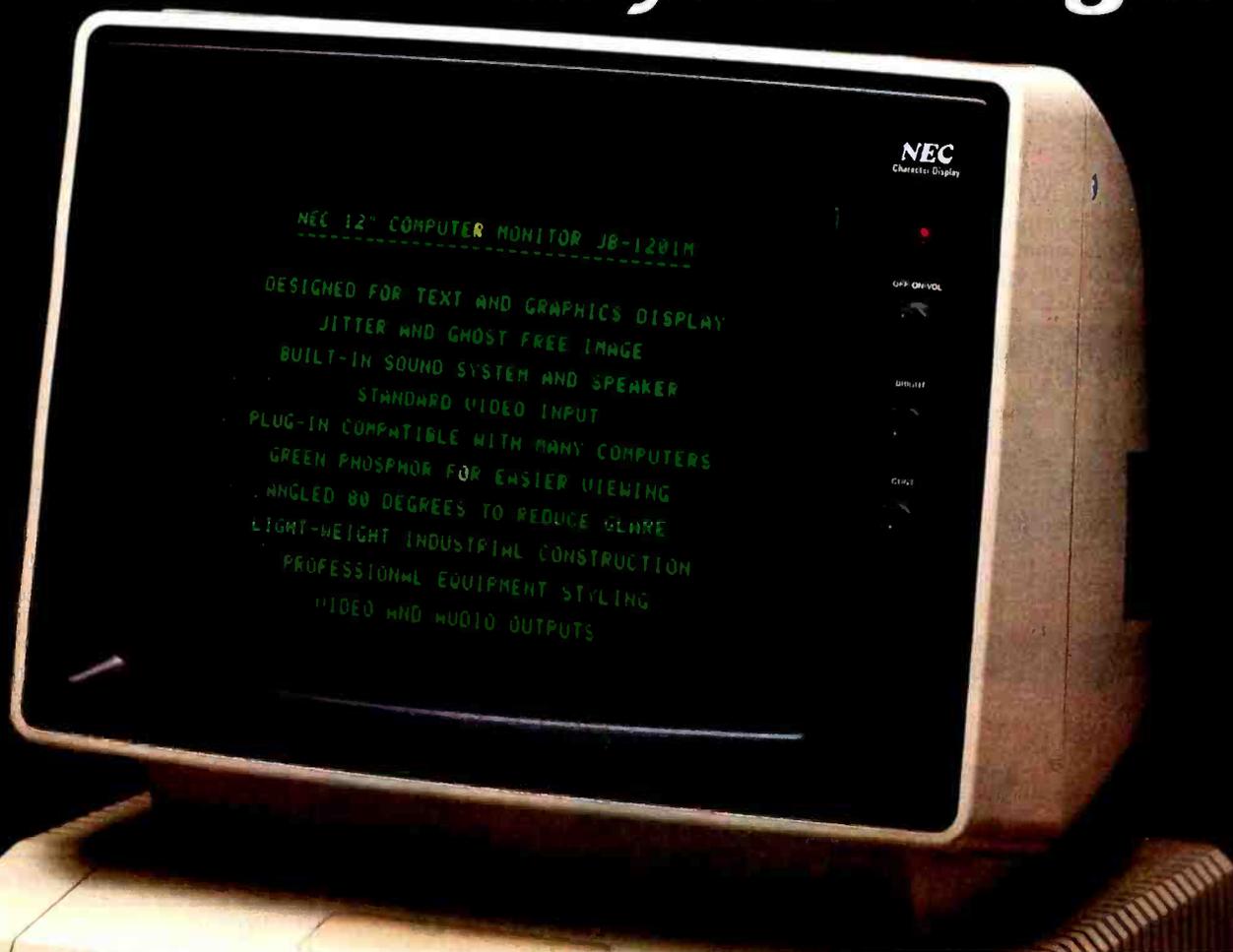
For more information, call or write:

small business applications, inc.

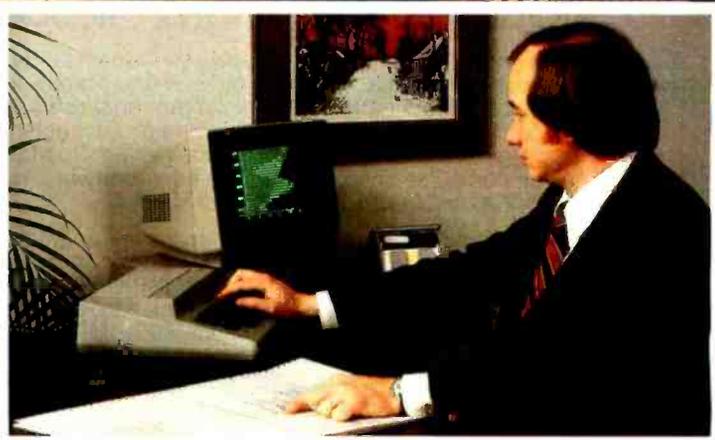
3220 Louisiana • Suite 205 • Houston, Texas 77006 • 713-528-5158

CP/M is a registered trademark of Digital Research Corp

Easy on your Eyes and your Budget



80 character display makes it ideal for word processing and scientific applications.



This high quality professional computer monitor provides sharp, clear display of up to 80 characters by 25 lines of text, making it ideal for word processing as well as standard business applications.

Lightweight industrial grade construction gives maximum portability with reliable operation.

NEC America, Inc.

130 Martin Lane, Elk Grove Village, IL 60007

reader, so only two memory modules can be added. Thus, a maximum of 830 program lines is available without data registers in practical applications, and this limit is quickly reduced. Even allowing for the HP-41C's greater storage efficiency (I find a 50% improvement over the TI-59), the HP-41C is only marginally better.

The lack of a TI response to the HP-41C threat mystifies me. Although users were surveyed last spring, no new product has appeared. The discounts being offered on TI's "59" calculators clearly suggest that something is coming soon, but it has been a year since the HP-41C's introduction.

Perhaps the pocket computers from Radio Shack and Sharp threw a wrench into the works. TI has always played a game of increased capacity at lower cost in the programmable-calculator marketing wars. I await TI's next entry with great anticipation. Users have profited immensely from the battles between Hewlett-Packard and Texas Instruments in this market. (Take out your old calculator and try using it now.) Vive la guerre!!!

G John Garner
319 Blue Haven Rd
Dollard des Ormeaux, PQ, Canada

Compollution

Steve Ciarcia's article "Electromagnetic Interference" (January 1981 BYTE, page 48) is a very good and long-overdue summary of the electronic noise-pollution problem. Many radio engineers have been fighting the battle against the plastic computer box and the poorly designed digital boards that dominate the industry. We are ready for some stiff regulations regarding fundamentals, such as simple metallic shielding and grounding practices, so that the rest of the world can continue to use RF (radio-frequency) communications.

One omission in Mr Ciarcia's article is the reference to a state-of-the-art handbook or text for more comprehensive information on the subject. One of the best comes from Bell Laboratories, in Henry W Ott's book *Noise Reduction Techniques in Electronic Systems* (New York: John Wiley & Sons Inc, 1976).

R W Burhans
Ohio University
Avionics Engineering Center
Athens OH 45701

This omission was caught and rectified. See "BYTE's Bits" March 1981 BYTE, page 314, for additional reading material. Also, see J N Demas's review in the September 1980 BYTE, page 311....GW

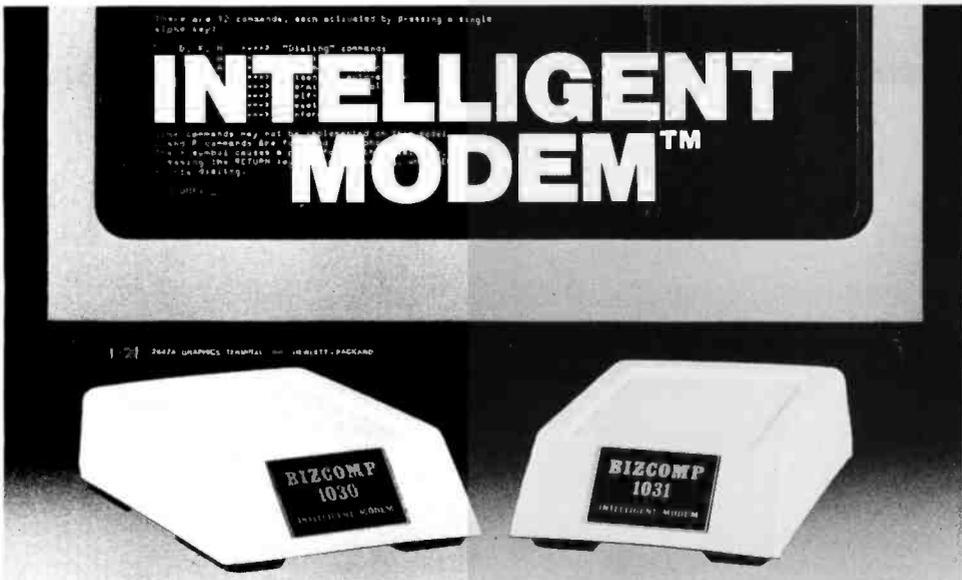
Well-Rounded Machine

We at Hewlett-Packard were very pleased to see Brain Hayes's excellent article on the HP-41C calculator. (See "The HP-41C: A Literate Calculator?", January 1981 BYTE, page 118.) He did make some statements that deserve clarification, however. In particular:

There is something absurd about the world's fanciest calculator not being able to give results accurate to more than seven or eight decimal places.

The example he used was the $(\sqrt{2})^2$ computation, which is a good illustration of a common misunderstanding about computer arithmetic. When calculating $\sqrt{2}$, the 41C works internally with 13 digits and then rounds correctly to 10 digits. This helps to insure the accuracy of the displayed result. But this result is still not really $\sqrt{2}$, merely the best representation possible on this, or any other, 10-digit machine: 1.414213562.

At this point, the calculator does not know where this number came from: it could be a previous result, or it could have been entered exactly as such through



Eliminate The Data Comm Hassles of Outmoded "DUMB" Modems

BIZCOMP's Intelligent Modem is new. Brand new. It teams a Bell 103-type "dumb" modem with a custom BIZ-080 microcomputer in an attractive desk-top enclosure. RESULT: Incredibly simple data comm for professional users. No more mad dash to get a handset into coupler muffs before being disconnected by the remote. No more exclusion-key telephone needed to do the dialing. No more outboard coupler boxes. And for computer sites, communications software written in high level language like BASIC or COBOL. How's that for simplicity!

The 1030 gives you automatic dial, automatic answer and, unique to the industry, automatic REPEAT dial. The top-of-the-line 1031 adds command-selectable tone or dial pulse dialing for TWX net applications and self-test for ensuring full functionality. Both models are FCC registered for direct connection and feature comm rates from 110, 134.5, 150, 200 to 300 baud. BIZCOMP's innovative Code-Multiplexed Design enables complete control using a simple 3-wire RS-232 interface. Don't burden your customers with data comm hassles. Install a BIZCOMP Intelligent Modem today.

**BIZCOMP Communications...
Why not start with the best?**

BIZCOMP

P.O. Box 7498 • Menlo Park CA 94025 • 415/854-5434

Rentals and leasing available from Leasametric, 800/227-6773; 415/574-5797 In Calif.

Patent Pending

THE NEW RELIABLES

Take a look at the new industry standard in reliability.

Our warranty on all IMS International products is two years from the day a dealer sells them.

Two years.

The systems we offer are some of the most advanced in microcomputer history. That gives the IMS dealer another distinct advantage in his marketplace.

There's more.

Low retail cost—well under \$10,000 complete—with the best margins and benefits in the industry. Face it, even the most impressive specifications are no replacement for profits.

Next to profits, full factory support is the second most important feature we give the IMS dealer.

Our systems are designed to meet the specific needs of

your business computer today *and* tomorrow. The price/performance comparison with competitors is one of an IMS dealer's easiest sales closes.

Tailored sales plan. National advertising backup. Point of purchase program. Protected territories. Complete system delivery in *30 days*.

We have what you and your customer need.

The package is complete. New. Reliable.

For more information on our superior computer line and the unique dealer program that comes with it, call Fred Williams (collect) 714/978-6966, or write us:

IMS Box 201
INTERNATIONAL 2800 Lockheed Way
Carson City, NV 89701



NEW CATALOGUE LISTINGS
FROM
JOHN D. OWENS
ASSOCIATES, INC.

CAT 100 FULL COLOR GRAPHICS

Complete S-100 color imaging system with high performance video FRAME GRABBER. 3 fundamental functions are + digitization of video input in real time ++ image storage in dual-port, on-board memory +++ video input of buffered image in gray levels, NTSC color or RGB color.

Discount price \$1,875.
Write or call for option descriptions and pricing, too numerous to list here.

HOUSTON INSTRUMENTS HIPAD DIGITIZER

Create your own graphics using either stylus or optional cursor. Excellent for architectural drawing, business graphs, schematics, free form drawing, etc. More accurate and easier to use than keyboard input or joysticks. "Stream mode" allows continuous placement of coordinate pairs on 11" X 11" pad using either stylus or optional cursor. For S-100 systems and also Apple, TRS-80, PET.

Our discounted price \$ 755.

LDOS for TRS-80 USERS

New operating system can support up to 8 drives (either 5 1/4", 8" or new Winchester fixed disk) in any combination. Features include ISAM Accessing Techniques. Keyboard type ahead, graphics string packer, dated files and many, many more.

Our discounted price \$ 126.
Manual only \$ 25.

DMA-DOS North Star 8" FLOPPY SUBSYSTEM

A new operating system, completely CP/M® compatible that allows use of both 8" (Shugart single sided, double density via Tarbell controller) and 5 1/4" drives.

Complete hardware, software package \$1,910.

TARBELL CPU Z-80

Features memory management hardware that allows dynamic mapping of logical to 1 MB of physical memory in 4K blocks. Supports an easy to use implementation of MP/M®. Either 2 or 4 MHZ, jumper selectable. TWO on board RS232 ports will full handshaking capability; crystal controlled programmable timer.

SEE OUR ADS ON PAGES
178 AND 179

JOHN D. OWENS
Associates, Inc.

12 Schubert Street
Staten Island, New York 10305
212 448-6283 212 448-2913 212 448-6298
Overseas Callers: Phone 212 448-6298

WE HAVE NO READER INQUIRY NUMBER.
PLEASE WRITE OR CALL.

Letters

the keyboard. Squaring this number correctly and rounding again yields 1.999999999. Any 10-digit calculator that does otherwise is either doing "funny arithmetic," or else is not telling you everything it knows. But the 41C has lived up to its claim: each calculation was performed correctly to 10 digits. Also, and at least as important, the behavior of the calculator is *utterly predictable and repeatable*.

A calculator is a tool, and, like any tool, it has its limitations. These limitations must be understood if the tool is to be used properly. The point is this: there exist sequences of calculations that will generate errors of *any* magnitude on *any* finite-precision arithmetic machine. Keeping this in mind, the "world's fanciest calculator," the HP-41C, is a tremendously powerful tool indeed.

Steve Abell
Research and Development Engineer
Hewlett Packard Company
Corvallis Division
1000 NE Circle Blvd
Corvallis OR 97330

MicroAce: More Power to Sinclair

I disagree with John McCallum's statement in "The Sinclair Research ZX80" (see the January 1981 BYTE, page 94) that by building the kit version "you will not save any money." My MicroAce cost a mere \$150—a savings of 25% over the price of a ZX80. It was easy to build, although the instructions were not nearly as elaborate as Heathkit's.

The MicroAce has room for two more programmable-memory integrated circuits than the ZX80. The increase to 2 K bytes almost triples the possible program length (portions of the first 1 K bytes are used for "housekeeping"). This expanded capacity gives you a much more usable computer. Its unique design means that you can store as much information as other systems that use 3 K to 4 K bytes.

I couldn't afford \$500 or more for a computer, but, for about \$175 (kit plus memory chips), I have learned quite a bit and gained much enjoyment while doing so.

John R Mullen
8518 Terrang Ct
Rockford IL 61111

The MicroAce kit is reviewed by Delmar Searls on page 46 of this issue.

Calling Z8000

The "BYTELINES" section of the January 1981 BYTE (page 200) contained

an item saying that Microsoft proposed a standard set of calling conventions specifying parameter-passing and register usage for the Z8000 microprocessor. It was actually Zilog Inc, inventor of the Z8000, that established the conventions. Zilog announced the Z8000 standards at last year's WESCON show in Anaheim, California. The announcement contained the statement that the conventions "have thus far been adopted by Microsoft and are under consideration by several other companies."

Thank you, BYTE, for letting me set the record straight by pointing out that Zilog originated the Z8000 calling conventions that were subsequently adopted by Microsoft.

Bruce Welner
Product Marketing Manager
Zilog Inc
10460 Bubb Rd
Cupertino CA 95014

Why Didn't We Think....



I always look forward to the latest issue of BYTE, as I am sure many others do. I would like to pass along this suggestion to my fellow readers who use an Apple II computer. It is my solution to the well-known "accidental RESET" problem that plagues users of that machine.

Manauba Sakuta, MD
6324 Wilryan Ave
Edina MN 55435

December Adventure

BYTE's "Product Reviews" of games in the December 1980 issue were absolutely perfect. There are too many bad programs on the market; being able to see a picture of the display (along with a description of how the game is played) is a big help.

I noticed that BYTE didn't continue this policy in the January 1981 issue—I realize that you can't have seven game reviews in every issue, but it would be nice....

Thanks.

PAD from Livermore CA ■

Mountain Hardware MusicSystem™

All the Instruments Anyone with an Apple can Play

MusicSystem generates the sound of any musical instrument—real or imagined! Solo or sextet. Rock or classical. Laid-back or loud. At home or in the concert hall or classroom. MusicSystem sets new standards for computer generated music.

Digital Synthesizer with 16 voices. Stereo output. Polyphonic-multi-voice chords and note sequences. Additive synthesis of instruments. Waveforms, envelopes, and amplitudes are fully programmable for each voice to create instrument definitions and music dynamics. 32 KHz sample rate. Frequency resolution is .5Hz steps. Graphical input of sheet music on high-resolution screen using standard music notation. Print out sheet music with a graphics printer. Complete software operating system. Graphical music editor using light pen (provided), game paddles, or keyboard. Pre-entered music provided for immediate playing and enjoyment. Thorough documentation and tutorial user's manual.

Drop by your Apple Dealer and ask to hear for yourself. You'll know what we mean when we say MusicSystem is all the instruments anyone with an Apple can play!

Available at Apple Dealers worldwide.



Mountain Hardware

LEADERSHIP IN COMPUTER PERIPHERALS

A Division of Mountain Computer, Inc.

300 Harvey West Blvd., Santa Cruz, CA 95060
(408) 429-8600

Music I can play? Send details.

Name _____

Address _____

City _____ State _____ Zip _____

Phone _____

*Apple is a trademark of Apple Computer, Inc.

Recurrence in Numerical Analysis

James J Davidson
c/o BYTE Publications
POB 372
Hancock NH 03449

Although Taylor's series are the most universally useful method of computing higher mathematical functions, they do have their drawbacks. In particular, many functions have representations only in the form of alternating series. This can cause great difficulty in maintaining accuracy if large arguments are required. Often, so many significant digits are lost in the process of computation that the results are, at best, useless. At worst, if you do not suspect that gross inaccuracies are occurring, you may make severe engineering mistakes.

If the various remedies such as argument scaling are ineffectual in improving accuracy, the only recourse is to seek alternate methods of computation. Of those alternatives, recurrence relations have the widest applicability.

What's a Recurrence Relation?

Various functions have the mathematical property that if you know two consecutive values, you can use those to find a third. This process can be repeated to find a fourth from the second and third, and so on. Of course, you need to pick the right pair to start from, but if you do, you can get to any value you want.

The simplest illustration of a recurrence relation is the Fibonacci series. This is a series of special numbers known in mediéval times to Leonardo of Pisa, surnamed Fibonacci (1175-1230). Fibonacci numbers are found in botany and other natural sciences, as well as in certain mathematical theories of aesthetics. They are interesting in their own right, and there is at least one society devoted to study of their mathematical properties.

The Fibonacci series proceeds in the following fashion:

0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, . . .

Each term is obtained by adding the two previous terms. As a formula, the series can be expressed as:

$$a_{n+2} = a_{n+1} + a_n$$

where the initial terms must be specified as 0 and 1. Once you get started, it is obvious that you can keep going indefinitely using the same formula. It is not even necessary to begin at the beginning. If you know the thirteenth and fourteenth terms, for instance, you can find the fifteenth by adding them together.

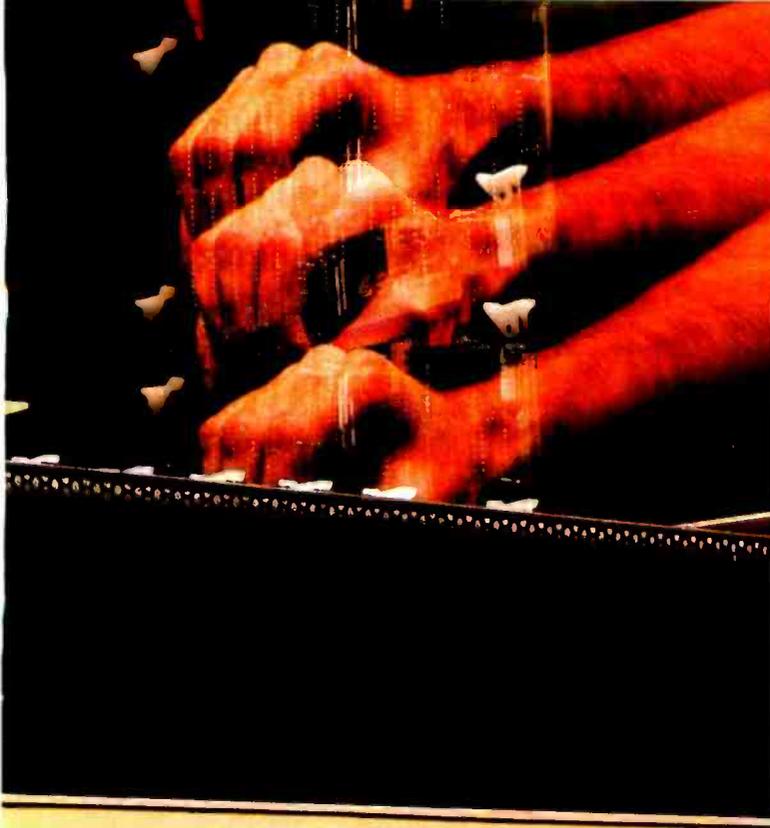
Programming this recurrence relation is not going to be much of a chore. The important thing to keep in mind is that three values must exist within the computer simultaneously: the n and $(n+1)$ terms, and the sum of these two, which is the value being calculated. Then, after the value is found, it must be *slid* into the $(n+1)$ position, with that one being slid into the n position. This sliding process is the only tricky part because it must be done in the proper order, and it is the heart of all recurrence programming.

Listing 1 shows how simple the job is. After initialization, the FOR...NEXT loop handles the calculation in 6 lines. The new term is calculated in line 160 and printed in line 170. The sliding process is done in lines 180 and 190. Note that A1 must be slid into A0 before A2 is slid into A1; otherwise, A1 will be lost. That, in principle, is all there is to programming recurrence relations.

Forward and Backward Recurrence

Recurrence relations have a property that on first acquaintance seems absolutely incredible: if you go in the "right" direction, you increase the number of significant digits in your answer with every new term. This means that in certain cases you can start out with a completely arbitrary guess and, if you go long enough, end up with eight or nine significant digits in your final result! On the other hand, if you go in the "wrong" direction, you lose digits with each iteration and end up with garbage.

There is nothing at all mysterious about this property. If you think about the Fibonacci series, you will realize



California Computer Systems
System 200

POWER FAIL HALT POWER ON

PUSH IN. PUSH ON.

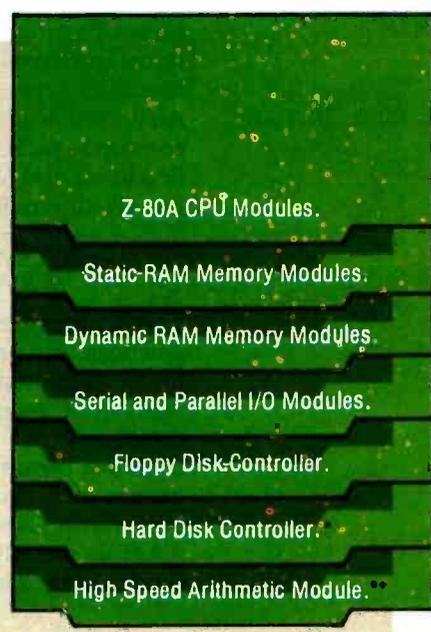
CCS. MAKING MINIS OUT OF MICROS.

Here's the CCS line of board-level computers for system builders on the move. **Push in** the CCS board. And **push on** with your application. CCS board-level systems go together easily, come up quickly, and run reliably, with a proven return rate of less than 1%.

CCS board-level computers offer systems builders the optimal combination of low development cost, low manufacturing cost, and high reliability from proven, tested modules.

A headstart on reliability. CCS modules are designed to industrial performance standards, manufactured to industrial quality standards, fully burned in and tested. You spend more time and energy on your application when you rely on CCS modules instead of reinventing (and rebuilding) standard computer functions.

A full selection of S-100 board-level computers. Whether you want to add capability to another S-100 based system, or build a system from scratch, chances are you'll find solu-



ons for all your system needs in the CCS product line. CCS manufactures a comprehensive selection, so you can tailor a system to your needs with a minimum of components. You buy exactly what you need. But you can easily expand later.

We'd like to tell you more about the CCS line of board-level computers, OEM systems, and computer systems. There's a lot more to tell. Send in the coupon for more information, contact your local computer dealer, or call.

Please have a sales representative call me.

Please send more information on CCS Board-Level Computer Modules.

Name _____

Company _____

Address _____

City/State/Zip _____

Phone () _____

 California Computer Systems
250 Caribbean Drive
Sunnyvale, California 94086
(408) 734-5811

* Available Quarter 2, 1981.
• For use with CCS System Models 200, 300, 400.

that that is exactly what happens there. Starting with two numbers one digit long (0 and 1), you can build up after thirty or forty terms to as many digits as your machine will hold. For this case, we are going in the right direction because the answers get progressively larger as we calculate each new term.

In this case also, we are moving in the direction of increasing index, n . This is called *forward recurrence*. If we were to start out with a high-order pair of terms and calculate down towards zero, that would be called

Listing 1: *The Fibonacci numbers through recurrence. The Fibonacci numbers are used here to demonstrate how easy it is to program a recurrence relationship. All that is necessary is to keep proper order in the calculation and the shifting of variables.*

```
0010 REM
0020 REM *** FIBONACCI NUMBERS
0030 REM *** BY RECURRENCE RELATION.
0040 REM

0100 INPUT "HOW MANY FIBONACCI NUMBERS",N

0110 A0=0
0120 PRINT A0
0130 A1=1
0140 PRINT A1

0150 FOR I=1 TO N-2
0160 A2=A1+A0
0170 PRINT A2
0180 A0=A1
0190 A1=A2
0200 NEXT I

0210 END
```

Listing 2: *A Taylor's series program for the Bessel functions. Lines 160 thru 190 calculate the first term. (Line 160 should not be necessary, but many BASICS insist on executing a FOR...NEXT loop at least once, regardless of index and target.) This program is not recommended if the argument will ever exceed about five or ten, depending on your BASIC.*

```
0010 REM
0020 REM *** BESSEL FUNCTIONS, FIRST KIND, INTEGER
ORDER
0030 REM *** BY TAYLOR'S SERIES.
0040 REM

0100 INPUT "ARGUMENT", X0
0110 INPUT "ORDER", N

0120 X=X0/2
0130 X2=X*X

0140 S=0
0150 T=1

0160 IF N=0 THEN 200
0170 FOR I=1 TO N
0180 T=X/I*T
0190 NEXT I

0200 FOR I=1 TO 999
0210 S=S+T
0220 T=-X2/I/(N+I)*T
0230 IF S<>S+T THEN NEXT I

0240 PRINT S
0250 END
```

Of the various mathematical functions that can be calculated by recurrence, the ones with the greatest engineering utility are the Bessel functions.

backward recurrence. For the Fibonacci series, backward recurrence is "wrong" (because you lose significant digits) and forward recurrence is "right" (because you gain them), but for some other functions the reverse is true.

Putting it another way, if you lose digits going one way, it is because (and only because) you are subtracting nearly equal large numbers. Avoidance of that situation is one of the cardinal principles of numerical calculation. In this case, avoidance consists simply of going in the opposite direction, in which case you are adding the numbers instead of subtracting them.

But how do you know which direction to go in? Very simply, look in a mathematics handbook. If that fails, and you have no knowledge of function behavior to guide you, trial and error is a solution. Set the program up for forward recurrence (which usually is easier) and see whether the terms get larger or smaller. If they get smaller, you guessed wrong. (Be sure that the decrease is not just local. Unfortunately, global function behavior must be known before you can be fully certain that you are going the right way.)

Bessel Functions

Of the various mathematical functions that can be calculated by recurrence, the ones with the greatest engineering utility are the Bessel and the Bessel-related functions. This is fortunate because many of these are strictly alternating series with no hope of argument scaling, and large arguments always seem to be the ones of greatest interest.

The family of Bessel functions includes many variations. There are the first, second, and third kinds; integer, fractional, and noninteger orders; and regular and modified types. The related functions include Kelvin, Airy, and Ricatti-Bessel. For now, though, we will be concerned exclusively with regular Bessel functions of the first kind, and of integer order. These arise as solutions of Bessel's differential equation:

$$x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} + (x^2 - n^2)y = 0$$

This equation appears in a wide variety of engineering and scientific problems, such as heat transfer and membrane vibrations. It also shows up indirectly in the analysis of frequency-modulated signals. Any time cylindrical coordinates are used in analysis, Bessel's equation is almost certain to be involved somewhere. As a consequence of that fact, Bessel functions are also called (particularly in German) cylinder functions.

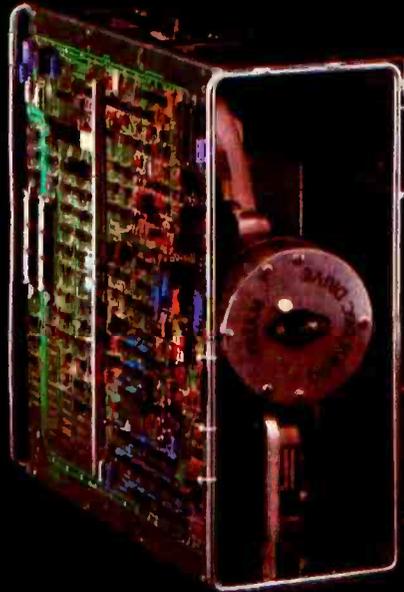
Let us see where the problem lies in computing these functions by Taylor's series. The Taylor's expansion is;

$$J_n(x) = \left(\frac{x}{2}\right)^n \sum_{i=0}^{\infty} \left(\frac{-x^2}{4}\right)^i \times \left(\frac{1}{i!(n+i)!}\right)$$

This is clearly a strictly alternating series, and the critical

THE HARD EDGE

IN SYSTEM PERFORMANCE...



31 MByte Formatted Capacity

The ADES S33 MByte Hard Disk Subsystem is the *HARD EDGE* in System Performance. The S33 transforms your S100 computer from a slow, floppy-bound machine into a high performance system. The S33 is a complete subsystem which includes the ADES PS100 S100 compatible hard disk controller card, the Priam DISKOS (TM) 3350 hard disk, an attractive desktop cabinet, power supply, CP/M* BIOS software, and ribbon cable. With its 31MB formatted capacity and a CP/M data transfer rate greater than 40K bytes/second the S33 can instantly increase the performance of any S100 computer system.

S33 FEATURES. The PS100 single card controller, which is IEEE-S100 compatible, contains an on-board processor, a 528-byte host interface RAM, and the hard disk interface. It has a fifteen command repertoire, on-board CRC to guarantee data integrity, user selectable base address, bank select feature, phantom RAM disable, and full S100 interrupt capability. It controls up to four Priam drives. In addition, the S33CBIOS software package allows easy integration into most CP/M systems. Application notes cover CBIOS integration and system boot directly from the hard disk.

EXPANDABILITY. With the S33 subsystem, you have freedom to grow in two different directions. First, the PS100 controller supports all Priam 8- and 14-inch hard disk drives, including the 68 MByte and 158 MByte models. As your database expands, so does your system's capability. Second, one PS100 controller handles up to four drives of any size and in any combination, providing a full range of capacities.

The S33 is only the first in the expanding line of ADES mass storage products. When you need an edge on your competition or more power in your personal system, look to ADES for the "*HARD EDGE* in System Performance."

*CP/M is a registered trademark of Digital Research.

ADES

ADAPTIVE DATA & ENERGY SYSTEMS

2627 Pomona Boulevard • Pomona, CA 91768

Phone: (714) 694-5858

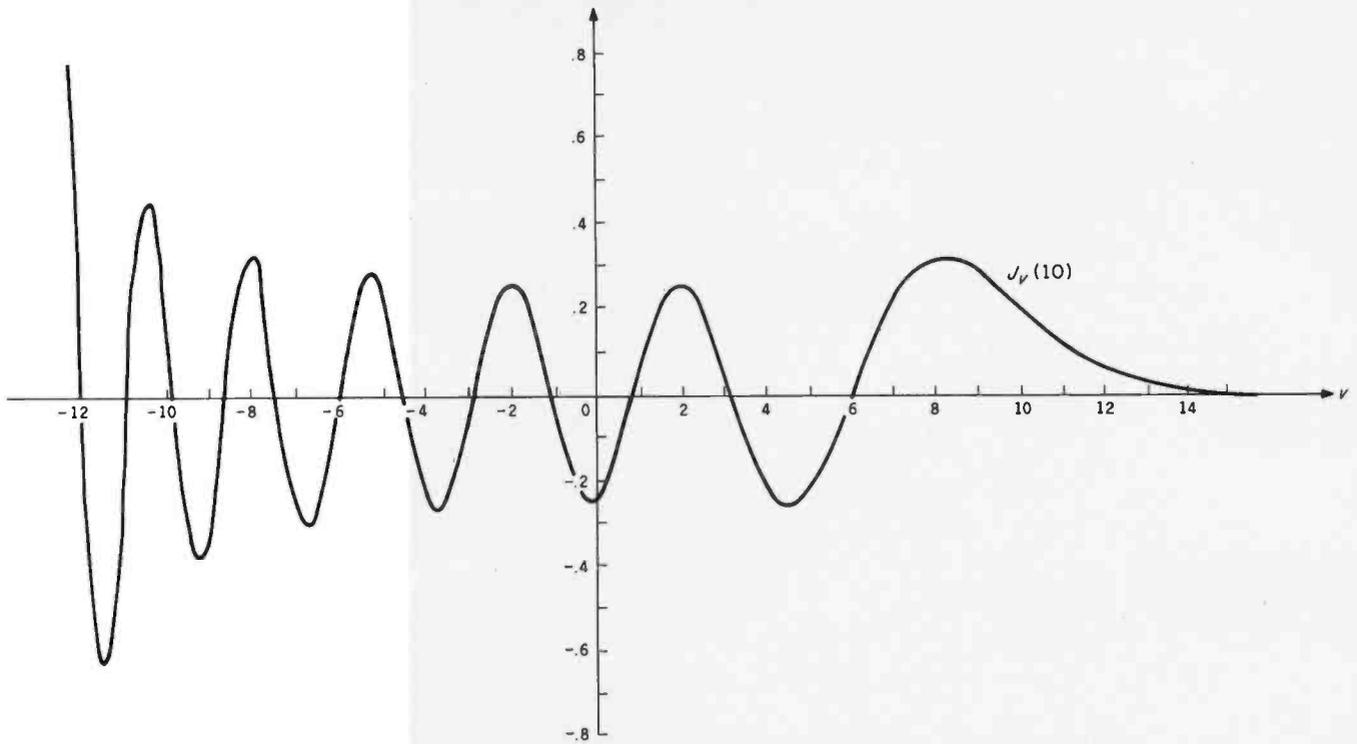


Figure 1: The Bessel function of argument 10 and variable order v . When programming a recurrence relation, information such as this is needed to determine whether to use backward or forward recurrence. Since the function goes to zero for large orders (values of v), we conclude that we need to use backward recurrence to achieve good accuracy. The Bessel function behaves similarly for other arguments: as soon as the order (v) exceeds the argument (x), the function rapidly declines to zero.

Terminal sale.



Display format 24 x 80—128 ASCII character set. Selectable transmission up to 19.2K baud. RS 232 interface. Typewriter standard type keyboard—59 keys.

\$525 each.*

Completely refurbished by Western Union, ADM3 terminals built by Lear Seigler, available at a price considerably lower than any other refurbished units you can buy.

Act now and get advantages few can offer!

- 90-day warranty.
- National service network.

Interested in other models? Also available are the 33KSR, GE Terminet 300 and GE Terminet 1200. Write on your letterhead to Jim Chenard, Western Union, Dept. A, One Lake Street, Upper Saddle River, NJ 07458. Or call (201) 825-5333.



*In quantity.

argument occurs at $x=2$. But it is rare that one is satisfied with values that small.

Listing 2 is the program for this series. Keep in mind that the magnitude of the Bessel function can never exceed unity, and see where your machine starts to bomb. If you have double precision, you may want to see how much difference it makes. Recognize, too, that a range of 10^{38} can be a real limitation. For $x=100$, the largest term nearly reaches 10^{41} . Depending on your BASIC, a maximum argument of five to ten is recommended.

Bessel Recurrence Relation

Now to recurrence. The relation we will use is:

$$J_{n+1}(x) = (2n/x)J_n(x) - J_{n-1}(x)$$

and the first thing we need to know is which direction to go. This is a recurrence in order, not argument, so the question is whether the function increases or decreases as the order gets larger and the argument stays constant. Figure 1 (from the National Bureau of Standards handbook) answers this clearly. At large positive arguments, the function heads toward zero. This means that, when we want to calculate $J_n(x)$ for a given n , we must calculate higher-order values of $J(x)$ and use the recurrence formula to calculate down to order n .

The next problem is where to start. This is quite an involved question, and, unfortunately, there are no established answers.

Let us suppose we want to calculate $J_8(22)$. We have to start someplace above eight, but where, and with what? If we knew, for example, $J_{18}(22)$ by calculation, we would probably just as easily know $J_8(22)$ by calculation and

DIMENSION 3

COLOR GRAPHICS

Takes your PET™, CBM™ or TRS-80™ into the future

Our VDP color board features 256 x 192 pixel resolution, 15 exciting colors on 5 planes producing 3-dimensional graphics and true animation,

standard composite video output to either T.V. set or monitor (through optional R.F. Modulator)

Plus 3 channel digitally synthesized sound and 16k onboard RAM, driver software is available to maximize user flexibility. Install Dimension 3 in your present computer within minutes your-

self. No technical expertise required. Dimension 3 from Dimensional Design Inc. is available through Computer City, Canada (dealer enquiries welcomed).

PET, CBM are registered TM's of Commodore International. TRS-80 is a registered TM of Tandy Corporation. Dimension 3 is a registered TM of DDI Dimensional Design Inc. Artist's representation.

Introductory price offer (PET-CBM) **\$595.00 U.S.** TRS-80 **\$649.00 U.S.**



MAIL TO: Computer City, Canada Inc. 1353 Portage Avenue,
 Winnipeg, Canada R3G 0V5 Phone: (204) 786-3383

Name Address Country
 Prov./State Postal/Zip Code
 Please send me () color cards. My system is TRS-80 () or **\$649.00 U.S.**
 original PET () or CBM () or **\$595.00 U.S.**
 Enclosed please find \$
 Master Charge #
 Visa #
 Signature
 Make cheques or money orders payable to Computer City, Canada Inc.
 Master Charge or Visa add 5%.

would not need to use recurrence. We will make an arbitrary guess (using it and zero as the two numbers needed to start recurrence) and let the virtues of "right" recurrence provide our significant digits.

However, while it is true that recurrence can provide increased accuracy, this is true only relative to the initial guess, which was arbitrary. This means the result we get may be highly precise but completely inaccurate. What we look for, then, is some way of normalizing, or adjusting, the result. Perhaps somewhere in the process, or in the final answer, there is a clue to what the right output should be. If so, that clue can be used to give us the correct value.

Normalizing Sum

The solution lies in one nice formula:

$$1 = J_0(x) + 2J_2(x) + 2J_4(x) + 2J_6(x) + \dots$$

If we simply double each even term as we calculate it and add them all together, then subtract one zeroth term (because it is not doubled in the formula), we should get unity. If we do not (and we will not), divide the recurrence result by this sum and out comes a closer approximation to the correct answer.

This does mean, however, that every calculation will always have to proceed all the way to zero order. The formula also tells us how far up we must start: at an order high enough that its contribution to the sum will be negligible.

The full process goes like this: you begin by choosing an argument at random, then finding the highest order that makes a difference in the total sum. If the total sum is greater than 1.00, divide the beginning argument by this

number and repeat the process. The final result should be a beginning argument and an order high enough so that two conditions are true: first, that the next higher-order term does not contribute significantly to the sum; and second, that the sum is approximately equal to 1.00.

You will find that the starting point depends both on the argument and the order of the answer you desire. Larger arguments always require higher starting points, as do higher orders. But the relationship is not simple, and no single equation will fit all points exactly. If the equation must err (and it must), it is best that it do so on the high side, although it should not be too far on the high side.

If the starting point is too low, the normalizing sum is inaccurate, degrading the answer. If it is too high, execution time becomes excessive and you run the risk of exceeding your machine's range. (The sum can grow very quickly.) Note, however, that it is the normalizing sum, not the recurrence calculation, that is the main source of trouble. Recurrence starts with an arbitrary guess anyway and goes in the "right" direction (backward), so accuracy is not an issue here (with one important exception that will be explained later).

Programming all of this—except for the equation derivation—really is not too difficult, but it is messy and time-consuming. Fortunately, it has been gone through by various mathematicians, and formulas do exist for finding the starting order. The results listed will vary, though, depending on the number of significant digits in the particular machine they were developed for.

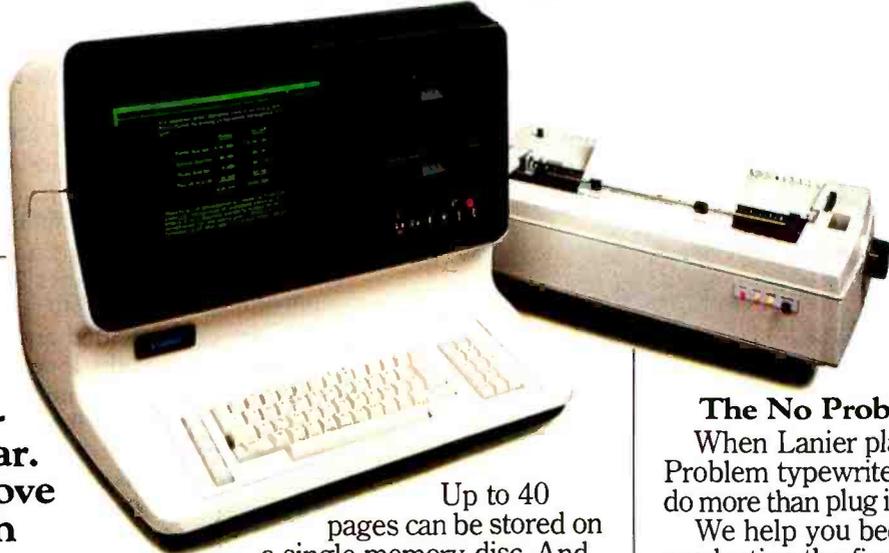
Table 1 gives the raw data rounded to the next higher even integer of the starting order necessary for ten-place accuracy. This information was compiled by Samuel G Allen of New York on an SR-56 pocket calculator. From

i	1	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
0				36	38	50	56	64	70	76	86	88	94	98	104	110	116	122	128	134	138
15	22	24	30	36																	
17	24	28	32	36																	
20	26	30	36	38	38																
25	30	36	38	42	44	50															
30	36	40	42	44	46	52	56														
35	40	44	46	48	48	54	58	64													
40	46	48	50	54	56	58	60	64	70												
45	54	54	56	58	60	62	64	68	70	76											
50	58	58	60	62	64	66	68	70	74	78	86										
55	62	64	64	66	68	70	72	74	78	80	86	88									
60	66	68	70	72	74	76	78	80	80	82	86	90	94								
65	70	72	72	76	78	80	82	84	84	86	88	92	94	98							
70	74	76	78	80	82	84	86	88	88	90	92	94	96	102	104						
75	80	82	84	84	86	88	88	90	92	94	96	98	100	104	106	110					
80	86	86	88	90	90	92	94	96	98	98	100	102	104	106	108	112	116				
85	92	92	92	94	96	98	98	100	102	104	106	106	106	108	112	116	118	122			
90	96	96	98	100	100	102	104	104	106	108	110	110	110	112	116	118	120	122	128		
95	100	100	102	104	106	106	106	108	110	112	114	116	116	116	118	122	124	126	130	134	
100	104	104	106	108	110	110	112	112	114	116	118	120	120	120	122	126	126	128	132	134	138

i	0.1	0.5	1	2	3	4	5	6	7	8	9	10	11	12
0	6	8	10	14	16	18	20	22	24	26	26	28	30	32
1	6	10	10	14	16	18	20	22	24	26	26	28	30	32
2	8	10	12	14	16	18	20	22	24	26	26	28	30	32
4	10	12	12	14	16	18	20	22	24	26	26	28	30	32
6	12	12	14	14	18	18	20	22	24	26	26	28	30	32
8	12	14	16	16	18	20	22	22	24	26	26	28	30	32
10	14	16	18	18	20	22	22	24	26	26	26	28	30	32

Table 1: Raw data used by S G Allen to derive his equation for the starting order of the recurrence relation.

The No Problem[®] Trial Offer!*



The Lanier No Problem[®] Typewriter can pay for itself in one year.

You can prove it in your own office! Right now.

It's true. One typist with a Lanier No Problem typewriter can do work as fast as 2 or 3 people using ordinary electric typewriters.

These savings alone could pay for a No Problem typewriter in one year. Or less.

That's just the beginning. Even office expenses such as floor space and filing are reduced. Paperwork gets done faster and more accurately.

The No Problem concept

The Lanier No Problem electronic typewriter is multi-use, with extraordinary powers.

It speeds up your everyday typing like no ordinary typewriter can.

Your secretary prepares pages on a TV-like screen instead of on paper.

Changes and corrections are made right on the screen.

No whiteouts. No erasures. No false starts.

You get your work back faster and it's right the first time.

Up to 40 pages can be stored on a single memory disc. And letter-quality printing is done at less than 30 seconds per page.

Many typewriters in one

The No Problem typewriter can perform additional tasks simply by inserting different No Problem Smart Discs.[™]



Lanier's unique Smart Discs use the same medium as the storage discs.

Want to add and subtract, multiply or divide? Insert the Math Master Smart Disc.

Other Smart Discs enable you to sort long lists, prepare personalized standard letters and even keep track of your timekeeping.



LANIER[®]

The No Problem Typewriter. It does more than just type.

RETURN POSTCARD AVAILABLE—BACK OF BOOK.

The No Problem Trial

When Lanier places a No Problem typewriter on trial we do more than plug it in and leave.

We help you become more productive the first day.

The No Problem typewriter has proven itself in thousands of offices from coast to coast. We'll show you how it works with *your* applications in *your* office.

So why wait?

The Lanier No Problem typewriter is available *today*, to solve today's office problems.

Send this coupon to set up an immediate appointment or call:

(800) 241-1706.

Except in Alaska or Hawaii. In Georgia, call collect (404) 321-1244.

Yes, I'd like to know more about the No Problem Trial Offer!

Name _____

Title _____

Phone _____ Best Time To Call _____

Firm Name _____

Address _____ County _____

City _____ State _____ Zip _____

What kind of typing or word processing system are you using now?

Lanier Business Products, Inc.
1700 Chantilly Dr. NE, Atlanta, GA 30324

4 81 B C 1

*Trial charges may be applied toward your No Problem typewriter purchase.
©1981 Lanier Business Products, Inc.

Listing 3: Generating Bessel functions by recurrence. This one is slower than Taylor's series for small arguments, but is vastly more accurate for large ones. Within the accuracy range of a machine, no limit has been found on maximum order or argument.

```

0010 REM
0020 REM *** BESSEL FUNCTIONS, FIRST KIND, INTEGER
      ORDER
0030 REM *** BY RECURRENCE RELATION.
0040 REM

0100 INPUT "ARGUMENT", X0
0110 INPUT "ORDER", N

0120 X=X0
0130 IF ABS(X)<1.E-10 THEN X=1.E-10

0140 Y=X
0150 IF N>X THEN Y=N
0160 N9=INT(Y+3*SQR(X)+9)

0170 J9=0
0180 J8=1.E-30
0190 S=0

0200 FOR I=N9 TO 0 STEP -1
0210 J7=2*I/X*J8-J9
0220 J9=J8
0230 J8=J7
0240 IF INT(I/2)=I/2 THEN S=S+2*J9
0250 IF I=N THEN J=J9
0260 NEXT I

0270 S=S-J9
0280 J=J/S
0290 PRINT J
0300 END

```

the data, he derived a fairly simple equation which errs conservatively by about ten percent in the region $N=4X$. The equation is as follows:

$$N9 = \text{int}(\max(N, X) + 3\sqrt{X} + 9)$$

which is implemented in lines 140 thru 160 of listing 3.

Program Comments

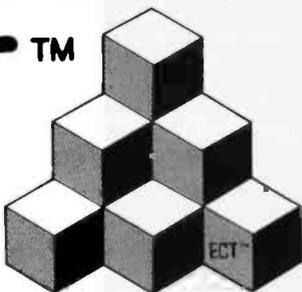
If you have followed the discussion to this point, the program in listing 3 should be straightforward. Lines 140 thru 160 calculate the starting order, and lines 170 thru 190 do the initialization. Note that the arbitrary guess for $J_8(J_n(x))$ is 1.0×10^{-30} . It is chosen small (and can be much smaller if your range goes to 10^{-99}), so that large arguments can be accommodated without overflowing the normalizing sum. $J_9(J_{n+1}(x))$ is initialized to zero, which reflects the assumption that the next higher term is too small to be significant.

The recurrence loop (lines 200 thru 260) includes the normalizing sum at line 240. Line 250 picks out the particular order you specified and stores it as variable J.

After exiting from the loop, line 270 subtracts a zero-order term from the sum, and line 280 divides the chosen value by S to normalize it properly.

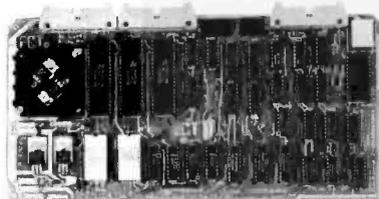
One fact has not yet been mentioned: the recurrence relation involves a division by x, so that $x=0$ causes an error message. But this is a perfectly legitimate argument at any order, so line 130 assigns a small value instead. It cannot be too small, though, or overflow will occur rapidly because of that division by x.

ECTTM



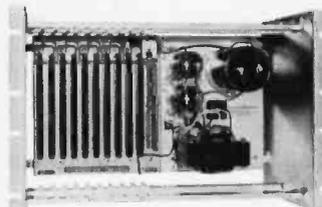
Building Blocks for Microcomputer Systems, Dedicated Controllers and Test Equipment.

**R²I/O
S-100 ROM,
RAM & I/O
BOARD**



ECT's R²I/O is an S-100 Bus I/O Board with 3 Serial I/O Ports (UART's), 1 Parallel I/O Port, 4 Status Ports, 2K of ROM with the 8080 Apple Monitor Program and 2K of Static RAM.

\$295.00



**RM-10
S-100
RACK MOUNT
CARD CAGE**

ECT's RM-10 is a rack mount 10 slot Card Cage with Power Supply, consisting of an ECT-100 rack mount Card Cage (19"W x 12.25"H x 8"D), the MB-10 Mother Board (with ground plane and termination) all 10 connectors and guides and the PS-15A Power Supply (15A @ 8V, 1.5A @ ± 16V).

\$295.00

Specializing in Quality Microcomputer Hardware
Industrial • Educational • Small Business • Personal

Card Cages, Power Supplies, Mainframes, CPU's, Memory, I/O, OEM Variations

ECTTM

ELECTRONIC CONTROL TECHNOLOGY (201) 686-8080

763 Ramsey Ave., Hillside, NJ 07205

THE DAWN OF A NEW AGE

The 2nd Generation™ is here!

MEASUREMENT systems & controls proudly introduces its new and exciting "2nd Generation" family of S-100* compatible products. Each has been specifically designed for use with multi-user and network operating systems such as MP/M, CP/NET, and OASIS. Every product is fully tested and burned-in, comes with a 1 year guarantee, and offers you features not currently available from any other source.

Z80 PROCESSOR BOARD — The most powerful CPU board available today. Outstanding features include 4MHz operation, high-speed serial and parallel I/O utilizing DMA or programmed control, eight vectored priority interrupts, and a real time clock.

MULTI-USER SERIAL I/O BOARD — For use in expanded systems requiring up to eight additional serial I/O ports. Features include: 16 maskable

vectored priority interrupts, RS-232C interfaces with full handshake, asynchronous or synchronous operation with asynchronous baud rates to 19,200. Available in four or eight channel versions.



DOUBLE DENSITY FLOPPY DISK CONTROLLER BOARD—

controls up to four 5¼-inch or 8-inch disk drives using IBM soft sectored formats. It features 1K of on-board buffering, DMA controlled data transfers and the performance characteristics of the superior NEC 765 chip.

64K BANK SELECTABLE MEMORY BOARD —

Features include I/O port addressing for bank select with 256 switch selectable I/O ports for the memory bank addressing. The memory is configured as four totally independent 16K software-selectable banks, with each bank addressable on any 16K boundary.

* All products meet the new IEEE standards.

"Attractive Dealer & OEM Prices"

See your nearest computer dealer, or contact us for the complete story on The 2nd Generation.

Systems Group

A Division of MEASUREMENT systems & controls
incorporated

1601 Orangewood Ave. / Orange, Calif. 92668
(714) 633-4460 TWX / TELEX: 678 401 TAB IRIN

See us at the sixth Computer Faire, booth
1526, San Francisco April 3-5

Altering this program to give a complete array of Bessel functions of various orders for a given argument is easy. Simply define an array of dimension $N+1$ and start storing values when the variable I becomes equal to N . At the end, each value must be divided by S .

You will find that execution time for this program is quite long. For small x , the Taylor's series is much faster and therefore may be preferred for arguments that are guaranteed restricted. When in doubt, use the recurrence method (listing 3).

Negative Orders

Note from figure 1 that the behavior at negative orders is very different than that of positive orders. So, instead of trying to adapt listing 3 to handle negative N , use the absolute value of N for N and transform the output by the relationship:

$$J_{-n}(x) = (-1)^n \times J_n(x)$$

How Accurate Is It?

There is only one practical way to check accuracy on a routine like this: compare the results against known values in a published table. But that creates a problem because available tables give out before the program does. The massive compilation by the staff of the Harvard Computation Laboratory (Harvard: 1947) goes up to $x=100$ and $n=135$.

The most sensitive test, though, is to check in the region of the zeros at various orders. The Bessel functions look like damped sine or cosine waves, crossing zero at

The most sensitive test is to check In the region of the zeros of the function.

intervals that look as though they might be periodic. (However, they aren't and the exact locations of the zeros is of considerable interest to mathematicians.) Obviously, if you put in an argument that is supposed to be at a zero of the function, you expect to get a result of zero. This is unlikely for two reasons:

- The locations of the zeros are transcendental numbers and cannot be specified exactly. The theoretical result, then, should not be exactly zero.
- Backward recurrence is "right" only when the function increases as you proceed in that direction. But at a zero, the function suddenly nosedives down (see figure 1). Here, $(2n/x) \times J_n(x)$ is supposed to equal $J_{n+1}(x)$, so their difference is zero. This is subtraction of nearly equal large numbers, which usually results in a small truncation error.

For the above reasons, all errors and inaccuracies accumulate at the zeros. In particular, truncation errors show up flagrantly here. Not only does truncation cause the output to be nonzero, it actually translates the apparent location of the zero to a lower value. The truncation is not really bad (it usually affects only the last digit), but those interested in the mathematical properties of Bessel functions should be aware that this bias does exist.

With that background, we can state that the accuracy of the program of listing 3 on a nine-digit truncating BASIC is seven to eight decimal digits. Note that I said *decimal* digits, not *significant* digits. As far as I can determine, the seventh digit after the decimal point is good to within one count anyway, including zeros. Away from the zeros, the eighth digit appears good to within one count. This includes any x or n up to one hundred, based on spot and systematic checks against the Harvard tables.

Using the Royal Society tables of zeros, further checks can be made under worst-case conditions. For example, the forty-eighth zero of order 19 occurs at $x=178.846699$. The actual output there is 7.6×10^{-9} , which will cause the seventh digit to be off by one count. Worse errors may be possible, but this one is the largest I found.

Other BASICs with fewer digits should have similar properties: about a two-digit loss as long as the range is not exceeded by the normalizing sum. For engineering use, this should be entirely adequate. ■

References

1. Abramowitz, M and I A Stegun. *Handbook of Mathematical Functions with Formulas, Graphs, and Mathematical Tables*. Washington: National Bureau of Standards, 1964.
2. Harvard Computational Laboratory Staff. *Tables of the Bessel Functions of the First Kind*. Cambridge: Harvard University Press, 12 volumes, 1947 and following years.
3. Olver, F W J (editor). *Royal Society Mathematical Tables, Volume 7: Bessel Functions Part III, Zeros and Associated Values*. New York: Cambridge University Press, 1960.

AOS On
A NOVA® 4/X?

Wild Hare's

**MTSS Provides NOVA® Users
With Multi-User Capabilities**

DG users now have a choice when upgrading to a multi-user environment. Previously, the only way to support a true multi-user environment was to upgrade to AOS, but not anymore.

MTSS provides all of the standard RDOS features for up to 16 users simultaneously and each user is totally independent. Users may edit, compile and execute programs written in FORTRAN IV, FORTRAN V, ALGOL, BASIC, MACS, etc.

This means no software rewriting is necessary. No new operating system need be installed.

More importantly, MTSS supports all NOVA*'s as well as ECLIPSE*'s so no expensive hardware upgrade is required.

**Now Data General Users
Have A Choice!**



WILD HARE COMPUTER SYSTEMS INC

P.O. Box 3581, Boulder, Colorado 80307
(303) 422-1182



Time & Money. Commodore®, Atari® & Apple® users get more with VisiCalc™ software.

A financial VP in Massachusetts is cutting the time it takes to prepare month-end reports from three days to three hours.

A California company is replacing most of its time-share computer service with a personal computer and VisiCalc, saving at least \$30,000 the first year.

Thousands of other personal computer users are also sold on how VisiCalc is increasing their productivity. Besides saving time and money, they're simplifying their work and getting more information that helps them make better decisions. A typical user reaction comes from a New York dentist:

"VisiCalc has become an integral part of my business"

VisiCalc displays an "electronic worksheet" that automatically calculates nearly any number problem in finance, business management, marketing, sales, engineering and other areas. The huge worksheet is like a blank ledger sheet or matrix. You input problems by typing in titles, headings and your numbers. Where you need calculations, type in simple formulas (+, -, ×, ÷) or insert built-in functions such as net present value and averaging. As quickly as you type it in, VisiCalc calculates and displays the results.

"I am extremely impressed with VisiCalc's capability, flexibility and orderly presentation of instructions"

So writes the director of a New York corporation. He appreciates VisiCalc's powerful recalculation feature. Change any number in your model and instantly all numbers affected by that change are recalculated and new results are displayed. You can ask "What if . . .?"; analyzing

more alternatives and forecasting more outcomes. It really increases your decision-making batting average!

When you finish, you can print a copy of the worksheet just as it appears on the screen and/or save it on diskette.

"I like VisiCalc's ease of use"

That response comes from a Utah businessman using VisiCalc for production forecasts, financial report ratio analysis and job cost estimating. Ease of use is VisiCalc's best-liked feature. It's designed for a non-programmer, and has an extensive, easy-to-understand instruction manual.

Users also like solving a wide variety of problems with VisiCalc . . . and solving them their way. VisiCalc can even justify the cost of a personal computer, according to a New Hampshire financial analyst:

"VisiCalc is paying for itself over and over."

VisiCalc is available for 32k Commodore PET/CBM, Atari 800 and Apple disk systems. VisiCalc is written by Software Arts, Inc.

See VisiCalc at your Personal Software dealer. For your dealer's name, call Personal Software Inc. at 408-745-7841, or write 1330 Bordeaux Drive, Sunnyvale, CA 94086.

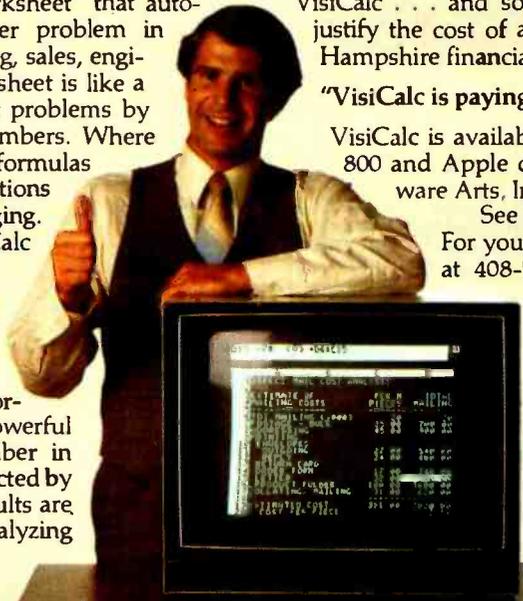
While there, see our other Productivity Series software: Desktop Plan and CCA Data Management System. They're like time on your hands and money in the bank.

**PERSONAL
SOFTWARE**

See us in Chicago at NCC, booth 881

Commodore is a registered trademark of Commodore Business Machines Inc., Atari is a registered trademark of Atari Inc., Apple is a registered trademark of Apple Computer Inc.

Circle 24 on inquiry card.



Programming Quickies

Apple Name-Address

Gary Stotts, 10390 Owens Cr, Broomfield CO 80020

Name-Address is a program that will store up to 100 names, addresses, and telephone numbers. It is written for the Apple personal computer and requires one disk drive. The program is organized as a binary tree so that names can be entered in any order and stored in alphabetical order. A larger number of names and addresses can be stored by changing the DIM statements in lines 30 thru 90.

The program first asks if there is an address file. Next the menu appears as follows:

- 1 - Add a Name
- 2 - List a Name
- 3 - List All Names
- 4 - Change a Name
- 5 - End

The required entries to add or change a name-address record are the name, the street address, the city-state-zip, and the telephone number. To list any one address, enter the name. The name must be entered as last name first with no commas. Option 5, "END", will always create a new name-address file. ■

Listing 1: Name-Address—a program for the Apple II that will store up to 100 entries, as shown here. More entries can be stored by changing the DIM statements in lines 30 thru 90.

```

10 REM BINARY TREE NAME/ADDRESS FILE
20 REM AUTHOR GARY A STOTTS
30 DIM N$(100): REM NAME ARRAY
40 DIM A$(100): REM ADDRESS ARRAYS
50 DIM B$(100)
60 DIM L$(100): REM LEFT LINK ARRAY
70 DIM R$(100): REM RIGHT LINK ARRAY
80 DIM P$(100): REM PHONE # ARRAY
90 DIM S$(50): REM STACK ARRAY
100 D$ = CHR$(14)
110 PRINT D$:"OPEN NAMADR, $6, D1"
120 CALL - 936: INPUT "IS THERE AN ADDRESS FILE (Y/N) ":Y$
130 IF Y$ = "N" THEN 200
140 PRINT D$:"READ NAMADR"
150 INPUT E
160 FOR I = 1 TO E
170 INPUT N$(I): INPUT A$(I): INPUT B$(I): INPUT L$(I): INPUT R$(I)
180 NEXT I
190 PRINT D$
200 CALL - 936: PRINT TAB(7):"NAME/ADDRESS PROGRAM": PRINT
210 PRINT "1 - ADD A NAME"
220 PRINT "2 - LIST A NAME"
230 PRINT "3 - LIST ALL NAMES"
240 PRINT "4 - CHANGE A NAME"
250 PRINT "5 - END"
260 PRINT: INPUT "ENTER YOUR SELECTION "":M$ = VAL (M$)
270 IF M$ < 1 OR M$ > 5 THEN 260
280 ON M$ GOSUB 320,720,930,1120,1340
290 GOTO 200
300 REM
310 REM ADD A NAME SUBROUTINE
320 CALL - 936: PRINT TAB(7):"ADD NAME RECORD": PRINT
330 E = E + 1: REM FIRST EMPTY POSITION IN LIST
340 I = 1: REM START SEARCH AT ROOT
350 INPUT "ENTER NAME "":N1$
360 IF LEN (N1$) < 1 THEN 350
370 INPUT "ENTER STREET ADDRESS "":A1$
380 IF LEN (A1$) < 1 THEN 370
390 INPUT "ENTER CITY-STATE-ZIP "":B1$
400 IF LEN (B1$) < 1 THEN 390
410 INPUT "ENTER PHONE NUMBER "":P1$
420 REM IF NAME IS LARGER THAN 1TH, SEARCH RIGHT BRANCH
430 IF N1$ > N$(I) THEN 500
440 IF N1$ < N$(I) THEN 480
450 PRINT "DUPLICATE NAME"
460 INPUT "ENTER C TO CONTINUE "":C$
470 RETURN
480 REM IF LEFT LINK NOT NULL, SEARCH LEFT BRANCH
490 IF L$(I) < > 0 THEN I = L$(I): GOTO 430
500 REM HANG NEW LEFT LINK ON PRIOR
510 L$(I) = E
520 N$(E) = N1$: REM FILL NEW RECORD
530 A$(E) = A1$
540 B$(E) = B1$
550 L$(E) = 0
560 R$(E) = 0
570 P$(E) = P1$
580 RETURN
590 REM IF RIGHT LINK NOT NULL, SEARCH RIGHT BRANCH
600 IF R$(I) < > 0 THEN I = R$(I): GOTO 430
610 REM HANG NEW RIGHT LINK ON PRIOR
620 R$(I) = E
630 N$(E) = N1$: REM FILL NEW RECORD
640 A$(E) = A1$
650 B$(E) = B1$
660 L$(E) = 0
670 R$(E) = 0
680 P$(E) = P1$
690 RETURN
700 REM
710 REM LIST A NAME SUBROUTINE
720 CALL - 936: PRINT TAB(7):"LIST A NAME/ADDRESS"
730 PRINT: INPUT "ENTER NAME TO LIST "":N1$
740 IF LEN (N1$) < 1 THEN 720
750 I = 1
760 IF N1$ > N$(I) THEN 870
770 IF N1$ < N$(I) THEN 850
780 PRINT N$(I): REM FOUND
790 PRINT A$(I)
800 PRINT B$(I)
810 PRINT P$(I)
820 PRINT: INPUT "KEY C TO CONTINUE "":C$
830 RETURN
840 REM SEARCH LEFT
850 IF L$(I) < > 0 THEN I = L$(I): GOTO 760
860 REM SEARCH RIGHT
870 IF R$(I) < > 0 THEN I = R$(I): GOTO 760
880 REM
890 PRINT "NAME NOT FOUND"
900 RETURN
910 REM

```

Listing 1 continued on page 34

DISCOUNT PRICES

APPLE II COMPUTERS

16K APPLE II	1089.00
32K APPLE II	1134.00
48K APPLE II	1179.00
DISK W CONTROLLER	545.00
DISK ONLY	475.00
APPLESOFT CARD	159.00
INTEGER CARD	159.00
PASCAL SYSTEM	425.00
SILENTYPE PRINTER	525.00



RAM MEMORY

FOR TRS-80, APPLE II	
16K SET 4116's	45.00

NORTH STAR COMPUTERS



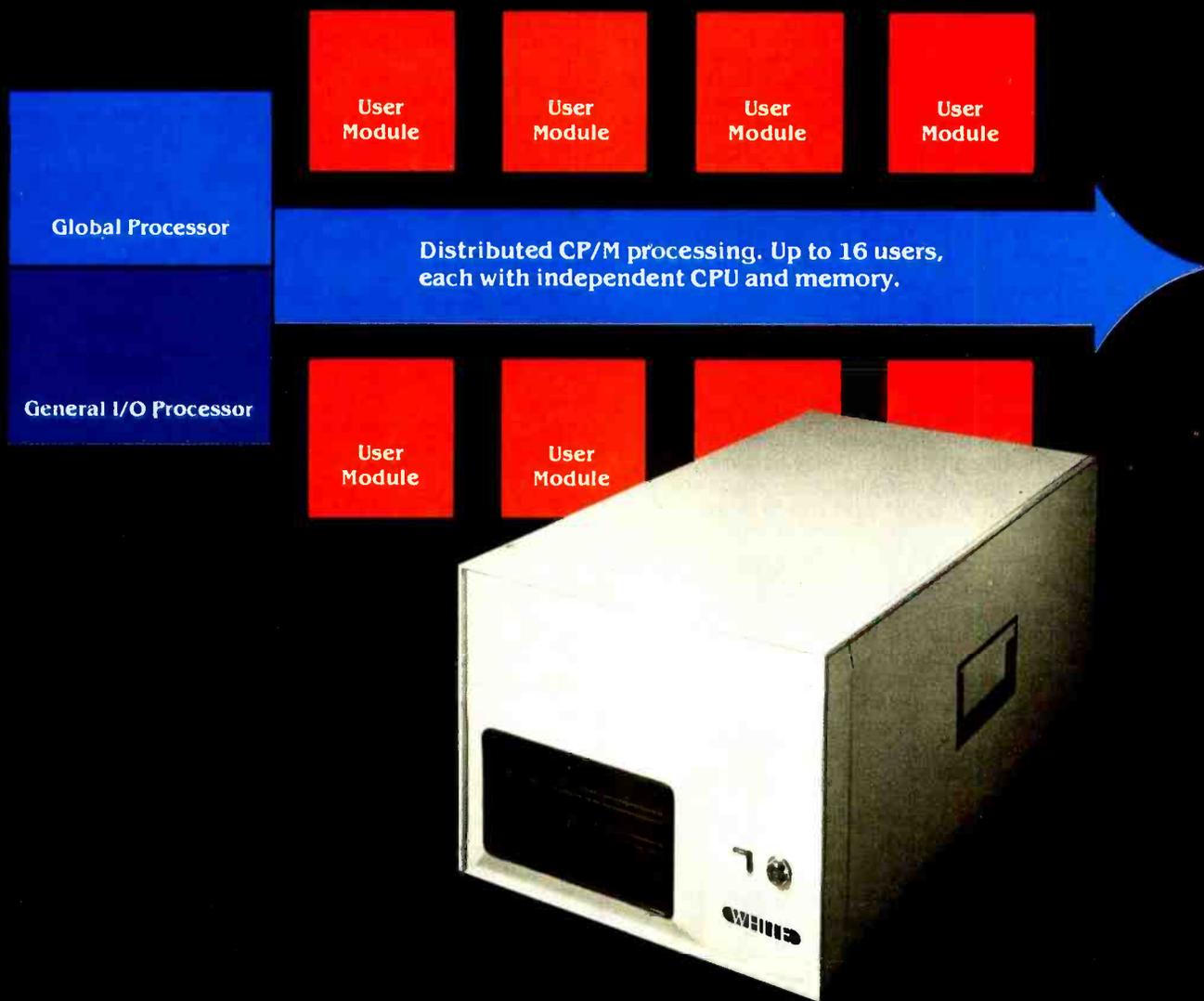
HRZ-1D-32K-ASM	2125.00
HRZ-2D-32K-ASM	2475.00
HRZ-1Q-32K-ASM	2375.00
HRZ-2Q-32K-ASM	2990.00

VERBATIM DISKETTES

BOX OF 10 5 1/4"	29.50
BOX OF 10 8"	39.50

FREDERICK COMPUTER PRODUCTS

MUNICIPAL AIRPORT
FREDERICK, MD. 21701
(301) 694-8884



How to tell if it's a White Computer.

(Users 2 through 16 — multiuser expansion with high performance through distributed processing.)

Look for a single user CP/M® system that expands to multiuser configurations economically.

Look for independent 6 MHz Z80B-based User Modules with 64K of RAM memory, each module with a port to the user terminal capable of handling baud rates of up to 38K under program selection. Look for high-speed block data transfers from user modules to the Global Processor for disk storage. That way, CP/M programs run independently for each user. Fast. And each user's station acts just like the fastest standalone system — no delays, no waiting for other users.

Look for a Z80-based Global Processor for disk and tape I/O that transfers data from disk to user modules at the data transfer rate of the peripheral device. And a controller that handles as many as 8

SMD disk drives for up to 528 megabytes of hard disk storage, plus up to four 8" floppies, *plus* optional streaming tape backup.

And look for a Z80-based General I/O Processor that supports up to eight printers — with 64K bytes of independent buffer memory.

That's part of how you tell if it's a White Computer. There's a lot more. Here's a number and address for more information.

CP/M is a registered trademark of Digital Research.
Z80, Z80A, Z80B are registered trademarks of Zilog Corporation.



White Computer Company △ 1876 Industrial Way
Redwood City, California 94063 △ 415 364 7570

High Technology

We make our competition obsolete with Information Master.™

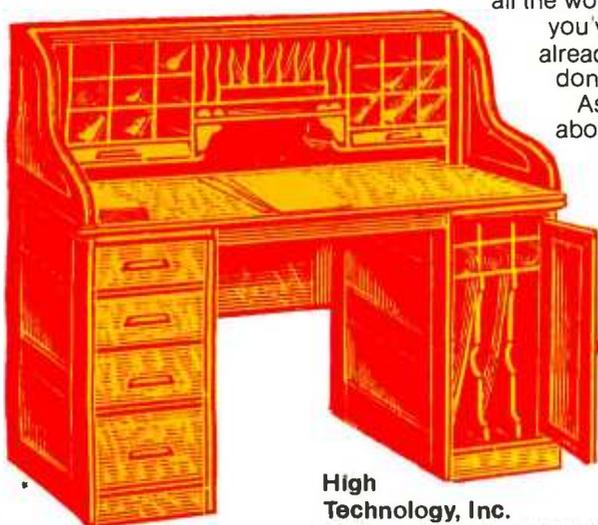
Information Master™ is the sophisticate of software packages, but it also speaks your language. Its uncomplicated English-speaking design makes it easy to learn. No programming knowledge is necessary. Put it in your Apple II*, and you're ready to go.

High Technology's Information Master organizes and prints everything from mailing lists to stock market data. Specify what records to store, type in the information, and Information Master organizes, calculates, stores and reports. Design your own reports and labels. Information Master is revolutionary in its adaptability and comes with a simple step-by-step instruction manual. Its screen layouts are designed to show you maximum information for easy operation. Information Master is so smart it stops mistakes that our competition lets you make.

If your computer dealer doesn't have Information Master, see one who does.

High Technology's perfect complement to Information Master, Data Master,™ allows you to change your mind months later

without redoing all the work you've already done. Ask about it!



High Technology, Inc.
Software Products Division
P.O. Box B-14665
8001 N. Classen Blvd.
Oklahoma City, Okla. 73113
405 840-9900

*Apple II is a trade name of Apple Computer, Inc

Programming Quickies

Listing 1 continued:

```

920 REM LIST ALL NAMES SUBROUTINE
930 P = 1:LI = 0:T = 0: CALL - 936
940 T = T + 1
950 SX(T) = P: REM PUSH STACK
960 IF P / \ 0 THEN P = LX(P): GOTO 940
970 T = T - 1
980 IF T = 0 THEN INPUT "ENTER C TO CONTINUE ":C: RETURN : REM ALL NAME FOUND
990 P = SX(T): REM POP STACK
1000 PRINT N6(P): REM PRINT NAME
1010 PRINT A6(P)
1020 PRINT B6(P)
1030 PRINT P6(P)
1040 PRINT
1050 LI = LI + 5
1060 IF LI = 20 THEN LI = 0: INPUT "ENTER C TO CONTINUE ":C
1070 T = T - 1
1080 P = RX(P): REM CHECK FOR RIGHT LINK
1090 GOTO 940
1100 REM
1110 REM CHANGE AN ADDRESS
1120 CALL - 936: PRINT TAB( 7):"CHANGE A NAME/ADDRESS": PRINT
1130 INPUT "ENTER NAME TO CHANGE ":N16
1140 IF LEN (N16) < 1 THEN 1120
1150 I = 1
1160 IF N16 \ N6(I) THEN 1310
1170 IF N16 \ N6(I) THEN 1290
1180 PRINT "OLD ":A6(I)
1190 INPUT "NEW ":A6(I)
1200 IF LEN (A6(I)) < 1 THEN 1190
1210 PRINT "OLD ":B6(I)
1220 INPUT "NEW ":B6(I)
1230 IF LEN (B6(I)) < 1 THEN 1220
1240 PRINT "OLD ":P6(I)
1250 INPUT "NEW ":P6(I)
1260 PRINT
1270 RETURN
1280 REM SEARCH LEFT
1290 IF LX(I) < \ 0 THEN I = LX(I): GOTO 1160
1300 REM SEARCH RIGHT
1310 IF RX(I) / \ 0 THEN I = RX(I): GOTO 1160
1320 REM
1330 REM EDJ
1340 PRINT D6:"DELETE NAMEADR"
1350 PRINT D6:"OPEN NAMEADR"
1360 PRINT D6:"WRITE NAMEADR"
1370 PRINT E
1380 FOR I = 1 TO E
1390 PRINT N6(I): PRINT A6(I): PRINT B6(I): PRINT P6(I): PRINT LX(I): PRINT RX(I)
1400 NEXT
1410 PRINT D6:"CLOSE"
1420 END

```

A Graphic Execution Display

R B Minton, 8617 E Stearn Lake Dr, Tucson AZ 85730

I wrote a program for my Ohio Scientific Superboard to compute artificial satellite orbits and noted it ran slower and slower as time and the number of orbits progressed.

It occurred to me that I could graphically display how fast the program was executing and find out where it was slowing down by adding some extra code. Every 20 lines or so, I inserted `K9=K9+1:GOSUB 2000`, and then at the end:

```

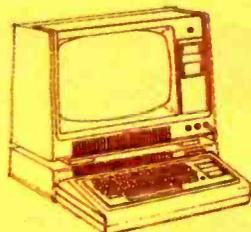
2000 S9=54244
2010 POKE S9+K9,48+K9
2020 FOR Z=1 TO 30:NEXT Z
2030 POKE S9+K9,32
2040 IF K9=9 THEN K9=0
2050 RETURN

```

This flashes the numbers 1 thru 9 from left to right on the bottom row of the video screen every time the main portion of the program loops. You can easily note the delay between certain numbers; this helps to pinpoint where the program is spending most of its time. The troublesome area or line can be further narrowed down by adding more GOSUBs, or by moving those from the faster part to the slower part. (Be sure that there are nine GOSUBs and that each is executed only once within the loop.)

This method alerted me to a poorly written line of code I would have otherwise never suspected. ■

TRS-80* Model I Computer Owners . . .



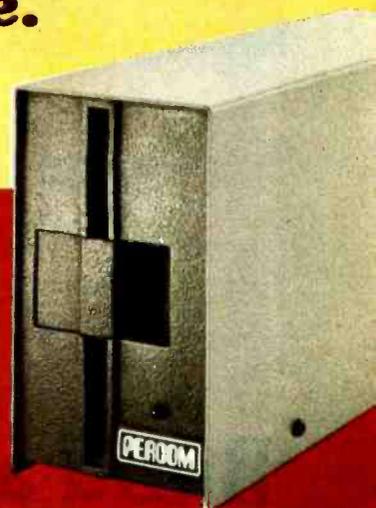
Double-density storage. It's really here!

Here at Percom. And your authorized Percom dealers.

And double-density storage is here in a big way. Because now you can choose from *three different levels* of mini-disk systems — all *double-density rated*.

And get the storage that precisely meets your application needs.

Not to mention the service and quality that's made Percom the industry leader.



Although rated for double-density operation, all levels of Percom drives *work equally well in single-density applications*.

You can operate these drives in ordinary single-density format using TRSDOS*, Percom OS-80™ or any other single-density operating system.

Or, you can add a Percom DOUBLER™ to your Tandy Expansion Interface and store data and programs in *either single- or double-density format*.

Under double-density operation, you can store as much as *350 Kbytes* of formatted data — depending on the drive model — on one side of a five-inch minidiskette. That's *four times* the capacity of standard 35-track Model I mini-disks, almost *100 Kbytes more than* the capacity of the *eight-inch IBM 3740 format!*

Available in 1-, 2- and 3-drive configurations in all three model lines, Percom *burned-in, fully-tested* drives start at only \$399.

TFD-40™ Drives



TFD-40 Drives store 180 Kbytes (double-density) or 102 Kbytes (single-density) of **formatted** data on one side of a 40-track minidiskette. Although economical-ly priced, TFD-40 drives receive the same full Percom quality control measures as TFD-100 and TFD-200 drives.

TFD-100™ Drives



TFD-100 drives are "flippy" drives. You store twice the data per minidiskette by using both sides of the disk. TFD-100 drives store 180 Kbytes (double-density) or 102 Kbytes (single-density) **per side**. Under double-density operation, you can store a 70-page document on one minidiskette.

TFD-200™ Drives



TFD-200 drives store 350 Kbytes (double-density) or 197 Kbytes (single-density) on one side of a minidiskette. By comparison, 3740-formatted eight-inch disks store only 256 Kbytes. Enormous on-line storage capacity in a 5" drive, plus proven Percom reliability. That's what you get in a TFD-200.



The DOUBLER™ — This proprietary adapter for the TRS-80* Model I computer packs approximately twice the data on a disk track.

Depending on the type of drive, you can store up to four times as much data — 350 Kbytes — on one side of a minidiskette as you can store using a

Tandy standard Model I computer drive.

Easy to install, the DOUBLER merely plugs into the disk controller chip socket of your Expansion Interface. No rewiring. No trace cutting.

And because the DOUBLER reads, writes and formats *either single- or double-density* disks, you can continue to run all of your single-density software, then switch to double-density operation at any convenient time.

Included with the PC card adapter is a TRSDOS*-compatible double-density disk operating system, called DBLDOS™, plus a CONVERT utility that converts files and programs from single- to double-density or double- to single-density format.

Each DOUBLER also includes an on-card high-performance *data separator circuit* which ensures reliable disk read operation.

The DOUBLER works with standard 35-, 40-, 77- and 80-track drives rated for double-density operation.

Note. Opening the Expansion Interface to install the DOUBLER may void Tandy's limited 90-day warranty.

Free software patch with drive purchase. This software patch, called PATCH PAK™, upgrades TRSDOS* for single-density operation with improved 40- and 77-track drives.

Quality Percom products are available at authorized dealers. Call toll free 1-800-527-1592 for the address of your nearest dealer or to order directly from Percom. In Canada call 519-824-7041.

™ trademark of Percom Data Company, Inc.

Prices and specifications subject to change without notice.

mark of Tandy Radio Shack Corporation which has no relationship to Percom Data Company.

PERCOM

PERCOM DATA COMPANY, INC.
211 N. KIRBY • GARLAND TX • 75042
(214) 272-3421

Build a Low-Cost Logic Analyzer

Steve Ciarcia
POB 582
Glastonbury CT 06033

The Digital Age has spawned a variety of electronic troubleshooting aids, including logic probes, integrated-circuit test clips, multi-trace oscilloscopes, and logic analyzers. All are useful, up to a point, but it is important to know when to use a particular test instrument and how much you can depend on it.

If the logic states of signal lines were the only information needed, a simple voltage measurement would suffice in digital troubleshooting. But *timing*, rather than *absolute voltage level*, is the more important consideration in digital systems. Most digital systems operate by setting discrete logic conditions on bus lines and then *strob*ing that data through the system at the occurrence of edges of specific clock pulses. A system operates correctly only if all the parallel states are set correctly at a specific instant in time. The system fails if any single logic state is in error at any clock time during program execution.

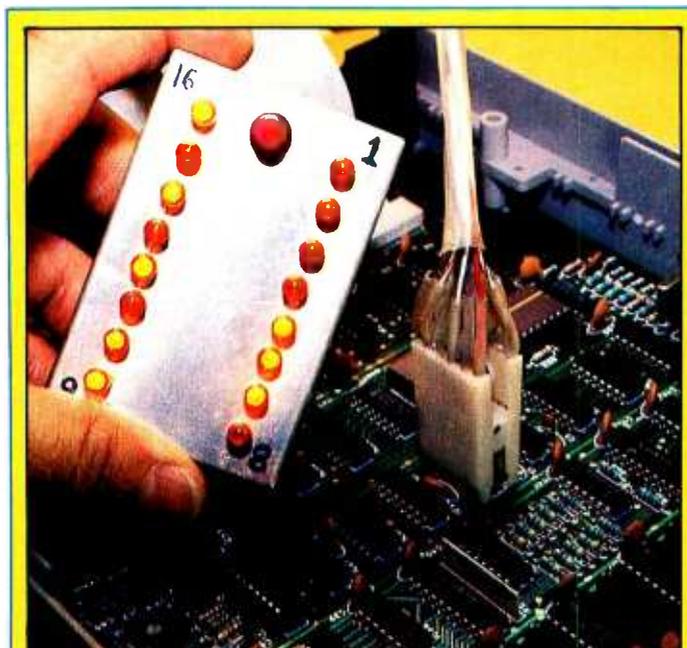


Photo 1: One frequently used test instrument is a direct-reading state indicator. The sixteen indicators are transistor-driven incandescent lamps or LEDs (light-emitting diodes). The indicator panel is attached to a "chip-clip" connector so that the logic states on any TTL (transistor-transistor logic) or LS (low-power Schottky-diode-clamped) TTL dual in-line package can be read while the circuit is energized. The display is most valid for static conditions.

The first special digital instrument was the logic probe. A schematic diagram of a typical logic probe is shown in figure 1. This device accurately indicates the logic state on

LED (light-emitting diode) indicators at any selected point in a circuit. However, it is a static device and will not follow rapidly clocked digital logic other than to indicate general activity. Even when the concept is expanded to include fourteen or sixteen separate indicators on the probe (as shown in photo 1), effective use still depends on stopping the system clock (or slowing it substantially) to examine static logic states. Unfortunately, stopping the clock changes the dynamics of circuit operation and may, in many instances, mask the true cause of problems.

More frequently, digital-logic errors are dynamic and occur during clock-state transitions. The errors are often due to timing problems associated with the propagation of signals through the circuit or with miscuing of multiplexed components. Because the logic state at clock transitions often

Copyright © 1981 by Steven A Ciarcia.
All rights reserved.

determines either proper operation or failure, a more suitable test instrument would be one that provides the operator with a view of all logic activity coincident with the transition of the clock.

To most people this sounds like a job for a multi-trace oscilloscope with its sweep triggered from the system clock. An oscilloscope can in many instances be of value, but unless it is an expensive storage-tube scope, fast system-clock rates can make viewing difficult. Also, viewing two signals with respect to each other in real time is of little help when the error occurs intermittently and involves more signals than can be viewed simultaneously.

What Is a Logic Analyzer?

One solution to the digital-troubleshooting dilemma is called a logic analyzer. This is an instrument that displays a "truth table" of the activity of the digital circuit being tested under actual operating conditions. After you have selected a key combination of input signals, called a *trigger* or *sync word*, and activated the analyzer, it stores all signal-input logic states for a specific number of

system-clock transitions. Depending upon the sophistication of the particular unit, many commercial logic analyzers can accommodate 32 or more inputs and store up to 256 clock cycles before and after the trigger event.

A logic analyzer acts like an electronic time machine.

In effect, a logic analyzer acts like an electronic time machine. When sequentially displayed in the order it was acquired, the stored data can be used to form state tables or timing diagrams of the circuit's operation.

For example, a logic analyzer might be used to troubleshoot a malfunctioning microcomputer I/O (input/output) port that keeps receiving consistent but wrong data. You don't know whether the error is caused by the wrong data being sent to the output register or by an incorrect address signal strobing the register at the

wrong time (try troubleshooting this kind of problem with just an oscilloscope). You can find out by connecting the logic analyzer to the address and data buses of the microcomputer.

Set the trigger-word switches to produce a trigger pulse when the address bus contains the I/O port address. When the trigger pulse occurs, you can examine the logic states on the data bus with the analyzer to see what value was being loaded into the port register at the occurrence of the trigger pulse, as well as those states following the pulse. It is like having an 8- to 32-channel oscilloscope with the display frozen in time on a specific clock cycle.

Commercial logic analyzers are generally stand-alone instruments with integral video-monitor or oscilloscope displays. They can present stored data in a variety of ways. A *data-domain* analyzer ordinarily displays logic states as lists of 1s and 0s. The listings are sequential and in either binary, octal, or hexadecimal format. This display method is particularly helpful when you are debugging address-bus problems. In such cases, data is most easily read as

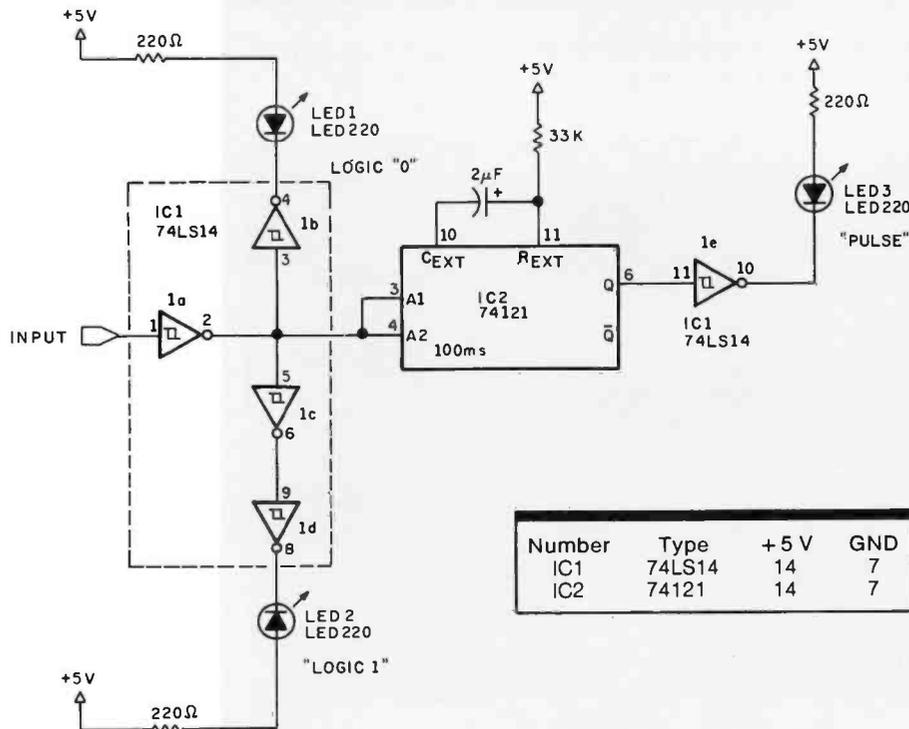


Figure 1: A simple logic probe that uses two integrated circuits. When a logic-0 signal voltage is applied to the input, the "logic 0" LED will light. When a logic-1 signal voltage is applied to the input, the "logic 1" LED indicator will light. If the input oscillates between the 0 and 1 states, the "Pulse" LED indicator will also light.

4-digit hexadecimal values.

For hardware troubleshooting, a *time-domain* analyzer is preferred. This unit presents the stored data in timing-diagram format. The result appears like the display of an 8- or 16-channel oscilloscope. The vertical scale has a high-voltage value that represents a logic 1 and a low-voltage value that represents a logic 0. The

data signals are plotted with respect to each other and can be displayed as a function of actual time.

A third data format is the *mapped* mode. Essentially, the display screen is divided into an *x, y* coordinate system, and data points are plotted as dots on the screen. In some units, vectors between dots connect successive data points so that it is easier for an

operator to trace sequential activity in the device under test. The process of interpreting this kind of display is essentially one of recognizing a "good" pattern and identifying wild vectors. Presumably, a properly operating program will have a repeatable pattern. Any discrepancies will show up as an extra dot or "wild vector."

The various types of logic-analyzer display formats are shown in figure 2 on page 40.

Regardless of the display format, all logic analyzers share a common internal structure. Generally, they incorporate the subsystems outlined in the block diagram of figure 3. All logic analyzers have some form of input conditioning, trigger-word selection and comparison, memory, and display (LEDs, oscilloscope, or raster-display tube, etc). The combination of capabilities is usually a function of price, which can range from \$2500 to \$10,000.

A Low-Cost Logic Analyzer

Obviously, we cannot hope to construct a logic analyzer that is equivalent to an \$8500 Hewlett-Packard unit. However, we can design a special logic analyzer as a peripheral device of a personal computer. By utilizing the display and processing power of the computer, we can greatly enhance the capabilities of a relatively simple hardware interface. Also, for those readers interested in the concept but not quite ready to grab their soldering irons, I will outline a method that demonstrates how to use your present computer to perform logic-analyzer functions totally in software. First, the hardware approach.

Figure 4 is the schematic diagram of a low-cost eight-input logic-analyzer interface that requires only one and a half parallel I/O ports (9 output and 6 input bits) for complete operation. It is easily expandable to 16 or even 32 inputs.

All probe inputs and clock signals are conditioned through Schmitt triggers to reduce noise and false triggering. When the sync word, set on external switches (SW1 through SW8), appears on the input lines, the analyzer automatically collects and stores 16 sequential words repre-



Photo 2: The prototype logic analyzer described in this article. The switches on the left are for setting the trigger (sync) word.

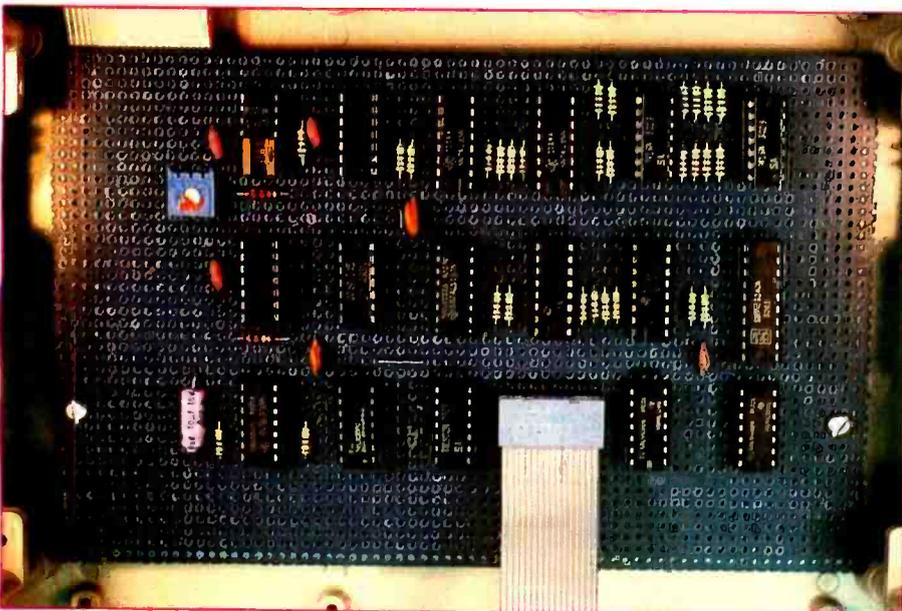


Photo 3: Inside the box of photo 2 is the circuit of the analyzer as shown schematically in figure 4. Seventeen integrated circuits are used.

senting input status at the instant of either an internal or external clock signal (usually the system clock). It can operate on either edge of the clock pulse and store data at frequencies as fast as 5 MHz. The prototype interface is shown in photo 2.

Unlike commercial logic analyzers, this unit has no integral CRT (cathode-ray tube) display: it has eight externally controlled LEDs. It depends instead upon the computer to display the list of stored data. After the interface has taken sixteen samples, it sends a Scan Complete signal to the computer. A computer program sets the Read/Write line to the Read mode and sets a 4-bit address to access the contents of the 16-word scratch-pad memory. As the 4-bit address is incremented, the appropriate 8-bit output is placed on the analyzer's data-output lines from the scratch-pad memory and is stored by the computer. In addition, as the computer reads the scratch-pad memory, the contents of each location are displayed on eight LEDs. If the addresses are changed slowly, or are otherwise physically set, the 16 stored words can be viewed directly without a special display program.

Once the data has been acquired by the computer, a format-and-display program lists the values on the computer's display in binary, octal, or hexadecimal format, simulating a commercial analyzer display. To gather an additional 16 words, the computer program merely sets the Read/Write line to the Write mode and toggles the Sample Enable line. The BASIC program in listing 1 on page 43 exercises the interface and displays the output shown in listing 2.

Inside the Interface

The analyzer hardware (shown in photo 3) has an interface consisting of seventeen integrated circuits. Input signals are fed through IC1 and IC2, which are hex Schmitt-trigger inverters. Photo 4 shows typical test connections. These conditioned outputs are in turn buffered and gated through to the memory section by IC3, a type-74LS240 8-input bus driver. The output of this driver is compared to eight preset switches through two 74L85 4-bit comparators (IC7 and IC8). (Trigger-word initiation is disabled by setting all switches to the logic-1 state. Storage will com-

mence on the first clock pulse after Sample Enable.) If the switch settings and data input are equal, a pulse is generated which stores the current input data. The first word stored is usually the sync word (assuming that the trigger word and external clock-pulse edge are synchronous).

On the trailing edge of the WE (memory-write-enable) pulse, the 4-bit memory-address counter IC9 is incremented. Data will be stored again at the occurrence of the next edge (positive or negative as selected) of the clock pulse.

Text continued on page 42

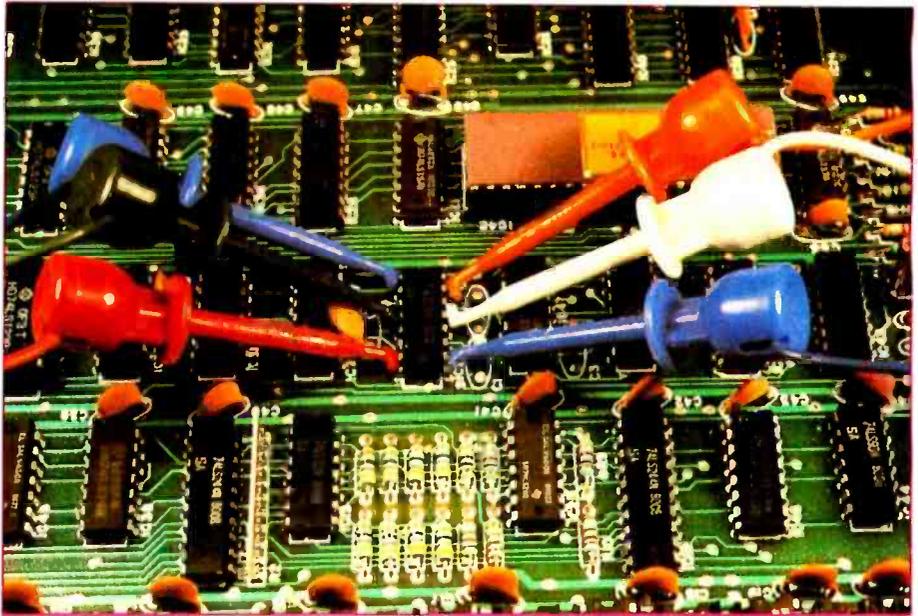


Photo 4: The analyzer is intended for use while a circuit is in dynamic operation. Connection to the circuit can be done with the "chip-clip" method shown in photo 1, or by using separate test probes. The latter is more versatile. The circuit shown under test is the Disk-80 expansion interface from last month's *Circuit Cellar*.

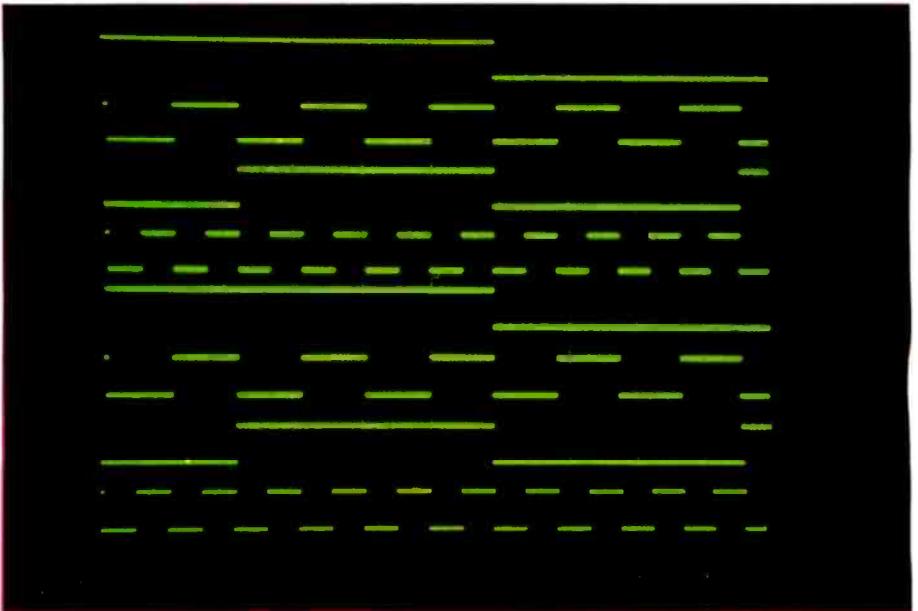


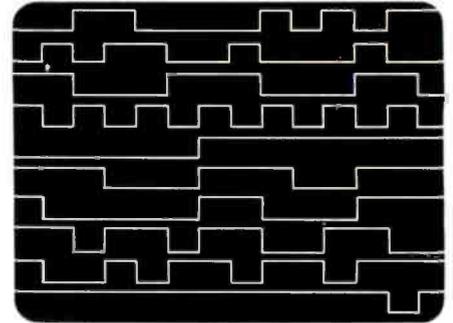
Photo 5: When the circuit of figure 5 (on page 42) is attached to the logic analyzer, a data-domain display can be converted to a time-domain display. Essentially nothing more than an eight-channel scope multiplexer, this circuit greatly expands the display potential of the average oscilloscope, as the photo demonstrates.

TRIGGER		3AC0	
PRE-TRIG		0063	
0110	0111	0110	1100
0110	0111	0110	1100
0110	0111	0110	1100
0110	0111	0110	1100
0110	0111	0110	1100
0110	0111	0110	1101
0110	0111	0110	1101
1011	0111	0110	1101
1011	0111	0110	1101

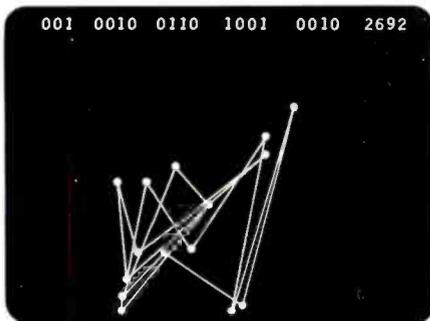
(2a)

TRIGGER		3AC0	
PRE-TRIG		0063	
676C		AF39	
676C		AF39	
676C		AF39	
676C		AF39	
676C		AF39	
676D		AF39	
676D		AF39	
B76D		1338	
B76D		1338	

(2b)



(2c)



(2d)

Figure 2: The data acquired by a logic analyzer can be displayed in various formats. The different types are:

(2a) The ones and zeros logic-state display. In this format, binary words are plotted against clock pulses in a matrix m bits wide by n clock pulses deep. This format is used most often where word flow or data sequence is of prime concern.

(2b) Same as 2a except that the data is listed in hexadecimal notation. Hexadecimal listings are most frequently used in logic analyzers specifically designed for microprocessor troubleshooting, where thirty-two to forty inputs are not uncommon.

(2c) The timing-diagram display. In the timing format, data words are plotted against time. This format is used most often for hardware troubleshooting to detect incorrect timing between signals.

(2d) Vector-display analyzer. In the vector-display format, data words define points on an x, y coordinate system. Usually, the data word is divided in half with a separate D/A converter attached to each segment. One output goes to the display's x input and the other goes to the y input.

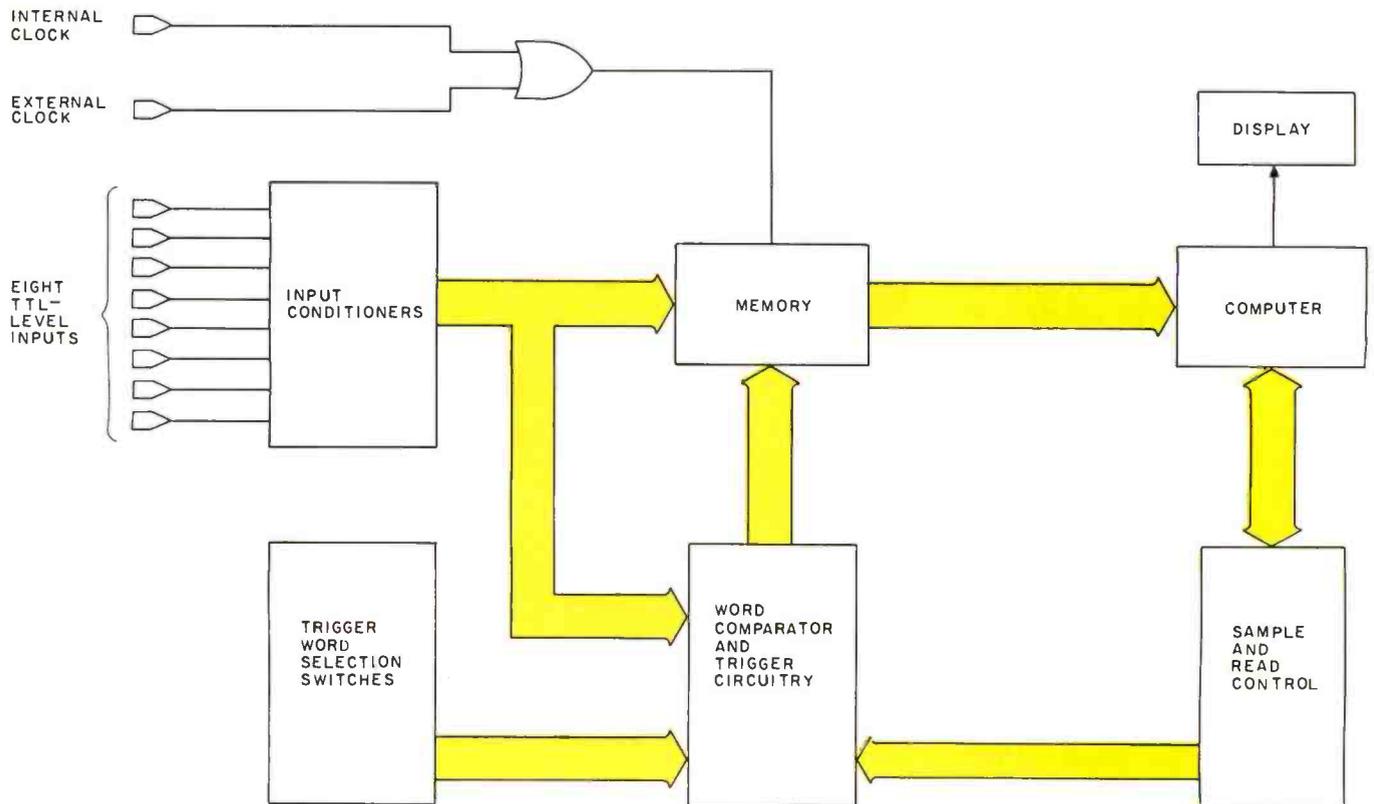


Figure 3: Basic block diagram of the simple logic analyzer. In this case, the block labeled "computer" refers to an externally attached personal computer. In commercial units, the computer and display are integral components of the logic analyzer.

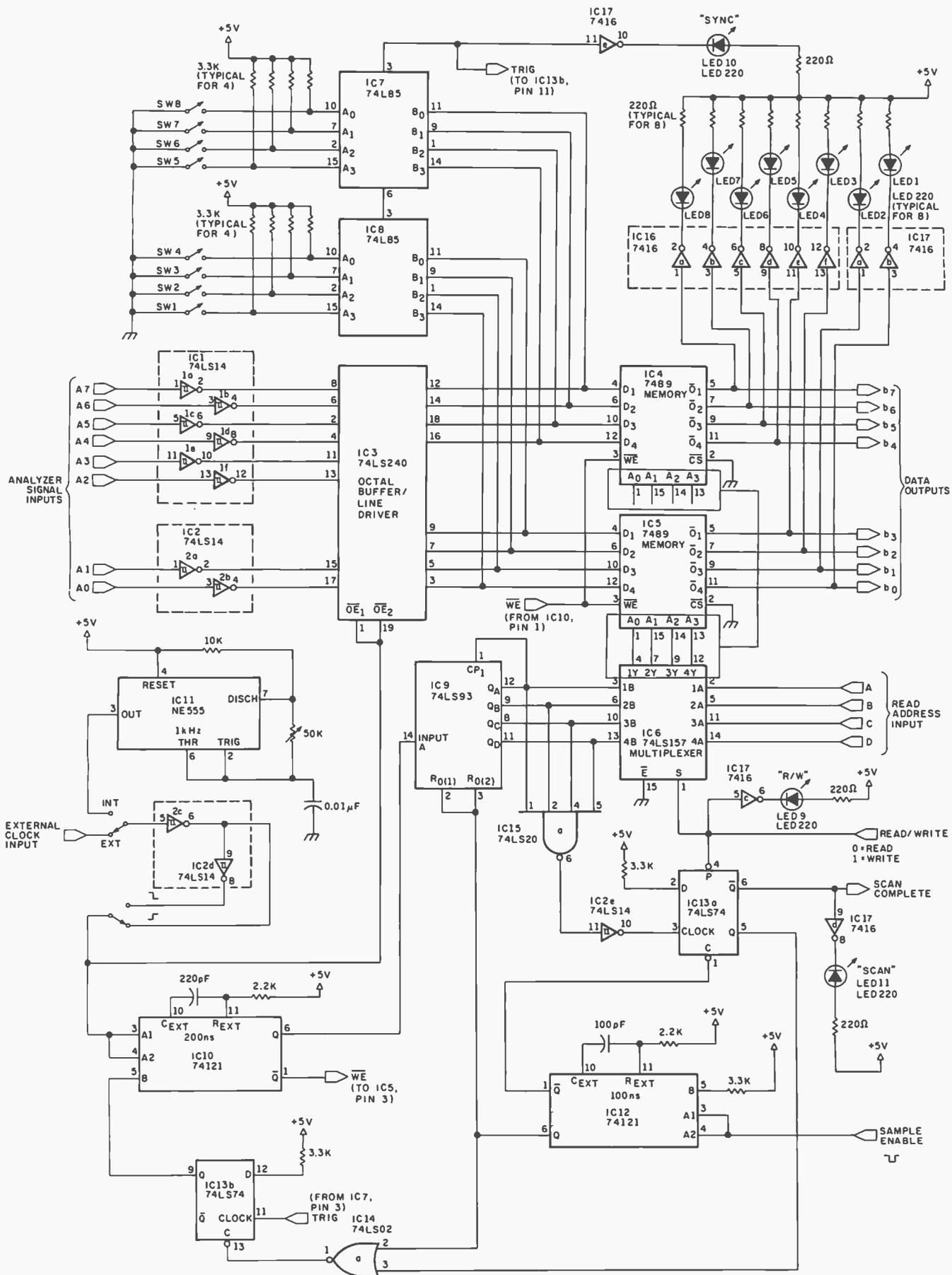


Figure 4: Schematic diagram of an eight-input logic analyzer. One and a half parallel I/O ports are required for operation. Note that the 74LS85 integrated circuits used here have a different pinout specification from the 74LS85. User connections are on the left; computer connections are on the right.

Number	Type	+5 V	GND
IC1	74LS14	14	7
IC2	74LS14	14	7
IC3	74LS240	20	10
IC4	7489	16	8
IC5	7489	16	8
IC6	74LS157	16	8
IC7	74L85	16	8
IC8	74L85	16	8
IC9	74LS93	5	10
IC10	74121	14	7
IC11	NE555	8	1
IC12	74121	14	7
IC13	74LS74	14	7
IC14	74LS02	14	7
IC15	74LS20	14	7
IC16	7416	14	7
IC17	7416	14	7

Table 1: Power connections for integrated circuits of figure 4, on page 41.

Text continued from page 39:

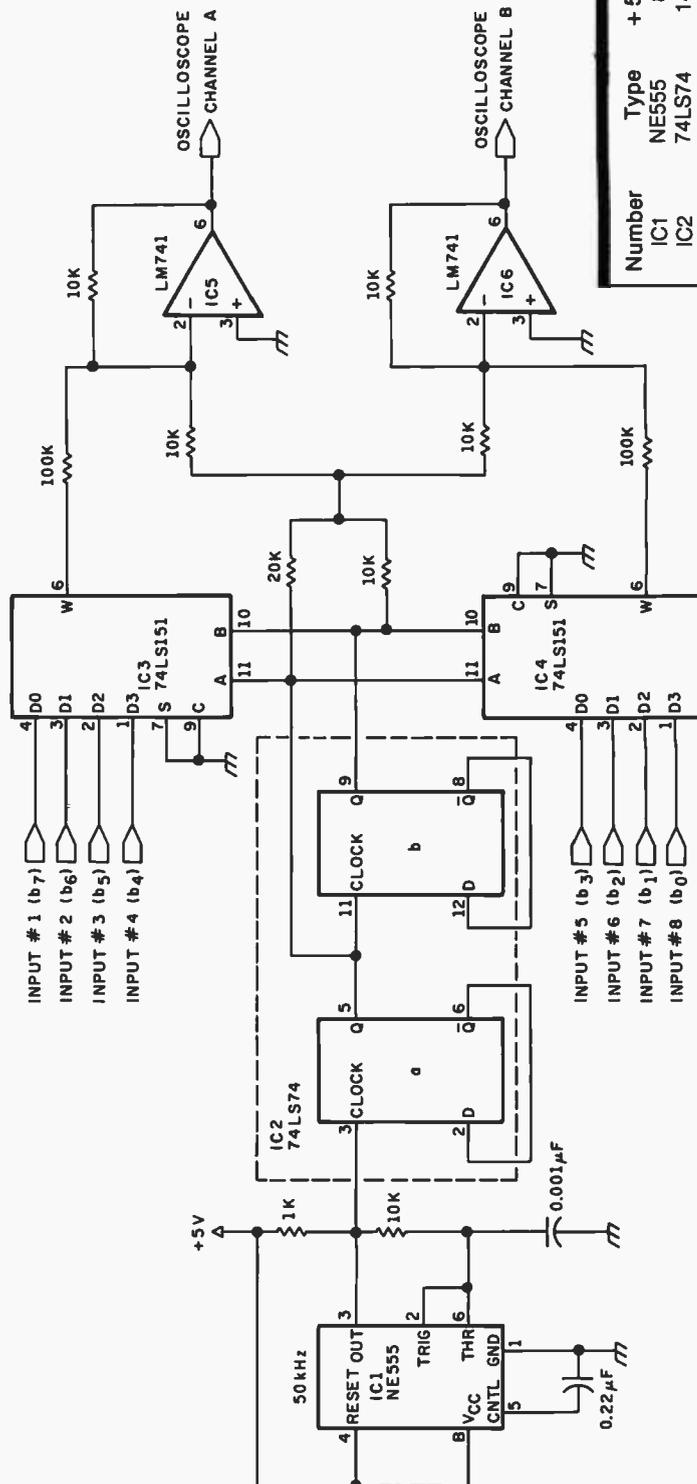
When sixteen samples have been taken, the 4-bit memory address is binary 1111. IC13 and IC14 detect this condition and set the Scan Complete line to a logic 0. This also disables further storage until the interface is reset with a Sample Enable pulse to IC2.

Reading the contents is simply a matter of setting the Read/Write line to a logic 0 and placing an appropriate 4-bit address on the Read Address input lines. When an address is set on these lines, the data-output lines of the analyzer will contain the contents of that memory location. The eight LEDs will also display that value.

Creating a Time-Domain Display

As previously mentioned, the display format available from this interface is generally a listing of 1s and 0s. This is quite useful under most circumstances but not as appealing to hardware buffs as a timing-diagram-type output. Even if your computer has graphics capability, writing a program to simulate a multi-trace oscilloscope display requires considerable software expertise.

The logic-analyzer interface can be converted to a time-domain display with relatively little extra hardware and only a single-line BASIC program. Figure 5 is the schematic diagram of the additional circuitry. Essentially, it consists of a dual 4-input digital multiplexer and 2-bit D/A (digital-to-analog) converter, which offsets each of the four channels when displayed. In effect, it



Number	Type	+5 V	GND	-5 V
IC1	NE555	8	1	
IC2	74LS74	14	7	
IC3	74LS151	16	8	
IC4	74LS151	16	8	
IC5	LM741	7	7	4
IC6	LM741	7	7	4

Figure 5: Eight-channel display multiplexer, which facilitates display of eight TTL inputs on a standard dual-trace oscilloscope. Its intended use is to convert the data-domain output from the circuit of figure 4 into a time-domain display on an oscilloscope.

allows a dual-trace oscilloscope to display eight channels simultaneously. Such a display appears in photo 5.

Conversion from data-domain to time-domain operation is not as difficult as it might seem. Consider the operation of the analyzer for a moment. Once the 16-word buffer is full, the data can be read out at any rate. If we cycle the read addresses very quickly, the outputs will form a repetitive pattern which can be easily viewed on an oscilloscope. The fast cycling can be accomplished using a 4-bit counter and oscillator source attached to the address-input lines or by using a simple program statement like:

```
100 FOR X = 0 TO 255:OUT 16,X:
NEXT X:GOTO 100
```

Using a dual-trace oscilloscope, you can view two signals, or, with the circuit of figure 5, you can view all eight data channels simultaneously. Since there is no system clock to contend with and the pattern repeats every sixteen steps, triggering problems are reduced and the display is stationary. All other interface operations remain the same.

Adding a Vector-Display Capability

If you are determined to hunt "wild vectors," the same technique employed to provide a timing plot lends itself to vector display. Using the same methods to cycle the buffer data on the output lines of the analyzer, substitute D/A converters for the multiplexer in figure 5. Typically, two 4-bit D/A converters are needed. One would be attached to the 4 high-order bits and the other to the 4 low-order bits. One D/A converter is attached to the x-axis scope input and the other to the y-axis input. When the buffer is cycled, a unique vector pattern will appear on the screen, describing the 16 data words stored in the analyzer's buffer. (A more informative discussion on this approach to troubleshooting was one of my previous articles, "A Penny Pinching Address State Analyzer," February 1978 BYTE, page 6. It has been reprinted in *Ciarcia's Circuit Cellar*, Volume I, available from BYTE Books.)

Listing 1: A BASIC program that exercises the computer/logic analyzer interface, displaying output through the computer's normal output devices.

```
100 REM Logic Analyzer Program
110 REM
120 REM data in on port 16, scan complete on bit 0 of port 17
130 REM read enable and sample enable are bits 6 and 7
140 REM of port 16
150 REM read address is bits 0 thru 3 of port 16
160 REM memory locations 25000 to 25015 is set aside as the data
170 REM buffer
180 PRINT"LOGIC ANALYZER"
190 PRINT:PRINT"Enable New Sample or List Analyzer Buffer";
200 PRINT" (E or L)";
210 INPUT A$
220 IF A$ ="E" THEN 250
230 IF A$ ="L" THEN 380
240 GOTO 190
250 REM Enable Logic Analyzer and take 16 readings
260 REM pulse sample enable line and set read/write line=0
270 OUT 16,255:OUT 16,0: OUT 16,255
280 REM
290 REM test scan complete line
300 IF INP(17) =255 THEN GOTO 300
310 REM when scan is completed store readings in table
320 FOR S=25000 TO 25015
330 N=S-25000
340 REM set read address and store analyzer output
350 OUT 16,N :A=INP(16):POKE S,A
360 NEXT S
370 GOSUB 380
380 REM Ones and Zeros data-domain display routine
390 PRINT:PRINT
400 PRINT"D7 D6 D5 D4      D3 D2 D1 D0"
410 FOR S=25000 TO 25015 :X=PEEK(S)
420 FOR N=7 TO 0 STEP -1
430 W=X AND 2^N
440 IF W>0 THEN PRINT"1  "; ELSE PRINT"0  ";
450 IF N=4 THEN PRINT" ";
460 NEXT N
470 PRINT"  SAMPLE #";S-24999
480 NEXT S
490 GOTO 190
```

READY

Listing 2: Sample output produced by the program of listing 1.

```
RUN
LOGIC ANALYZER

Enable New Sample or List Analyzer Buffer (E or L)? E
```

D7	D6	D5	D4	D3	D2	D1	D0	
0	0	0	0	1	1	1	0	SAMPLE # 1
1	1	0	1	0	1	0	1	SAMPLE # 2
0	0	1	1	1	0	1	0	SAMPLE # 3
1	0	0	0	1	0	0	0	SAMPLE # 4
0	0	0	0	0	0	0	1	SAMPLE # 5
1	1	1	1	0	1	0	1	SAMPLE # 6
1	1	0	0	1	1	0	1	SAMPLE # 7
0	0	0	1	0	0	0	0	SAMPLE # 8
0	0	0	1	0	1	1	0	SAMPLE # 9
1	1	1	1	0	0	0	1	SAMPLE # 10
1	1	1	0	0	0	1	1	SAMPLE # 11
0	0	1	0	0	0	1	0	SAMPLE # 12
1	0	1	0	0	1	1	0	SAMPLE # 13
0	0	0	0	0	0	0	1	SAMPLE # 14
0	0	0	1	1	1	1	1	SAMPLE # 15
1	1	0	0	1	1	0	1	SAMPLE # 16

Enable New Sample or List Analyzer Buffer (E or L)?

Logic-Analyzer Functions Created Through Software

While I generally prefer to demonstrate hardware interfaces in my articles, the functions of a logic analyzer can easily be simulated in software if data-acquisition speed (under 20 kHz) is not critical. While it may not be appropriate for testing microcomputer bus signals, it should work for slower applications.

Figure 6 is a flow diagram outlining the specific steps involved in accomplishing this function. While any existing parallel input port will suffice, the Motorola 6820 PIA (Peripheral Interface Adapter) shown has a separate clock input, which greatly facilitates proper timing.

In Conclusion

As digital hardware becomes more complex, the instruments used in troubleshooting and debugging these circuits must themselves become more sophisticated. This sophistication, however, need not always be provided in the form of a commercially produced test instrument. Often the solution can be intelligent application of existing equipment with limited modifications.

The logic analyzer I have described can be used for all types of troubleshooting and testing of digital circuits. However, its true flexibility is revealed when the instrument captures the extremely fast data flowing in a microcomputer and generates a stationary timing diagram with the results. Built from scratch, combined with an oscilloscope, and exercised by a computer, this interface costs only a fraction of the price of commercial analyzers, yet approximates many of their features.

Next Month:

Build a remote-controlled motorized moving platform. ■

Editor's Note: Steve often refers to previous Circuit Cellar articles as reference material for the articles he presents each month. These articles are available in reprint books from BYTE Books, 70 Main St, Peterborough NH 03458. Ciarcia's Circuit Cellar covers articles appearing in BYTE from September 1977 thru November 1978. Ciarcia's Circuit Cellar, Volume II presents articles from December 1978 thru June 1980.

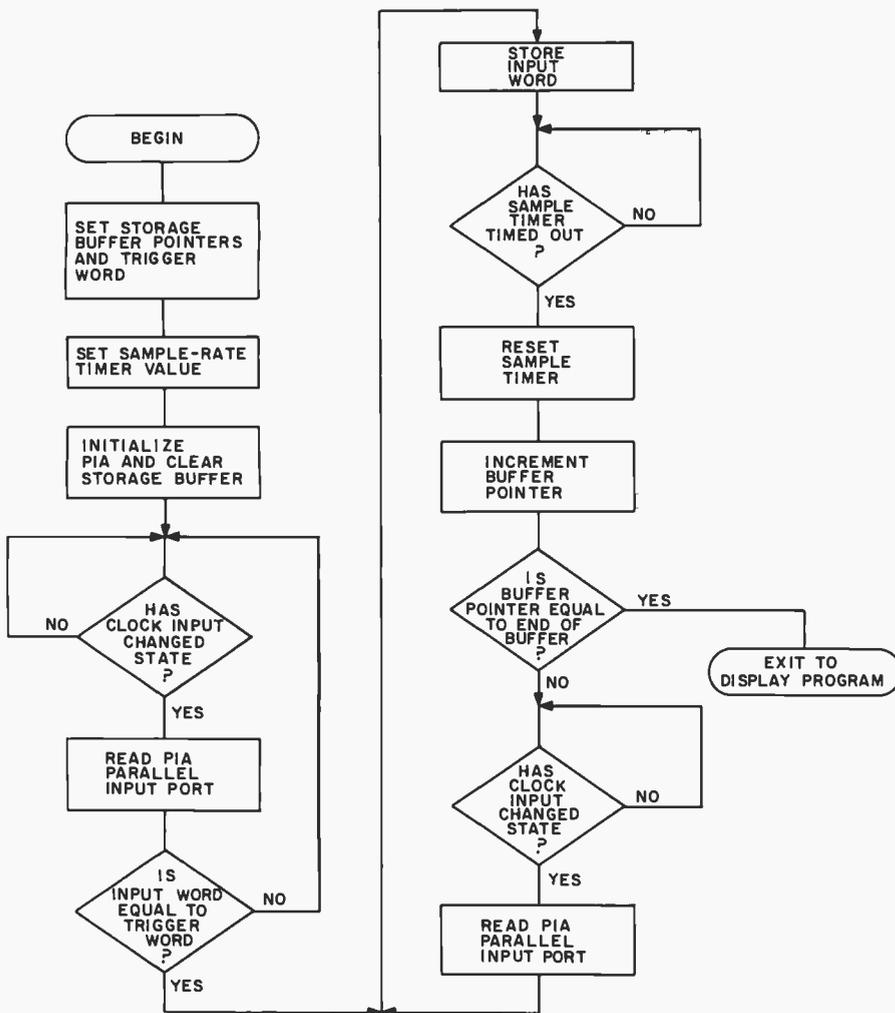


Figure 6a: Flowchart of a software logic analyzer. Using a Motorola 6820 PIA (Peripheral Interface Adapter), this sequence of operations is all that is required to demonstrate logic-analyzer functions in software. This method is limited in speed of operation by the execution time of the program.

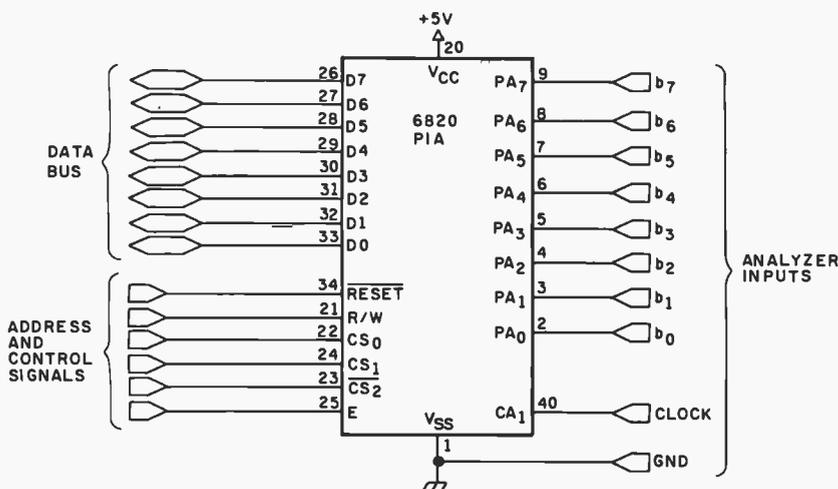
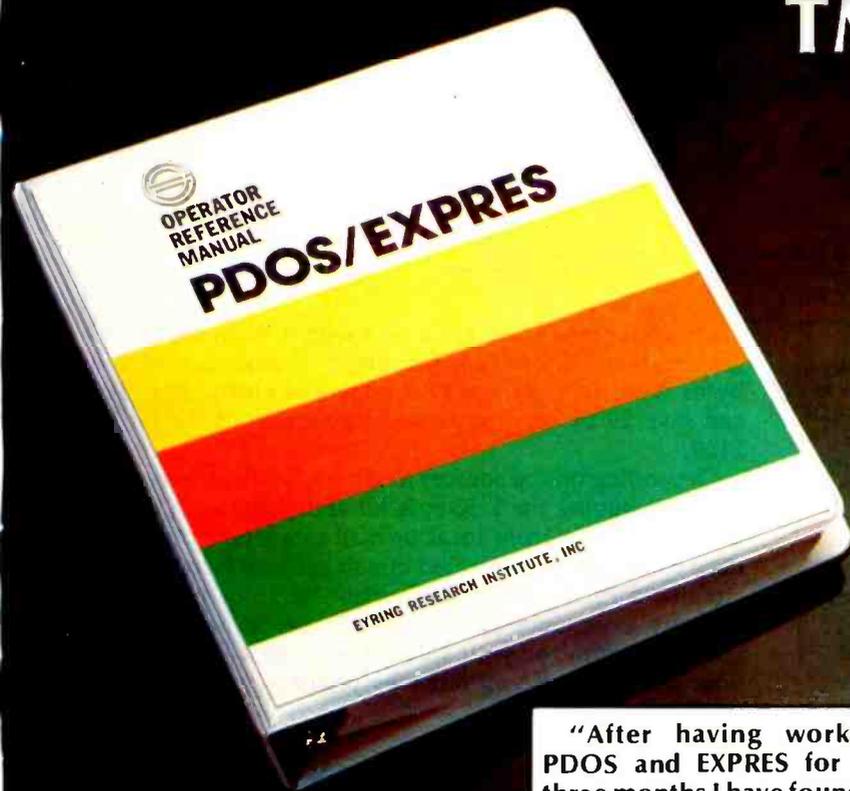


Figure 6b: Pinout chart of the Motorola 6820 PIA used by the algorithm of figure 6a.

Development Software For Texas Instruments TM990 Micro Modules



"After having worked with PDOS and EXPRES for the past three months I have found them to be a powerful and versatile combination. The true multi-user, multi-tasking capability has made it a pleasure to use in our laboratory environment where programs are being used simultaneously for controlling laboratory apparatus taking and reducing data. . . We are enthused by the product. . ."

Tom Ochs
Assistant Research Professor
Desert Research Institute

Eyring Research Institute, Inc., authors of TI's POWER BASIC™ and UNIVERSITY BASIC™, is pleased to release development software for use on the TM 990 microcomputer modules. PDOS/EXPRES™ is a powerful multi-user, multi-tasking operating system designed for development, scientific and industrial applications.

The PDOS/EXPRES™ system includes:

- 8k byte PDOS multi-tasking operating system
- Advanced EXPRESS BASIC language interpreter
- Stand alone run module support

PDOS supports up to 16 concurrent user tasks with prioritized round robin clock swapping. Up to 32 contiguous or non-contiguous files can be simultaneously open in sequential, random, shared and read only access modes. Large or small floppy disks, bubble memory, hard disks

and extended memory capabilities of up to 256k bytes are handled by the operating system. Named files on 256 directory levels are easily accessible from EXPRES BASIC and assembly language programs. Disk files are time stamped with date of creation and last update. I/O drivers are a simple extension to the PDOS file structure.

The EXPRES BASIC interpreter uses advanced interpreting techniques which approach execution speeds of common threaded code compilers while maintaining the highly advantage-

ous interactive approach to program development. Other features include:

- Multi-line recursive functions with local variables
- Variable names of unlimited length
- Reverse Polish pseudo-source token storage

PDOS/EXPRES™ is available for either an EPROM based system or a RAM based system. A handsome 250 page Operator Reference Manual walks you through the features and use. All for an attractive price of \$1500.00*.

Order your PDOS/EXPRES™ software from your nearest authorized Texas Instruments distributor or contact Eyring Research Institute, Inc. for further information and a free color brochure. Write or call Eyring Research Institute, Inc., Software Marketing Dept., 1455 West 820 North, Provo, Utah 84601, phone (801) 375-2434.

® Eyring Research Institute, Inc.

*U.S. price, subject to change without notice

The MicroAce Computer

Delmar Searls, 1825 S Johnstone, Bartlesville OK 74003

About the Author

Delmar Searls is a professor of mathematics at Bartlesville Wesleyan College, Bartlesville, Oklahoma. His interest in microcomputers is a result of both professional and personal experience: he learned BASIC programming by using a PET microcomputer on the job; at home, he taught himself electronics, beginning with the basics, and continuing through digital electronics and microprocessors. His interest in the MicroAce was sparked by the remarkably low price.

The MicroAce is a small, Z80-based microcomputer in kit form. When completed it measures 23.2 cm by 18.8 cm by 4.1 cm (9 $\frac{1}{8}$ inches deep, 7 $\frac{3}{8}$ inches wide, and 1 $\frac{1}{8}$ inches high). It features an integer BASIC in ROM (read-only memory), touch-sensitive keyboard input, cassette I/O (input/output), and video output through an on-board UHF modulator. The video display consists of 24 lines of 32 alphanumeric and graphics characters.

The kit comes in two forms, depending on the amount of user-programmable memory purchased. For \$149 (in-

cluding shipping) you get a unit with 1 K bytes of programmable memory, expandable to a maximum of 2 K bytes with the purchase of an upgrade kit for \$29. You can save \$9 by buying the second version of the kit for \$169.

Depending on the sources available, you can save even more by buying the 1 K-byte kit and purchasing the extra components from local or mail retailers. You would need to buy three integrated-circuit sockets, two memory circuits, a 74LS32 integrated circuit, and one capacitor.

If my experience is typical, you can expect to wait about a month for your MicroAce to arrive if you mail your order; less if you order by phone.

Construction

The advertisement for the MicroAce (as it appeared in BYTE and in other magazines) states that you will receive a "teach-yourself BASIC manual" and that "a hardware manual is also included with every kit." This is not correct. There is no hardware manual supplied with the kit, only the BASIC manual which includes a section entitled "Construction," preceding the first chapter.

The assembly instructions are very general and, in my opinion, not quite sufficient for those who have no ex-

At a Glance

Name

MicroAce (kit)

Manufacturer

MicroAce
1348 E Edinger
Santa Ana CA 92705
(714) 547-2526

Price

\$149 (with 1 K bytes of programmable memory)

Dimensions

23.2 cm by 18.8 cm by 4.1 cm (9 $\frac{1}{8}$ inches by 7 $\frac{3}{8}$ inches by 1 $\frac{1}{8}$ inches)

Processor

Z80, 8-bit

System Clock

Frequency

3.25 MHz

Memory

4096 bytes of ROM
1024 bytes of programmable memory

Mass Storage

Cassette tape recorder supplied by user

Other Features

Touch-sensitive keyboard, RF-modulated output (UHF channel 35), display of 24 lines by 32 characters

Documentation

Teach-yourself BASIC manual (67 pages)

Audience

Anyone who wants an inexpensive microcomputer



Photo 1: The MicroAce kit as shipped. Starting at the bottom and moving clockwise around the main circuit board are: the discrete components, the integrated circuit sockets, the integrated circuits themselves, voltage regulator, power supply, UHF modulator, antenna switch box, cable materials, and black plastic case. The 8- by 11 $\frac{1}{2}$ -inch instruction manual gives an indication of the size of this computer.

perience in circuit-board kit construction. There are no guidelines for proper soldering techniques and no step-by-step instructions that are commonly found with kits from the larger kit manufacturers.

Component values are written in a rather unusual notation. For example, a resistance of 470 ohms is written 470R, 1000 ohms is written 1K0, 2200 ohms is written 2K2, 47,000 ohms is written 47K, and 1,000,000 ohms is written 1M0.

There is a logical pattern to the notation, but it is different from that which is normally used. I suspect that the notation is British, since the MicroAce is essentially the kit version of the Sinclair ZX80, which is made in England.

Another unusual practice is the frequent listing of capacitance in nanofarads rather than picofarads. While this notation may be unusual, it should not cause any real problem as color codes and identifying marks are also listed for the various components.

The smaller components are packaged in plastic bags, while the larger items are packed loose (see photo 1). There were no missing parts, and, in fact, I received three extra resistors and one extra capacitor. There was a moment of concern when I discovered that the parts list called for eleven diodes and only nine had been supplied. A close inspection of the circuit board, however, revealed that only nine were required.

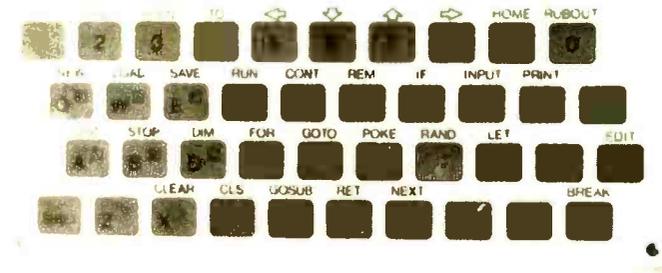
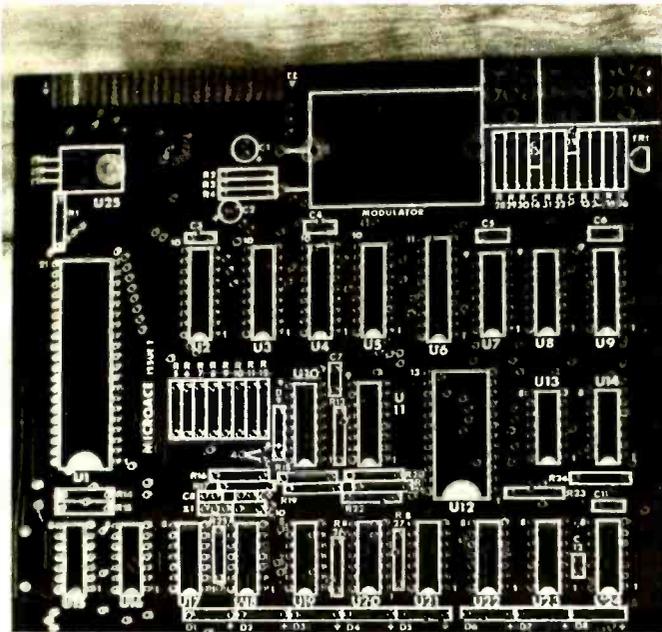


Photo 2: Component side of the main circuit board. Note that component locations are clearly marked, and that the keyboard is an integral part of the printed-circuit board.

The circuit board is double sided with holes soldered through. Component locations are indicated by white outlines and white identification labels on the component side of the board (see photo 2). Component type and value is determined by cross-referencing the identification label (R2, C12, U8, etc) with the parts list.

The actual assembly is straightforward and very easy, especially for those familiar with circuit-board projects. The construction notes suggest that components be soldered to the board in the following order: sockets for the integrated circuits, discrete components, cable sockets, voltage regulator, and the video modulator.

Next, the integrated circuits can be installed. Be sure to follow the appropriate precautions when handling the MOS (metal-oxide semiconductor) devices, which include the Z80, two programmable-memory chips, and the ROM circuit. At this point the unit can be tested for proper operation. The last stage in construction, following successful testing, is the installation of the unit in its case (see photo 3).

The 1 K-byte version of the kit does not provide the sockets for three circuit locations. (These are supplied with the upgrade kit.) I suggest that anyone building this version use masking tape to identify these locations prior to construction. Otherwise, it would be easy to install a socket in one of these locations, only to come up short later on. Once a socket is soldered in, it is practically impossible to remove.

There are no instructions given for the preparation of the cables that will attach your television and cassette recorder. You are provided with about 10½ feet of shielded cable, two phono plugs, and four mini-jacks. As simple as this task may appear, more instructions should

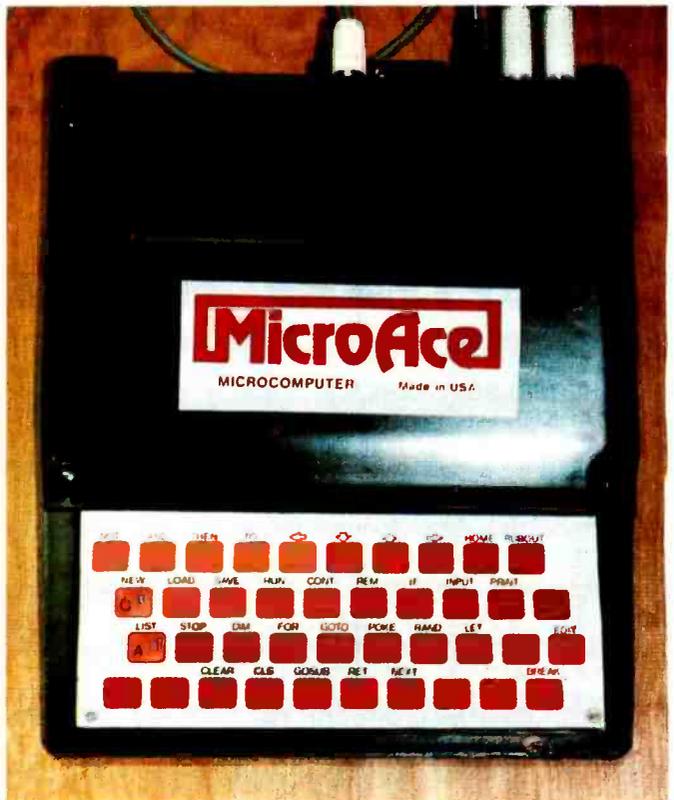


Photo 3: Completed MicroAce with cables.



Photo 4: Sample program displayed on a standard color television set. The current program line is 180, as indicated by the reverse-video cursor.

have been given to aid the inexperienced builder.

The fastenings provided for attaching the circuit board to the lower half of the case, and for fastening the upper half of the case to the lower, are plastic devices referred to as "rivets." In my opinion, these fasteners are inadequate. In fact, the rivet at one circuit-board location was useless and kept popping out. To remedy the problem, I used a fine round file to enlarge the holes in the plastic case, and substituted small nuts and screws for the rivets. Plastic washers were used to prevent the circuit board from becoming marred.

The keyboard appears to be built up with two layers. The bottom layer consists of the front one-third of the circuit board, while the second layer is laid on top and seems to be secured with some sort of adhesive. This is done by the manufacturer, not the kit-builder.



Photo 5: Layout of the MicroAce keyboard. Note that each BASIC keyword is associated with a specific key.

On my unit, this overlay was positioned slightly too far to the left, so that I had to press the right edge of the key, rather than the middle, to get a response to the keyboard entry. In addition, some keys require considerably more pressure than others. These factors, plus the fact that no audio or tactile feedback is given to indicate a successful keyboard entry, make the keyboard a little frustrating to use.

Program Entry

The output of the modulator is received on or near channel 35 on a regular television set. I used an RCA 13-inch color set and had no trouble obtaining a good display. With the controls set for normal reception of commercial broadcasts, the display appears as white characters on a gray background. If desired, white letters on an almost black background can be obtained by adjusting the contrast and brightness controls (see photo 4).

On power-up, the display is blank with the exception of a reverse-video "K" at the lower-left corner of the screen. Whenever this reverse K appears, a nonshifted

SOFTWARE ENTREPRENEURS WANTED

THE 1981 SOFTWARE WRITER'S MARKET lists hundreds of firms who want software from independents.

They will buy rights to your software or market and distribute it for you.

Includes service bureaus, consulting companies, mini/micro manufacturers, publishers, computer stores, international/national market outlets — Wang, Apple, HP, ADL, Digital, Atari, CDC, MCAUTO . . .



free updates for two months with this ad.

Detailed writeups describe how they procure software from independents, what kinds they want, payment rates, how they market, contract details . . .

Names, addresses, phone numbers of key industry contacts.

The only market report of its kind specifically for independents and small software businesses.

Call or write to order! **\$45.00** per copy
VISA/MASTERCARD ACCEPTED
Include card no. and expiration date with orders.

KERN PUBLICATIONS • 190 Duck Hill Road • P. O. Box 1029 • Duxbury, MA 02332 • (617) 934-0445

Here's the easy way to write your own programs.

Heathkit Self-Study Courses give you a complete command of computer language, so you can write the programs that do your specific tasks. Choose from four programming languages.

Easy, step-by-step learning

You learn at your own pace, performing exercises on your computer and following a clearly written and illustrated text. Tests at the end of each unit assure your understanding before proceeding to the next unit. In most courses your reading is reinforced by cassette tapes, so you see *and hear*, for more thorough learning.

Hands-on programming exercises

You learn by doing, not just reading. Special exercises guide you through the steps of designing and writing your own programs for your computer. Upon completion of the courses you'll be able to tailor existing programs to your specific needs, or write your own original programs from scratch.

Recommended for college credit

Many Heathkit Courses are now recommended for college credit by the American Council on Education. If you can't go back to college, now you can bring college home to you.

Free Heathkit Catalog

Details and prices on the complete line of Heathkit Self-Study Courses on computer and electronics subjects are in the new, free Heathkit Catalog. Send for yours today or pick one up at your nearby Heathkit Electronic Center.

FOUR HEATHKIT PROGRAMMING COURSES

BASIC™: easiest-to-learn, hobbyist's language
PASCAL™: sophisticated, easy-to-use language
COBOL™: the businessman's language
ASSEMBLY: very efficient, very precise language
Coming soon: FORTRAN™ and Microsoft™ BASIC™



Write to Heath Co.,
Dept. 334 764,
Benton Harbor, MI 49022.

In Canada, write Heath Co.,
1480 Dundas Highway East,
Mississauga, Ontario, L4X 2R7.



Visit your
Heathkit Store
Heathkit products
are displayed,

sold and serviced at 62 Heathkit
Electronic Centers in the U.S.
and Canada. See your telephone
white pages for locations.

In the U.S., Heathkit Electronic
Centers are units of Veritechnology
Electronics Corporation.

Heathkit®

keyboard entry from the bottom three rows of keys (see photo 5) will result in a BASIC keyword being printed on the screen.

Keywords (and thus the use of a reverse K) are BASIC commands which are stored in a single byte of memory but are spelled out on the screen. For a list of these keywords, as well as other BASIC commands and functions, see table 1.

Nonshifted keyboard entries from the top row are printed as numeric characters for the line numbers (which must be between 1 and 9999, inclusive). As a line number is entered, the reverse K will shift to the right, one space at a time. As long as the reverse K is on the screen, any shifted-key input (other than an editing command) will result in a syntax error. Commands entered without a preceding line number are executed immediately in the "command mode."

After entering a line number, press the key corresponding to the BASIC keyword with which your program line is to begin. Every program line must start with one of these keywords. For example, in some forms of BASIC, the LET keyword is optional, and "10 LET A=5" can be written "10 A=5". This is not possible with the MicroAce.

Following the entry of a keyword, the reverse K cursor changes to a reverse L, signifying that you are in the letter mode and that keyboard entries will be interpreted as regular alphanumeric or graphics characters. As you type in a program line, the system monitor checks for syntax errors after each character is entered. A line contains a syntax error if, in its present form, the line is incorrect or incomplete. Suppose you wish to enter the following line:



Basic system with: 600K bytes

\$2995.

- 1.2 megabytes \$3995.
 - 2.4 megabytes \$4995.
- Suggested list price.

A Z80A CPU combined with the CP/M® operating system opens new vistas to software availability for eight-bit micros. FORTRAN, COBOL, BASIC, APL, PL/1 and Pascal are available now to accommodate today's scientific, educational, sophisticated small business and personal system users.

- 4MHz Z80A CPU
- CP/M 2 operating system
- 64K 200ns main memory
- 6K 300ns video memory
- 8-inch dual floppy drives
- color video text & graphics
- sound generator
- 2-serial ports
- 2-parallel ports
- 4-counter/timers

Quantity discounts are available.
OEM inquiries are invited. Please contact:

COLONIAL DATA SERVICES CORP.
105 Sanford St., Hamden, Connecticut 06514
(203)288-2524 EAST COAST • (415)957-9195 WEST COAST

©CP/M is a registered trademark of Digital Research, Inc.

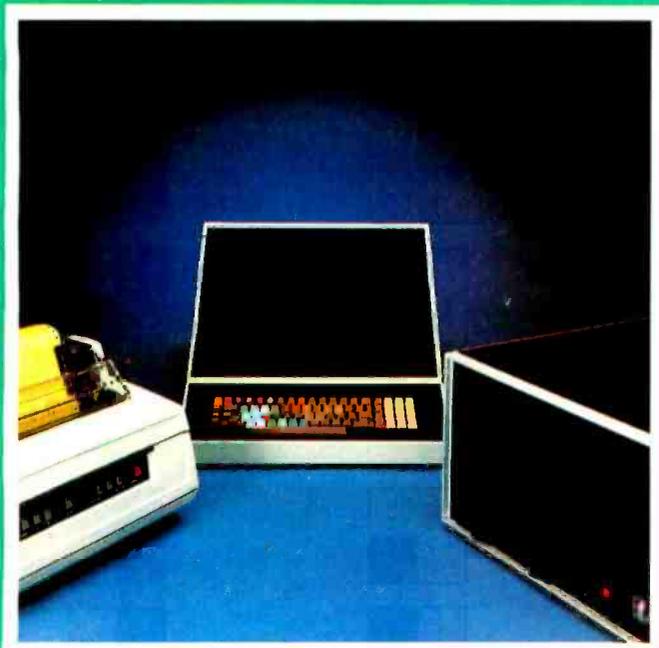
20 PRINT "THE FINAL SUM IS "; A

The PRINT command is entered by pressing one key (the letter O) because the machine is in its keyword mode at the start of each new line. Immediately following the entry of the first set of quotation marks, a reverse-video S (for syntax) appears to the right of the reverse-L program cursor. This does not indicate that an error has been made, but rather that the line is incomplete. As the literal

Keyboard Abbreviation	Keyword Commands
	Comments
CLEAR	Set all variables to zero
CLS	Clear the screen
CONT	Continue
DIM	Dimension (one-dimensional arrays)
FOR	
GOSUB	
GOTO	
IF	
INPUT	
LET	
LIST	
LOAD	Cassette input
NEW	
NEXT	
POKE	
PRINT	
RAND	Randomize
REM	Remark
RET	Return
RUN	
SAVE	Cassette output
STOP	
	String Functions
	Comments
CHR\$(N)	Return character or keyword string corresponding to decimal code N.
CODE(S)	Return decimal code number of first character in string S
STR\$(I)	Convert the integer I into its corresponding string representation.
TL\$(S)	Delete the first character from string S.
	Other Functions
	Comments
ABS(N)	Return absolute value of N.
PEEK(N)	Return decimal value stored in memory at address N.
USR(N)	Start machine-language routine at address N.
RND(N)	Return a random number between 1 and N if N is positive.
	Logical Functions
	Comments
AND	Check to see if two or more conditions are met simultaneously.
OR	Check to see whether any one of two or more conditions is met.
NOT	The opposite of a stated condition is tested.
(These logical functions have additional uses which cannot be detailed here.)	
	Arithmetic Operations
+	Addition
-	Subtraction
*	Multiplication
/	Division
**	Exponentiation (2**3 = 2*2*2 = 8)

Table 1: Commands and functions available in MicroAce integer BASIC, with comments at selected points. The manual supplied with the kit provides a more detailed explanation.

**Solution \sō'lü-shŭn \n[ME,fr.MF,fr.L solution-]
la: An answer to a problem.**



At last there's a microcomputer designed to solve your business' problems, not create new ones. In delivery for close to three years, the MicroDaSys Millie™ is a proven hardware design that now comes with the fantastic SoftwareHows™ DBI Accounting Solutionware™ you've seen advertised -- a \$2500 dollar value alone! This is one computer that's complete when you buy it, right down to the best applications software available. There are no "required options". And we've got all the best features: Z-80, 64K, CP/M¹, dual double density 8" floppies for 1MB on line storage, 82x24 CRT with special features, IBM format keyboard with numeric pad, NEC 55cps letter quality printer, S-100 bus. Also, Millie is supported by a nationwide rep network and one of the best service contracts in the business. And Millie is price competitive with much smaller computers. Why settle for less than the best? Call or write today for flyers and manuals. You'll be glad you did.

MicroDaSys, Inc. 2811 Wilshire Blvd., Santa Monica, CA 90403

(213) 829-6781 TWX: 910-321-2378

¹ Reg.™, Digital Research

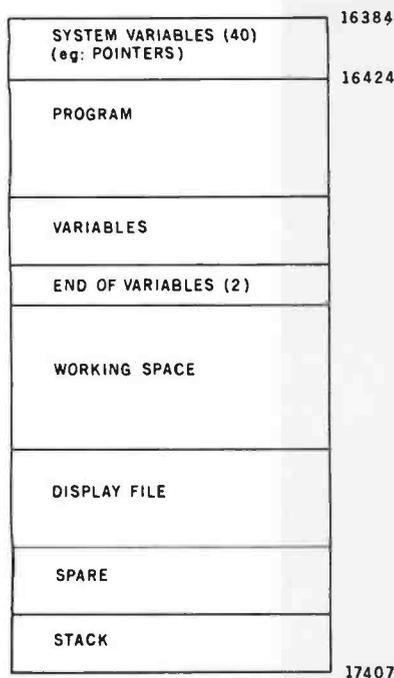


Figure 1: Map of the programmable memory in the MicroAce computer. Fixed boundary addresses are given in decimal; the other boundaries are variable. Numbers in parentheses give the size of a fixed block in decimal bytes.

string is entered, the reverse LS moves to the right as a double cursor. When the second set of quotation marks is entered, the reverse S disappears because the line now has the correct syntax.

Consider a second example. You wish to enter the line:

```
125 LET I=I+1
```

but inadvertently type:

```
125 LET I+1=I
```

This line would not be accepted because it contains a syntax error. The reverse S cursor would be located directly after the + symbol.

Notice that in this case the reverse S does not follow the reverse L cursor, but remains at the point where the error occurred. In the case of multiple errors, the reverse S will always be located at the first error contained in the line. When this error is corrected, the reverse S moves to the second error, and so on.

As indicated above, no line containing a syntax error will be accepted into a program. This guarantees that every line in your final program is complete and free of syntax errors. It does not, of course, prevent errors of logic. When a line is complete and correct, it can be entered into a program by pressing the NEWLINE key—the MicroAce equivalent of a RETURN key.

As a line is entered into a program it is placed into memory in two places. First, it is placed into the program storage area, which begins at decimal address 16424. (See figure 1 for a simplified map of the programmable memory.) It is also relocated in the display-file section of memory so that it appears on the upper portion of the screen.

AVAILABLE ON KEYBOARD
AND USING CHR\$

AVAILABLE USING
CHR\$ ONLY

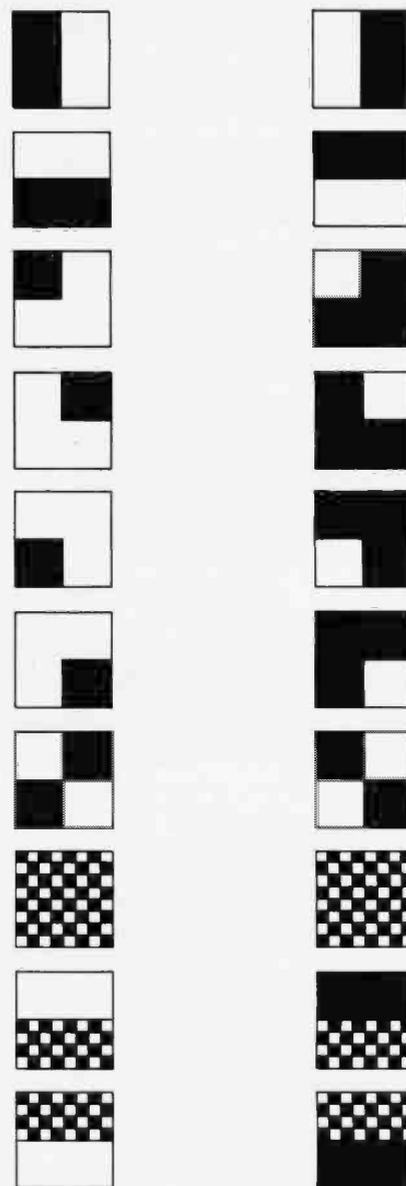


Figure 2: Graphics symbols available with the MicroAce. Note that the first ten symbols are addressable from the keyboard, while the second ten are their reverse-video images, available only through the use of the CHR\$ function in BASIC.

Recall that on power-up the reverse K was at the lower left and that line entry was done at the bottom of the screen. As new lines are entered they appear in numerical order. The most recently entered line is identified by a line cursor (a reverse video >).

A line entered with a number between those of two previously entered lines is placed in the appropriate position on the display, and the line cursor is moved to its location. When the screen is full, the addition of new lines causes the program listing to scroll up, always leaving the most recently entered portion on the display.

This method of using programmable memory for both program storage and display storage leads to problems. In some systems, the video-display memory is dedicated, meaning that an advertised 1 K bytes of programmable

Most small system users think all micro-computers are created equal. And they're right. If you want performance, convenience, styling, high technology and reliability (and who doesn't?) your micro usually has a price tag that looks more like a mini. It seems big performance always means big bucks. But not so with the SuperBrain!

Standard SuperBrain features include: twin double-density 5¼" drives which boast nearly 350,000 bytes of disk storage — expandable to 10 megabytes. A full 64K of dynamic RAM. A CP/M* Disk Operating System to insure compatibility to literally hundreds of application packages presently available. And, a 12" non-glare, 24 line by 80 column screen.

*Registered trademark of Digital Research, Inc.

You'll also get a full ASCII keyboard with an 18 key numeric pad and individual cursor control keys. Twin RS232C serial ports for fast and easy connection to a modem or printer. Dual Z80 processors which operate at 4 MHz to insure lightning-fast program execution. And the list goes on! Feature after feature after feature.

Better yet, the SuperBrain boasts modular design to make servicing a snap. A common screwdriver is about the only service tool you'll ever need. And with the money you'll save on purchasing and maintaining the SuperBrain, you could almost buy another one. For under \$3,500, it is truly one of the most remarkable microcomputers available anywhere.

Whether your application is small business, scientific, educational or just word processing, the SuperBrain is certainly an exciting solution to the small computer problem. And since you can easily expand it, you'll probably never outgrow it.

Call or write us today for a complimentary copy of our "SuperBrain Buyer's Guide." We'll show you how you can get big system performance without having to spend big bucks.

**INTERTEC
DATA
SYSTEMS**

2300 Broad River Rd. Columbia, SC 29210
(803) 798-9100 TWX: 810-666-2115

SUPERBRAIN™



memory are used for program storage only, and that additional memory is supplied for storing video data.

With the MicroAce, the programmable memory available to the user must perform both tasks. Thus, as program length increases, the area for displaying the program listing begins to shrink as less and less memory is available for display storage. As a result, the program line-entry "window" moves up from its bottom position on the screen. The advantage of this system is that when your line-entry window is near the top of the screen, you know you are close to filling the available program memory. The disadvantage is that shorter and shorter segments of a program can be listed at any one time. As you will see later, this dual use of memory causes similar difficulties when running a program.

Another feature of the MicroAce is that there is no limit (other than available memory) to the length of a program line. Thus, a large section of text can be printed using a single PRINT command. This can save time and memory if properly used.

A disadvantage of the system is that multiple statements on a single line are not allowed. For example:

```
230 LET A=5: LET B=9
```

would have to be written as:

```
230 LET A=5  
235 LET B=9
```

In another example:

Leverage User Environment Termed 'Unusually Friendly'

Advanced Human Engineering, Superior Documentation, Detailed Tutorials and Ongoing Support Are Cited

Early reports from users of *Leverage*, the microcomputer-based information management system recently introduced by Urban Software Corporation, reveal a level of satisfaction rarely found among users of microcomputer applications programs. Several factors have been cited to explain this highly favorable response, including:

- State of the art human engineering. Features like an extensive on-line manual directly accessible by the program, graphic menu selection and automatically programmed menus allow unparalleled ease of use.
- Several easy to follow tutorials demonstrate the capabilities of the system and provide an ideal vehicle for mastering its operation.
- Clear, complete documentation includes a glossary, an index and numerous tables and figures.
- Urban Software is firmly committed to the ongoing support of *Leverage*. Many enhancements are planned, and a monthly newsletter will provide application notes, manual updates, bug reports and new product announcements.

Leverage Program \$185
Manual Alone \$ 15 (Credited to subsequent program purchase)
Leverage Newsletter ... \$ 10/year (First year included with purchase)
For complete details on *Leverage*, call or write for a brochure.
Leverage is a trademark of Urban Software Corporation.

Urban Software Corporation

19 West 34th Street • New York, NY 10001 • (212) 947-3811

200 INPUT A,B,C

would have to be written as:

```
200 INPUT A  
205 INPUT B  
210 INPUT C
```

Program Editing

As indicated earlier, new lines can be inserted anywhere in a program by entering them in the normal fashion. Entire lines can be deleted by entering the line number and pressing NEWLINE. If the line that is currently displayed needs editing, the following procedure is used: the up and down arrows (shifted 7 and shifted 6, respectively) are used to locate the line cursor at the proper line; then EDIT (shifted NEWLINE) is pressed to copy the desired line in the program-entry window at the bottom of the screen.

The left and right arrows (shifted 5 and shifted 8, respectively) are used to position the program cursor within the line. Deletions are made by placing the program cursor to the right of the desired character or keyword and pressing RUBOUT (shifted numeral 0).

Insertions are made by merely typing in the correct character or keyword. The portion of the line to the right of the insertion shifts to the right to accommodate the inserted text. You cannot over-type incorrect text; it must be deleted using the RUBOUT command.

A line that is not presently on display can be edited in one of two ways. The up or down arrows can be used to scroll the program listing down or up on the display until the desired line appears, or the LIST command can be used instead.

Normally, a LIST command will list the program starting with the line preceding the requested line. If, for example, the lines are numbered by tens, then a LIST 120 will result in a listing that begins with line 110 and continues as far as space and display memory permit. In either case, once the desired line is displayed on the screen, it can be edited as described above.

MicroAce has one disconcerting feature that affects the entering and editing of programs. The microprocessor performs only one function or task at a time. Thus, it either handles keyboard input or controls the video display, and as a result, every key closure during program entry and editing causes the display to roll. This makes it difficult to use the editing arrows, as it is hard to follow a moving cursor on a rolling display.

Running a Program

A program is executed by entering the RUN keyword command followed by NEWLINE. During program execution, the display remains blank until a STOP or INPUT command is executed, a BREAK or an error occurs, or the program completes its run. At that point, the microprocessor is free to devote its attention to the video display. This means that a PRINT command in a program merely loads the data into the display memory for future use. It will not appear on the display until active execution of the program ceases. For this reason, animated graphics are not possible.

As mentioned earlier, there are some problems related to running programs, because the available program-

Sweeten Your Apple II* with the ES/F Mass Storage System



▲ Actual Size

Actual Thickness ▼

THESE FACTS SPEAK FOR THEMSELVES!

	CASSETTE	ES/F	MINI-DISK
SPEED (10K Load)	60 sec	5.5 sec	8.4 sec
CAPACITY (K bytes)	100 (C-10)	125 (75')	103 APPLE DOS
RELIABILITY (Designed for digital data?)	NO	YES	YES
SYSTEM COST (First unit W/I/F)	\$60	\$300	\$600
SECOND UNIT	N/A	\$150	\$500
MEDIA COSTS	\$3.00	\$3.00	\$5.00
OPERATING SYSTEM	NONE	APPLE SOS	APPLE DOS

Let's face it. Cassette players were not designed to store digital data and programs. That's why we designed a digital storage system using a continuous tape loop: the Exatron Stringy/Floppy (ES/F) and the Wafer. There's no expensive interface to buy—the ES/F comes ready to sweeten your Apple II*.

Once your Apple II* is sweetened with our ES/F . . . you won't find a juicier deal. We're so sure, that we offer an unconditional 30-day money-back guarantee and a one-year limited warranty. Over 5,000 owners have met the wafer . . . why don't you?

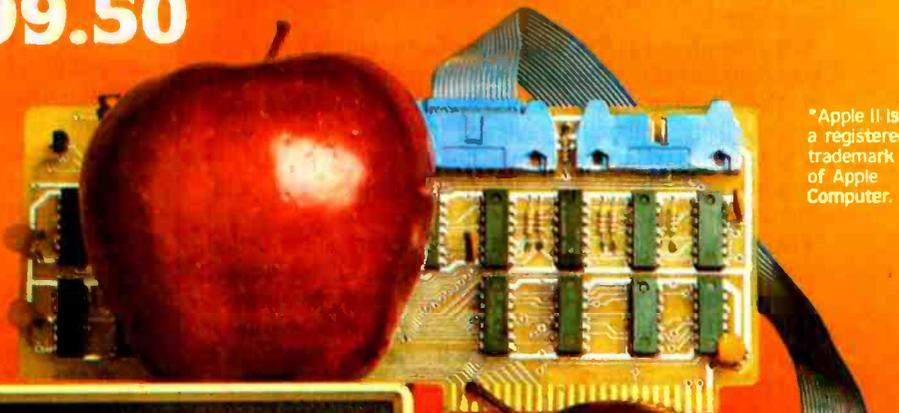
EXATRON'S STRINGY/FLOPPY . . .

SPEED, CAPACITY AND RELIABILITY FOR ONLY \$299.50

CALL OUR HOTLINE
. . . (800)-538-8559

IN CALIFORNIA,
CALL (408)-737-7111

exatron
181 Commercial Street
Sunnyvale, CA 94086



*Apple II is a registered trademark of Apple Computer.



SUPERBRAIN™ AND COMPUSTAR™ USERS' GROUP



Your users' group is here at last! We are Super★Star International, an independent, world-wide users' group for Intertec Data Systems' SUPERBRAIN™ and COMPUSTAR™ computers.

Our monthly magazine SUPER★STAR will fulfill all your computing desires. When you join our group, you will enjoy the latest: technical information, tips for beginners, special business uses, equipment reviews, the Intertec story — the people, ideas, and machines behind your computer. In every issue you'll get a free program, industry news, and software reviews.

Plus, we want your programs for our Software Supermarket, where all members can buy programs at affordable prices.

We will investigate all the accessories you have always wanted, test them, and offer them for sale at reduced prices.

With our group buying power we'll give you discounts on commercial software. And that's not all. We'll find group rates for car rentals, hotels, gifts, and more.

Super★Star International, with savings, service, and efficiency — we're here to win your heart.

Yearly membership fee is \$50.00 U.S., \$58.00 Canada, \$74.00 Europe and So. America, \$81.00 Australia.

Your fee may be tax deductible; consult your accountant.

Dealers are invited to contact us concerning a special dealer program. Software houses, we are interested in your programs! Send checks with your name and address, made out to:

SUPER★STAR

SUPER★STAR INTERNATIONAL CORPORATION
3722 Chestnut Place
Denver, Colorado 80216
(303) 623-7973

Not affiliated with Intertec Data Systems.

*Superbrain and CompuStar are the trademarks of Intertec Data Systems.

mable memory is used for both program and display storage. Program memory is given priority, so if, for example, a PRINT command giving some instructions contains more characters than the available display memory can accommodate, the displayed message terminates at the point where display memory was filled, program execution stops, and an error message appears at the lower-left portion of the screen.

This clearly limits the amount of displayable text that can be included in a program. In the worst possible situation, where the entire screen is filled, 768 bytes of memory ($32 \times 24 = 768$) would be required for the display alone. Only 256 bytes remain in which to store system pointers, program lines, variables, and so on.

Furthermore, the display will not scroll during program execution. If a PRINT command results in a line of text beyond line 24, program execution ceases and a different error message is displayed. The PRINT and CLS (clear screen) commands must be used judiciously in order to avoid printing too many lines, on the one hand, and clearing text before it can be read, on the other.

MicroAce Integer BASIC

Integer BASIC is limited in its computational capabilities. All numbers used in computation must be integers in the range -32768 to 32767 , inclusive. Results of arithmetic operations are truncated (ie: all fractions are dropped). Thus, 99 divided by 100 would come out 0, because the division normally yields a quotient of 0.99. But integer BASIC drops all fractions, leaving 0.

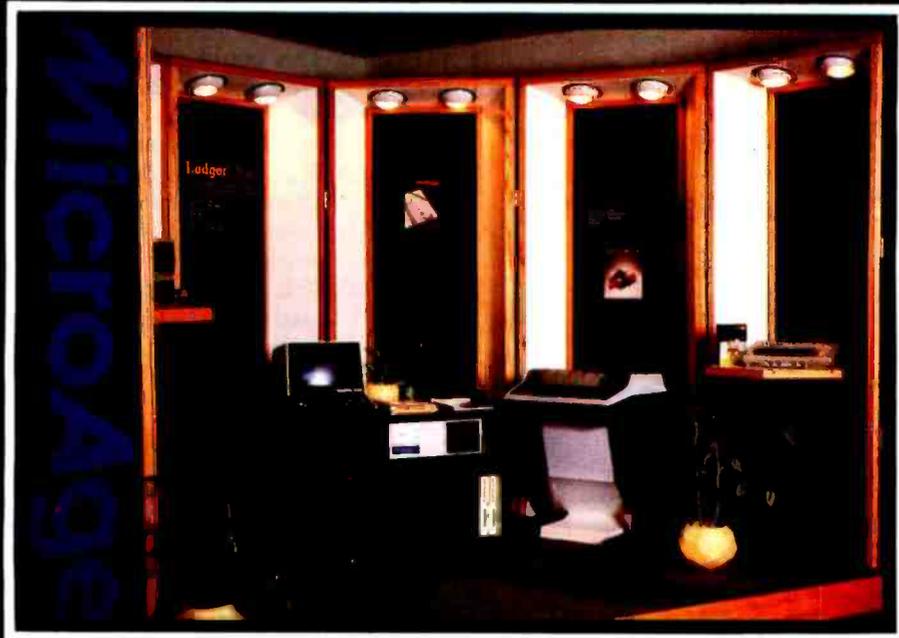
Only the fundamental operations of addition, subtraction, multiplication, division, and exponentiation (using positive integral exponents) are implemented. This is true not only for MicroAce integer BASIC, but for any form of integer BASIC. The purpose of integer BASIC is to provide the user with a high-level programming language in as little memory as possible. This should be kept in mind when evaluating the capabilities of an integer BASIC.

While the features of MicroAce BASIC are given in table 1, a few points should be emphasized. Note that string manipulation, a feature not always included in integer BASIC, is possible. Also, aUSR function is provided which allows the user to run machine-language programs. I have not yet experimented with this feature, but should point out that the manual does not teach you any machine-language programming. It merely suggests that you write a monitor in BASIC to enter machine-language programs, and use theUSR function to run them.

The use of keywords was discussed earlier. This greatly simplifies program entry because entire commands are entered with a single keystroke. Memory is conserved because each keyword occupies only a single byte of memory. Any keyword command can appear in an executable program line including LIST, LOAD, SAVE, RUN, and NEW.

You have to be very careful with some of these commands. Program execution terminates following a LIST. The NEW command executed in a program, or in command mode (executed directly from the keyboard), would wipe out everything in memory, including the program itself. The LOAD and SAVE commands would be of little value in a program since the cassette recorder

THE SOLUTION STORE SM



... Makes The Difference!

MicroAge Computer Stores sell solutions to your professional, business and household-management problems, not just hardware. That's what makes the MicroAge difference! From systems integration to easy-to-understand application software, research and development to warranty service and repair, systems consulting to training and installation. In all these, we offer the latest, most innovative approaches. That's why we are the forerunners . . . the pioneers in the microcomputer industry.

But don't just take our word for it. Visit the MicroAge Computer Store nearest you and see the difference solutions make. We have differences you'll experience with every time and money-saving idea. The difference that will keep you satisfied now and for years to come!

MicroAge.
COMPUTER STORE

"Where Vision Becomes Reality"

9530 Viscount
El Paso, Texas
(915) 591-3349

2760-S South Havana
Aurora, Colorado
(303) 696-6950

2675 Mayfair Road
Milwaukee, Wisconsin
(414) 257-1100

1490 W. Spring Valley Rd.
Richardson, Texas
(214) 234-5955

24 W. Camelback
Phoenix, Arizona
(602) 265-0065

2591 Hamilton Road
Columbus, Ohio
(614) 868-1550

611 Rockville Pike
Rockville, Maryland
(301) 762-7585

1707 Monroe Avenue
Rochester, New York
(716) 244-9000

2065 El Camino Real West
Mountain View, California
(415) 964-7063

83 South 10th Street
Minneapolis, Minnesota
(612) 338-1777

Coming soon to:
Houston, Texas
Salt Lake City, Utah
St. Louis, Missouri
Indianapolis, Indiana

Lincoln, Nebraska
Wichita, Kansas
San Diego, California
Portland, Oregon

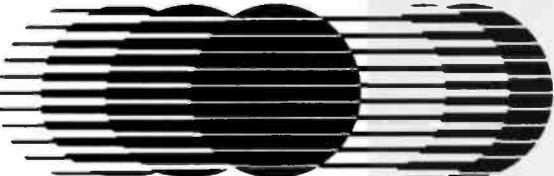
5742 E. Broadway
Tucson, Arizona
(602) 790-8959

1220 Melbourne Drive
Hurst, Texas
(817) 284-3413

2525 N. Scottsdale Road
Scottsdale, Arizona
(602) 941-8794

4550-50 E. Cactus
Phoenix, Arizona
(602) 996-2910

FOR FRANCHISE OPPORTUNITY INFORMATION CALL (602) 967-1421



HOBBYWORLD ELECTRONICS, INC.

19511 Business Center Dr. • Dept. B4
Northridge, CA 91324

April Specials

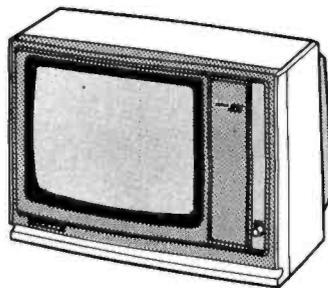
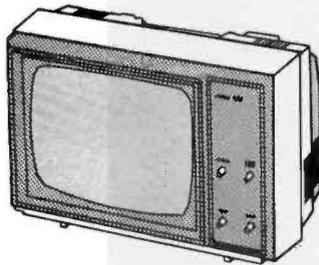
NEW Leedex Monitors

Leedex 100G

- Green phosphor for easy viewing
- Hi-resolution

Cat No. 2999

\$169⁰⁰



13" Color Monitor

- Hi-Resolution
- Full color
- Low cost

Cat No. 3000

\$399⁰⁰

Don't Miss Out . . .

. . . on the other terrific buys in the Hobbyworld catalogue. Page after page of computer products for the Atari, Apple, TRS-80 and others. Our catalogue is FREE, so write or phone for your copy NOW!

Toll Free:

(800) 423-5387

Local & Outside USA:

(213) 886-9200

Open Monday thru Friday: 10am-6pm

Saturday: 9am-5pm

We're changing our name to keep pace with the times! Look for our new name, HW Electronics, in our ads beginning in June, 1981.

would have to be turned on at just the right moment in order to complete the command execution.

The MicroAce BASIC provides an error message whenever program execution ceases. The number of different messages is limited, but remember that all program lines must have correct syntax before they are accepted into a program. The error messages are given in the format c:nnn where c is an error code, and, in most cases, nnn is the last program line executed. Here are some examples:

- 0:400 This could mean one of two things. Either the program has come to a successful end at line 400, or a BREAK was executed and line 400 would have been the next line executed in the program.
- 5:40 This indicates that a PRINT command in line 40 attempted to print beyond the twenty-fourth line on the display, which, as noted above, is not possible.
- 4:40 This might indicate that a LET command was used when there was no more memory available for variables storage. (The error code indicates there is not enough memory to perform the given line.)

The system of error messages, together with the syntax checking feature, make program debugging quite easy. This is definitely one of the strong points of MicroAce BASIC.

One negative aspect of the MicroAce BASIC is the inability to halt program execution at an INPUT command. When executing an INPUT command, the BREAK key is, in effect, ignored. This is not that unusual as other computers exhibit the same property. However, any key entry, including NEWLINE (and that is a bit unusual), that is not a valid response to the INPUT command results in the appearance of the reverse-video S syntax error cursor, which means that the response will not be accepted. It must be deleted using the RUBOUT command, and a correct response must be entered before program execution resumes.

I entered a relatively simple game program which involved locating a submarine within a three-dimensional region. The player is allowed seven trials, and must input three coordinates during each trial. Thus, a maximum of twenty-one INPUT commands will be executed. Unless a STOP command or an escape routine is included in the program (or you disconnect the power), there is no obvious way to terminate execution of the program until all twenty-one INPUTs are responded to properly. This could make debugging of highly interactive programs a time-consuming process. By the way, even though this program was quite short, the instructions for playing the game could not be displayed without overflowing the available display memory. Consequently, they had to be omitted from the program.

Graphics

There are twenty graphics symbols available, as shown in figure 2. Note that only ten are available from the keyboard. The remaining ten are reverse-video graphics available by using the CHR\$ function.

In fact, any alphanumeric character, graphics symbol, or keyword string can be printed using the CHR\$ func-

NEVER UNDERSOLD!

That's right, if you can find a lower price in this magazine for any of the items listed in this ad, we will reduce our price below our competitor's price. See each box below to determine how much EXTRA we will cut off of THEIR price if we're not lowest. Please consider the competitor's shipping charges, **OUR SHIPPING IS FREE!**

FLOPPY DISKETTES & SUPPLIES

IF YOU CAN FIND A LOWER PRICE IN THIS MAGAZINE ON ANY OF THESE ITEMS, DEDUCT \$.50 FROM OUR COMPETITOR'S PRICE, THAT'S OUR PRICE!

Call For Quantity Discounts

Verbatim Diskettes (box of 10)	
5 1/4" MD525-01 soft, 10 or 16	\$26.50
5 1/4" MD577-01 quad soft, 10 or 16	\$33.00
8" FD34-1000 soft	\$30.00
8" FD32-1000 hard	\$30.00
8" FD34-8000 double density soft	\$44.00
8" FD32-8000 double density hard	\$44.00

Printwheels (specify style)	
Qume or Diablo	\$6.50

Labels	
3 1/2" x15/16" (5000 labels)	\$18.75
Other sizes and quantities	CALL

Ribbons	
Diablo Hy Type I	\$4.95
Diablo Hy Type II	\$5.25
Qume 5print	\$3.50
Centronics Zip Pack	\$3.95
MANY OTHERS	CALL

PRINTERS

IF YOU CAN FIND A LOWER PRICE IN THIS MAGAZINE ON ANY OF THESE PRINTERS, DEDUCT \$10 FROM OUR COMPETITOR'S PRICE, THAT'S OUR PRICE!

Epson MX 80	CALL
Okidata Microline-80	\$550
Okidata Microline-82	CALL
Okidata Microline-83	CALL
IDS Paper Tiger 445G	\$775
IDS Paper Tiger 460G	\$1193
Anadex DP-8000 (AP)	CALL
Anadex DP-9500	\$1395
Centronics 737	\$799
NEC W/Sellum Bi.Dir. Board	\$2595
Vista 25 CPS	\$1595
Qume	CALL
Diablo	CALL
Escon Interface	\$545

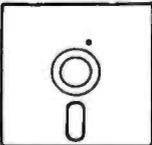
Call For Other Printers

SOFTWARE, MODEMS & TRS-80 HARDWARE

IF YOU CAN FIND A LOWER PRICE IN THIS MAGAZINE ON ANY OF THESE ITEMS, DEDUCT 5% FROM OUR COMPETITOR'S PRICE, THAT'S OUR PRICE!

SOFTWARE	
Microsoft	
Basic Compiler	\$345
Basic-80	\$319
Fortran-80	\$399
Cobol-80	\$599
Macro-80	\$144
Pickles and Trout CP/M	CALL
Graham Darlan	CALL
Peach Tree	CALL
Magic Wand	CALL
Supersoft	CALL
PCD Pascal	\$350
Visicalc	\$124
Space Invaders	\$23
Adventure	\$26
Head cleaning kit	\$26
MODEMS	
UD5 103CP	\$175
D-CAT	\$155
CAT	\$145
TRS-80 HARDWARE	
Micropolis 77 track	SUPER SALE \$399
Loba Drives	CALL
Matchless Drives	CALL

4636 Park Granada
Calabasas, Ca. 91302



**Alpha
Byte
Storage**



For phone orders CALL:
(213) 883-8594

IF YOU CAN FIND A LOWER PRICE IN THIS MAGAZINE ON ANY OF THE ITEMS LISTED BELOW, DEDUCT 5% FROM OUR COMPETITOR'S PRICE, THAT'S OUR PRICE! (BUT IF YOU DON'T SEE IT, CALL FOR A PRICE—WE WILL BEAT EVERYBODY!)

S-100 HARDWARE APPLE HARDWARE

CALIFORNIA COMPUTER SYSTEMS:	
16K Static RAM (Model 2016C)	\$349
32K Static RAM (Model 2032A)	\$599
64K Dynamic RAM (Model 2032A)	\$599
16K Static RAM (Model 2065A)	\$299
Main Frame (Model 2200A)	\$339
Floppy Disk Controller (Model 2422A)	\$339
4 Port Serial I/O (Model 2710)	\$CALL
25+2P I/O (Model 2718)	CALL
Z-80 CPU (Model 2810)	\$249
Godbout Econoram	CALL
SD Systems Versa Floppy	\$279
Expando RAM	\$CALL
CALIFORNIA COMPUTER SYSTEMS:	
Parallel Interface (Model 7720A)	\$112
Asynchronous Serial Interface (Model 7710A)	\$149
Programmable Timer (Model 7440A)	\$149
12K ROM/PROM Module (Model 7114A)	\$75
Arithmetic Processor (Model 7811A)	\$374
Synchronous Serial Interface (Model 7712A)	\$149
GPB Interface (Model 7490A)	\$281
3 1/2 Dldigit BCD A/D Converter	\$140
Centronics Printer Interface (Model 7728)	\$99
MOUNTAIN HARDWARE:	
Super Talker	\$270
ROMWRITER	\$157
INTROL/X-10	\$180
ROMPLUS+	\$162
MUSICSYSTEM	\$499
Apple Clock	\$252
Loba Drive	\$CALL
Videx 80 X 24	\$345
Andromeda	\$189

tion. Most characters can be printed in reverse-video as well. The BASIC manual provides a complete list of all available characters and strings, along with their decimal codes. The code is unique to MicroAce and thus not compatible with standard computer codes.

Since each character position on the 24 by 32 display is divided into four parts by the graphics symbols, a resolution of 48 by 64 dots is possible. Remember though, that an extensive graphics display greatly limits the amount of memory available for program storage.

Cassette Input and Output

I had to try two tape recorders before I could successfully load a program from tape. The first recorder I tried lacked a tone control and could not load a program, regardless of the volume setting. The second recorder had a tone control and loaded properly with the control set at maximum treble.

The proper volume level seems to vary from tape to tape, even when they are made by the same company. Before saving a program, the program name is recorded on the tape by voice.

A cable is attached between the microphone output of the computer and the microphone input of the recorder. The recorder is placed in its record mode and the SAVE command is entered followed by NEWLINE. The television screen goes blank for about five seconds, followed by a jumpy display of horizontal white lines. This indicates that the data is being output to the recorder. When the display returns to normal, the save is complete.

Loading a program involves a similar series of steps. In

OVER 8 MBytes OF SOFTWARE AT \$8* PER DISKETTE FULL

The exchange library of The CP/M® Users Group has nearly 50 volumes of software available. Everything from editors, assemblers, languages, games, tools and more—and almost everything in full source code.

Send \$6** for full library catalog.

THE CP/M USERS GROUP

1651 Third Avenue, New York, N.Y. 10028.

*Domestic price. Inquire for overseas price.

**The complete catalog of CPMUG is available for \$6 prepaid to the U.S., Canada and Mexico. \$11 prepaid to all other countries.

© CP/M is a registered trademark of Digital Research. The CP/M Users Group is not affiliated with Digital Research.

this case, however, you cannot be certain that the program is being input until the screen resumes its normal display, giving a listing of the tail end of the successfully loaded program.

If, after a reasonable interval of time, the display does not return to normal, the BREAK key may be used to reset the computer. Occasionally, you may have to disconnect the power momentarily to recover from an unsuccessful load. Once the proper volume setting is found, however, loading can be done quite reliably.

The Teach-Yourself Manual

The manual supplied with the MicroAce, entitled *The Teach-Yourself BASIC Manual*, is shown in photo 1. The title may be slightly misleading. It brings to mind a tutorial text complete with exercises for the reader, but it is not that kind of text. It merely introduces the BASIC commands, one at a time, illustrating their proper use and perhaps some typical applications.

At the same time, the processes of program entry, program editing, and program execution are taught. Token coverage is given to the art of programming, but in all fairness it might be unreasonable to expect a more detailed explanation. As an introduction to the use and syntax of fundamental BASIC commands, the manual is quite adequate.

While typing errors (or misprints) are inevitable, I do think that special care should be given to printing sample programs. One program in the manual has two lines which read "GO TO 7000" when the program contains no line numbered 7000. Those two lines should have read "GO TO 1000". As written, the sample program would not run successfully.

Other Considerations

I believe that any product's value is partially determined by the manufacturer's willingness to respond to the consumer's request for aid or assistance. Nine weeks prior to the writing of this review, I sent a letter to MicroAce requesting answers to specific questions related to the MicroAce and to future plans for upgrading and expansion. That letter was never answered. This, to me, indicates a lack of interest in serving the customer.

At the same time that the letter was sent to MicroAce, a similar letter was sent to Sinclair Research Limited, the company that markets the Sinclair ZX80. (The MicroAce is essentially a kit version of Sinclair's machine and is manufactured under a license from Sinclair Research Limited.)

Sinclair's response to my letter left many questions unanswered (especially in regard to future plans), but they did say that the MicroAce operates in the same manner as the ZX80. Consequently, the comments made in this review concerning the operation of the MicroAce would apply to the Sinclair ZX80 as well.

I was also told by Sinclair that while the unit operates like the ZX80, it is not identical to it, and that peripherals marketed for the ZX80 might not work with the MicroAce. They did not elaborate, and, as noted above, MicroAce had no comment at all.

Conclusions

The MicroAce kit is a very inexpensive introduction to the world of microcomputers. Kit construction is easy

Suddenly Radio Shack's New TRS-80™ Color Computer is Even Better!

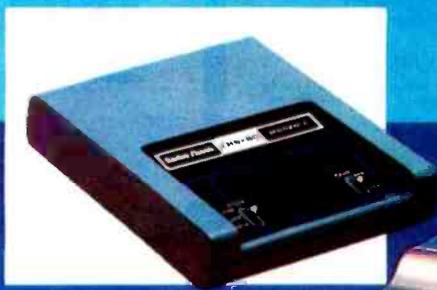
New Extended Color BASIC. Here's an advanced TRS-80 Color Computer that includes a 16K ROM Extended BASIC with advanced graphics, eight brilliant colors, and sound, for an unprecedented low price! You can draw fine lines, circles, rectangles, boxes and more with easy-to-use one-line commands. Four graphic modes with two color sets allow up to 49,152 programmable screen points (pixels). There are 255 separate tones for music or sound effects. All this on a 16K RAM machine (including video memory) loaded with the dynamic features a serious programmer demands. You get a 32x16 screen, multi-character variable names (two significant), editing, tracing, user-definable keys, 255-character string arrays, floating point 9-digit accuracy, and even machine language routines.

Priced at Only \$599, the TRS-80 Extended Color BASIC Computer is useful, entertaining and educational. Yet using it can be as simple as plugging in one of Radio Shack's instant-loading Program Paks. Come in and see what's already available. The computer attaches to your TV, or our own \$399 TRS-80 Color Video Receiver. For just \$24.95, you can add a pair of joysticks which add flexibility to games and video displays. A built-in serial interface lets you attach a printer or a modem. A tutorial Color BASIC instruction manual is included, of course.

More Good News. Extended Color BASIC is also available as an upgrade kit (\$99) for the 4K Color Computer (16K RAM required — \$119). There's a modest installation charge for each kit.

New TRS-80 VIDEOTEX Software (with the modem shown below) offers Color Computer owners quick, affordable access to many kinds of information and data services. For example, our exclusive agreement with CompuServe® Information Service gets you local, national and international news, weather and sports from 11 area newspapers and the Associated Press News Service; information on over 32,000 stocks and bonds; an educational reference service; entertainment news and reviews; nationwide Electronic Mail with other users; and much more! You'll also access Dow Jones Information Services for Wall Street news, stock quotes and more.

Only \$29.95 Buys You VIDEOTEX Software including a free hour on both CompuServe and Dow Jones, plus operator's manuals. Come see the new TRS-80 Color Computer, its programs and accessories, at one of our 6000 outlets today!



NEW

A Low-Cost, Direct-Connect Modem. A convenient alternative to an acoustic coupler. The TRS-80 Modem I lets you enter the world of microcomputer communication for only \$149. Cable extra.

Specifications. Low-Power CMOS Circuitry. Full duplex. 300/600 baud; 100 compatible ANS/ORIG. Sensitivity: -24 dB/15-33 dB. Connectors: DB25/4-pin DIN. Includes interface to Modem I-cassette port. FCC

Radio Shack®

A DIVISION OF TANDY CORPORATION

6000 STORES, 1200 COMPUTER CENTERS AND 150 SERVICE CENTERS

enough that beginners can tackle the project with confidence, assuming that they learn correct soldering techniques.

Proper soldering is so crucial to success that I would advise those with no experience to purchase Heathkit's soldering course. This course is part of Heathkit's continuing education program, and costs \$15.95 plus shipping. While I have not seen this particular course, I am sure, based on my experience with their other products, that it would be worthwhile. For further information, write to Heath Company, Benton Harbor MI 49022.

MicroAce BASIC contains several nice features. The use of keyword commands simplifies program entry and reduces the amount of memory required for program storage. Because line syntax is checked before the line is entered into a program, fewer programming errors can occur. This feature is especially useful for those just learning how to use BASIC.

The machine's compact size and light weight make storage and transportation very easy. The unit is simple

to attach to a home television set, and the cassette input and output operations are reliable, once the proper settings are found.

The largest drawback is the severely limited amount of programmable memory. This disadvantage is most apparent when you try to write any but the shortest programs utilizing a significant amount of video display. I would strongly encourage any prospective buyer to purchase the 2 K-byte version of the MicroAce. Another drawback is that the screen is blank during active program execution. This limits the types of possible graphic displays, and can be somewhat annoying.

If you recognize the limitations of the machine and don't expect too much, then I think you can buy the MicroAce kit with confidence. It is most appropriate for someone who wants an inexpensive unit as a teaching tool in order to learn the fundamentals of BASIC programming. It might also appeal to hobbyists who want to "tinker around" with microcomputers but don't want to risk their more expensive equipment. ■

COMPUTERS

OKIDATA



Microline 80	\$499
Microline 82	\$699
Microline 83	\$949

NORTHSTAR



Burned and tested - backed by fast warranty service. Find out why our prices, availability and service make us the #1 source for the #1 S-100 system.

HRZ-II 64K DD	\$2595
HRZ-II 64K Quad	\$2995
HRZ-II 32K DD	\$2339
HRZ-II 32K Quad	\$2689

SOROC



IQ120	\$729
IQ135	\$799
IQ140	\$1159

ONYPX



The 2-8000 arrives with Winchester storage, tape backup, proven multi-users software, Pascal, Fortran and more.

C8002	\$14,885
-------	----------

PAPER TIGERS



445G	\$749
460G	\$1119

ATARI



Buy a 16K Atari 800 for **\$775** and get 1 add'l. 16K for \$69 and/or 410-\$59. Star R. \$39. Joysticks \$14. 810 Drive \$49.

ZENITH



The all-in-one computer that's backed by your local Zenith/Heath service center.

Z89 w/48K 2 SIO's	\$2149
-------------------	--------

TELEVIDEO



912C	\$729
920C	\$759
950	\$949

ANADIX



DP-8000	\$759
DP-9000	\$1199
DP-9500	\$1299
DP-9501	\$1299

TERMINALS



Hazeline 1420	\$799
Hazeline 1500	\$859
ADM3A1	\$759
Pk Bantam	\$599
Zenith Z-19	\$789

We participate in arbitration for business and customers through the Better Business Bureau of Maricopa County.



Scottsdale Systems

6730 E. McDowell Road #103, Scottsdale, Arizona 85257

Open 8-5 Mon.-Fri.



(602) 941-5856



Export prices slightly higher: TWX 910-950-0082 (IMEC SCOT)

MORE PRINTERS

TI 810 Basic	\$1489	Diablo 630	\$2299
TI 825 RO Basic	\$1160	Epson MX-80	Call
C. Irah Starwriter	\$1499	MPI 88G	\$669
Centronics 737-P	\$724	Mallbu 165	Call
Centronics 737-S	\$779	NEC 5510 w/Tractor	\$2699
Darasaurh DS180	\$1399		

ORDERING

Mail-Order Only

2% cash discount included / charge cards add 2%. Prices subject to change, product subject to availability. Arizona residents add 5%. F.O.B. Scottsdale. 0-20% restocking fee for returned merchandise. Warranties included on all products.

COMPARE FLEXIBILITY.



Model 950

- Advanced editing with wraparound
- Smooth scrolling
- 15 baud rates (50B to 19.2kB)
- Protected fields
- Underlining
- Split screen with line lock
- Non-glare screen
- Programmable function keys
- 15 special graphics characters
- Versatile screen attributes
- Self test
- 25th status line
- Buffered auxiliary port
- 14 X 10 character resolution
- Integral modem option
- Tiltable screen

Tailor this smart CRT terminal to your particular needs and make it your own. It has the flexibility and brains to provide all the performance you need but is priced to make sense whether you need 10 or 1,000.

The TeleVideo model 950 detachable keyboard CRT Terminal has 11 special function keys—22 functions with the shift key—that can readily be programmed to your requirements using 256 bytes of on-board RAM.

You needn't stop there. You can change keys, key functions, even keyboard locations. And the 950's micro-processor based design means you can customize the firmware for your system.

Of course the 950 has premium TeleVideo performance—advanced editing with wraparound, split screen with line lock, and smooth scrolling. It also features a

25th status line, speeds to a true 19.2 kilobaud, and 15 special characters for powerful line graphics.

Contact TeleVideo for a detailed brochure, or call today to discuss how you can use these capabilities to make this terminal uniquely yours. TeleVideo, Incorporated, 2149 Paragon Drive, San José, CA 95131. (408) 946-8500.

Nationwide Field Service is available from General Electric Company. Instrumentation and Communication Equipment Service Shops.



COMPARE PRICE.

CALIFORNIA Costa Mesa (714) 557-6095 • San Jose (408) 946-8500 • MASSACHUSETTS Boston (617) 688-8891
NEW YORK/NEW JERSEY Paramus (201) 265-1321 • TEXAS Dallas (214) 980-9978

Digital Minicassette Controller

James Kahn
2284 Ellena Dr
Santa Clara CA 95050

The microcomputer-system designer has had a difficult time finding low-cost storage devices. Frequently, the choices have been limited to either standard Phillips audio cassettes or floppy disks. Although these are relatively inexpensive storage media, the transport mechanisms, or drives, are not. In addition to the transport, a controller and data formatter is required to interface the transport to the microcomputer system. The controller may either be a dedicated LSI (large-scale integration) device or be

Commonly used mass-storage mechanisms and associated controllers are often quite expensive.

built up discretely from SSI (small-scale integration) logic consisting of TTL (transistor-transistor logic) gates and flip-flops.

There is now another choice besides the floppy disk and the Phillips cassette: the digital minicassette. Not only is the storage medium inexpensive, so is the transport (about \$140, versus \$400 for a floppy-disk drive). As a bonus, the transport is extremely compact (only 23 cubic inches) and requires little power (1 watt). This makes it suitable for a wide range of low-end applications ranging from experimental systems to data logging for test instrumentation.

There *is* one problem with designs using a minicassette: controlling it. There are several choices for the transport controller. One choice is to design a controller of discrete SSI logic. Although this choice will provide good performance, it requires a handful of discrete components. The SSI controller will use much circuit-board space, compromising the advantage of a compact transport. A better design would use a minimal number of components and take advantage of current LSI technology.

One such controller-design solution is to use the Intel 8255A Programmable Peripheral Interface IC (integrated circuit) to interface the transport to a microcomputer system. Although this design provides a simple solution to the problem, the processor would be burdened with providing the low-level control needed by the transport, in addition to supporting its normal real-time I/O (input/output) tasks. Examples of these low-level tasks are transport start-up, data formatting, and transport shut-down.

There is, however, a better LSI solution available: distribute the system intelligence from the micro-

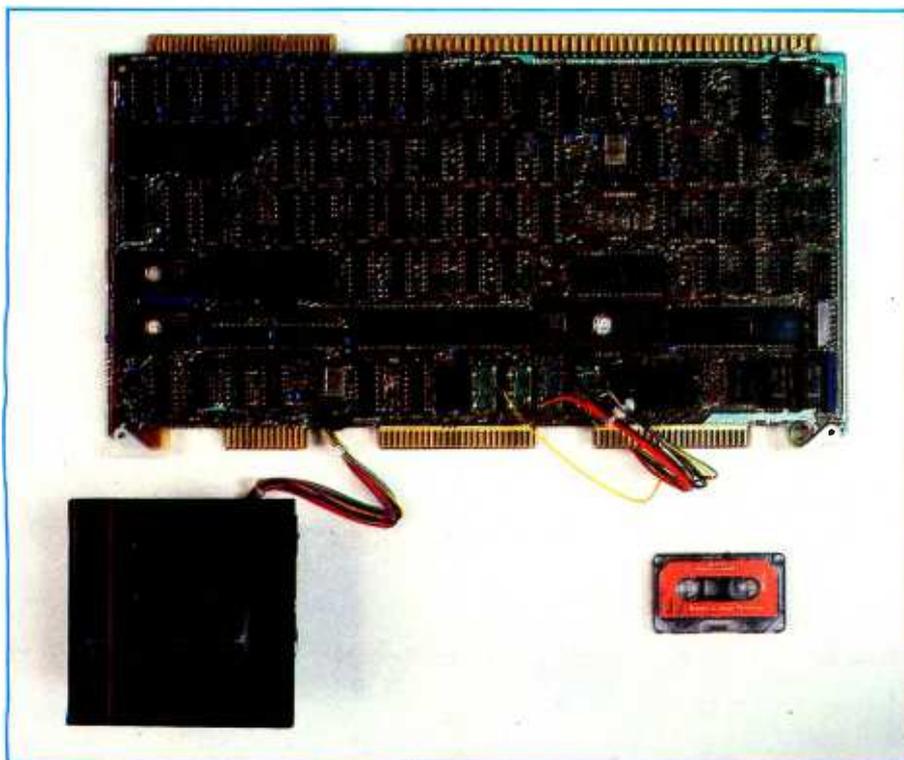


Photo 1: The author's minicassette system includes an Intel iSBC 80/30 single-board computer and a Braemar CM-600 Mini-Dek transport.



The best news since CP/M... customizable full screen editing

As a serious computer user you spend much of your time editing, whether it be for program development or word processing. Make the best use of your time with the help of VEDIT, an exceptionally fast and easy to use full screen editor. VEDIT is a highly refined and proven editor which is easy enough for novices to learn and use. Yet its unequalled set of features also makes it the choice of computer professionals. And because VEDIT is user customizable, it adapts to your keyboard, hardware, applications and preferences.

In VEDIT, the screen continuously displays the region of the file being edited, a status line and cursor. Changes are made by first moving the cursor to the text you wish to change. You can then overtype, insert any amount of new text or hit a function key. These changes are immediately reflected on the screen and become the changes to the file.

VEDIT has the features you need, including searching, file handling, text move and macros, plus it has many special features. Like an 'UNDO' key which undoes the changes you mistakenly made to a screen line. And a mode which allows a programmer to enter all text in lower case and let VEDIT convert the labels, opcodes and operands, but not the comments, to upper case. The screen writing is almost instantaneous on a memory mapped display or can use your CRT terminal's editing capabilities. Disk access is very fast too, and VEDIT uses less than 12K of memory. The extensive 70 page, clearly written manual has sections for both the beginning and experienced user.

Totally User Customizable

Included is a setup program which allows you to easily customize many parameters in VEDIT, including

the keyboard layout for all cursor and function keys, screen size (up to 70 lines, 200 columns), default tab positions, scrolling methods and much more. This setup program requires no programming knowledge or 'patches', but simply prompts you to press a key or enter a parameter.

The CRT version supports all terminals by allowing you to select during setup which terminal VEDIT will run on. Features such as line insert and delete, reverse scroll and reverse video are used on 'smart' terminals. Special function keys on terminals such as the H19, Televideo 920C and IBM 3101, and keyboards producing 8 bit codes or escape sequences are also supported.

New Features and Support

The new release includes disk write error recovery, indent and undent keys for structured programming, and the ability to insert a specified line range of another file at the cursor position. Versions for MP/M^R and the Apple II^R SoftCard^R are now also available.

Ordering

Specify the CRT version, your video board or microcomputer, the 8080/Z80 or Z80 code version, and disk format required.

Standard Package: Disk and manual.....\$110
Manual: Price refunded with software purchase.....15

VISA and MASTER CARD Welcomed.
Attractive Dealer Terms.

CP/M and MP/M are registered trademarks of Digital Research, Inc. Apple II is a registered trademark of Apple Computer, Inc. SoftCard is a trademark of Microsoft.

North Star ● Heath H8/H89 ● SuperBrain ● Apple II SoftCard ● Sorcerer ● TRS-80 Model I
TRS-80 Model II ● MP/M ● Most other CP/M^R Systems with CRT or Memory Mapped Displays

CompuView Products Inc.

618 Louise, Ann Arbor, Michigan 48103 ● Telephone (313) 996-1299

99-2017

with *Vector-pak* You Can Package Almost ANY System Faster, Have It Look Better, & Cost Less!

Using one of these systems?

- MULTI-BUS,
- Motorola Exorciser,
- Rockwell AIM 65 Expansion,
- STD-BUS,
- S-100 & IEEE 696.

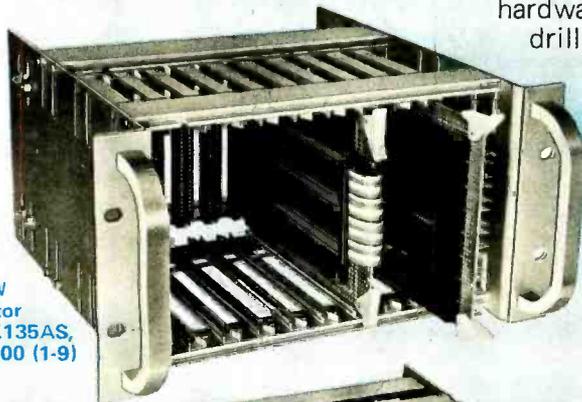
New packaging available.

Vector exclusives;

Your choice of plastic or metal card guides, fixed or adjustable positioning. Mount connectors or motherboards **without** special hardware or hole drilling. Vector



Vector CCK100,
\$49.80 (1-9)
for S-100, IEEE696, Motorola Exorciser.



NEW
Vector
CCK135AS,
\$36.00 (1-9)



Complete as shown, Vector
CMA3A-20 with modules, 152.00 (1-9)

ships more card cages and packaging off-the-shelf, than any other company. For expert assistance, call the packaging professionals in California, (213)365-9661, outside California, use our toll-free number: (800)423-5659.

processor to its peripheral devices by using an intelligent peripheral controller to carry the burden of low-level peripheral interface requirements. The processor now interfaces at a higher level, issuing the appropriate command to the controller and transferring the data to and from the controller in response to its I/O requests.

The controller provides a buffer between the processor and the transport. For example, the cassette transport expects data in a serial format, while the microprocessor is designed for handling data in either 8-bit words or 16-bit words. The controller performs data conversion from serial to parallel and buffers the data. This buffering is necessary to compensate for the I/O-service latency caused by other time-critical tasks handled by the microprocessor (ie: the data is held until the computer can devote itself to the controller). As a direct result, the system's work load is reduced, allowing it to utilize this savings in time to support other tasks, yielding a higher-performance microprocessor system.

Applying this to the minicassette design, we look through the available literature for dedicated single-device cassette controllers. Unfortunately, there are no devices of this caliber for minicassettes. There is, however, another solution: use the Intel UPI-41 Universal Peripheral Interface (UPI) integrated circuit. Two versions are available; we can use one of them, the 8741A, and design software, customizing it to control the minicassette transport.

The 8741A, shown in figure 1, is a complete, single-chip microcomputer containing 1024 bytes of EPROM (erasable programmable read-only memory), 64 bytes of programmable memory, 18 programmable I/O lines (providing a direct interface to the peripheral device), and a timer/event counter with an 8-bit prescaler for real-time I/O. In addition, it contains a complete slave-microprocessor bus interface, including both interrupt and direct-memory-access capabilities. A pin- and function-compatible factory-mask ROM (ie: programmed only at the factory) version of the UPI-41, the 8041A, is also available.

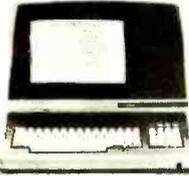
The 8243 I/O-port expander completes the system and interfaces directly to the I/O port of either of

 **Vector Electronic Company**
INCORPORATED

17460 Gladstone Avenue, Sylmar, California 91342; TWX (910) 495-1539

SYNCHRO-SOUND

The ORIGINAL Computer People
who KNOW Computers
and offer EVERYTHING you need
in Small Computer Systems



TERMINALS

ADDS Regent 25

LEAR SIEGLER

ADM 3A
ADM 31
ADM 42



SOROC Technology

IQ 120
IQ 140

PRINTERS

QUME Sprint

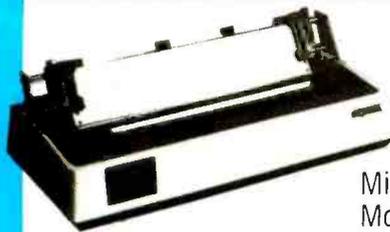
5/45 KSR 5/55



DECwriter IV LA 34



TELETYPE 43



OKIDATA

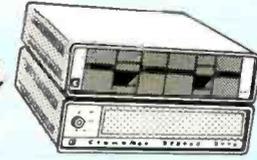
Microline 80 \$570.
Model SS1 for
Atari 800 \$695.

A PERFECT TOTAL COMPUTER SYSTEM!



Texas Instrument
810 Multi Copy
Impact Printer

150 characters per
sec. bi-directional
printing



Cromemco
System Zero/D
Computer

with model DFF
disk drive



Hazeltine
1420 Video
Intelligent Terminal

Upper & lower
case, numeric pad,
function keys, etc.

ONLY \$5795.



HAZELTINE Executive 80 Series

Model 20 Model 30

COMPUTERS



NORTHSTAR
HORIZON II
HORIZON II Quad

CROMEMCO System 3



ATARI
400
800

MORE SPECIALS

Integral Data Systems Model 445 Printer . . . \$695.00	Livermore Accoustic Coupler \$195.00
Centronics 779-2 775.00	Centronics Micro Printer 349.00
Televideo Model 950 1295.	5" Scotch Diskette Box 34.95
Industrial Micro Systems 16 K static memory . . . 349.00	8" Scotch Diskette Box 39.95

MANY OF OUR PRICES ARE TOO LOW
TO ADVERTISE. PLEASE CALL OR WRITE

We carry a full line of Alpha-Micro Products.
We have a full staff of Programmers and Computer
Consultants to design, configure and deliver a Turnkey
Computer System to meet your specific requirements.



SYNCHRO-SOUND

ENTERPRISES, INC.

THE COMPUTER PEOPLE

125 Mineola Ave., Roslyn Heights, N.Y. 11577 • TWX 710-582-5886

PHONE ORDERS CALL:
516/484-1852

TOLL FREE:
800/221-2320

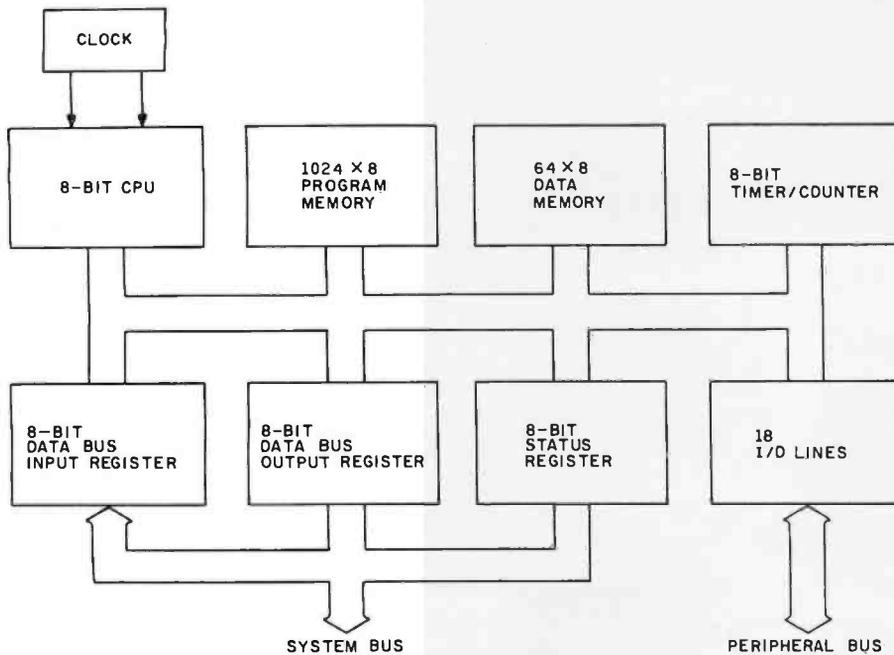


Figure 1: Internal block diagram of the 8741A/8041A Universal Peripheral Interface. I/O lines can be programmed as inputs or outputs; 8041A control-program memory must be factory programmed; 8741A memory is user-programmed.

the two slave microcomputers. Each 8243 provides 16 programmable, bidirectional I/O lines.

Using the 8741A allows the designer to develop a custom peripheral interface for particular I/O problems. These devices have found applications in such diverse areas as character-printer control, data encryption, keyboard control, and intelligent displays. Developing an 8741A design is straightforward. The

designer develops a control algorithm using the UPI-41A cross assembler and programs the on-board EPROM of the 8741A. Testing may be accomplished using either an ICE-41A in-circuit emulator or the single-step mode of the 8741A.

The Hardware

The complete microcomputer system is shown in photo 1, including the CM-600 minicassette transport.

The microcomputer system for this design consists of an Intel iSBC 80/30 single-board computer. It supports an 8085A microprocessor, 8 K bytes of EPROM, and 16 K bytes of programmable memory. In addition to an 8255A parallel interface and an 8251A serial interface, it contains a Multibus system bus connector allowing expansion beyond the board's local resources. Incidentally, there is an 8741A socket built into the board as well.

Let us examine the microcomputer-to-8741A hardware interface. The computer sees the 8741A as three registers in its I/O address space: the data register, the command register, and the status register. The decoding of these registers is shown in figure 2. Within the 8741A, both the data and commands are written into the same physical register, the Data Bus Buffer Input register (DBBIN). The state of the register-select input, A_0 , determines whether a command or data has been written ($A_0=0$ for data). All output to the microprocessor is read from the Data Bus Buffer Output register (DBBOU).

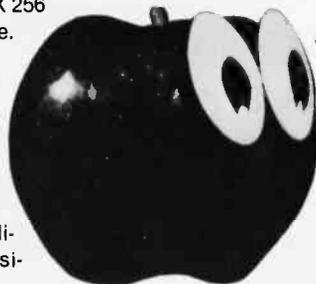
The status register is composed of 4 software-programmable bits and 4 reserved bits reflecting the state of the 8741A slave microcomputer (see figure 3 on page 78). The Input Buffer Full (IBF) bit and Output Buffer Full (OBF) bit reflect the state of the DBBIN and DBBOU registers, respectively. Flag 0 (F_0) and Flag 1 (F_1) can be set and complemented via the

LET YOUR APPLE SEE THE WORLD!

The DS-65 Digisector® is a random access video digitizer which converts a TV camera's output into digital information the Apple can process. It features 256 X 256 resolution with up to 64 levels of grey scale. Scanning sequences are user programmable. On-board software in EPROM is provided for displaying digitized images on the Hi-Res screen.

Use the DS-65 for: Precision Security Systems
 • Computer Portraiture • Robotics • Fast to Slow Scan Conversion • Moving Target Indicators • Reading UPC codes, schematics, musical scores and paper tape •

NEW SOFTWARE FOR THE DS-65 IS NOW AVAILABLE ON DISK!



— Portrait System Software: This program includes captions and a credit line, reverse printing for T-shirt application and the option to save portraits on disk.

— Picture Scanner: Provides a variety of different dithering algorithms for compressing the digitized image into the Hi-Res screen.

Write or call for more information!

GIVE YOUR APPLE THE GIFT OF SIGHT!

THE MICRO WORKS

DS-65 Price: \$349.95
 FSII Camera Price: \$299.00
 Combination Price: \$599.00

Master Charge / Visa Accepted

P.O. BOX 1110 DEL MAR, CA 92014 714-942-2400

The Perfect Fit

The Micromodem II data communications system and the Apple II* computer. What better combination to maximize the capabilities of your personal computer!

This popular direct connect modem can transmit data between an Apple II and another Apple II, a terminal, another microcomputer, minicomputer or even a large time-sharing computer anywhere in North America. The Micromodem II has unique automatic dialing and answer capabilities which further increases the communications possibilities between the Apple II and another computer or terminal.

You can send and/or receive messages or data when you are out of your office, home or out of town. Your branch business locations can communicate with each other regarding inventory and other matters over the phone. Or you can communicate with friends across the country. And you can access information utilities like the SOURCE for various business and personal applications.

The Micromodem II consists of two parts. One part includes the printed circuit board which holds the Micromodem II, ROM firmware and the serial interface. The board plugs directly into the Apple II providing all the functions of a serial interface card plus programmable auto dialing and auto answer capabilities. The on-board ROM firmware enables the Micromodem II to operate in any of three modes to perform different tasks-terminal mode, remote console and program control mode.

The other part of the Micromodem II datacomm system is a Microcoupler which connects the Micromodem board and Apple II to a telephone line. The Microcoupler gets a dial tone, dials numbers, answers the phone and hangs up when a transmission is over. There are none of the losses or distortions associated with acoustic couplers. The Microcoupler is compatible with any North American standard telephone lines and is FCC-approved for direct connection in the U.S. It works with standard dial phone service or Touch-tone service.

The Micromodem II is completely compatible with Bell 103-type modems. Full and half-duplex operating modes are available as well as speed selectable transmission rates of 110 and 300 bps.

Why not increase your Apple II's capabilities by outfitting it with the sophisticated Micromodem II data communications system? The Micromodem II is available at retail computer stores nationwide. For the store nearest you, call or write:

Circle 48 on Inquiry card.

 **Hayes**

Hayes Microcomputer Products Inc.

5835 Peachtree Corners East, Norcross, Georgia 30092 (404) 449-8791

™ Micromodem II is a trademark of Hayes Microcomputer Products, Inc.

* Apple II is a registered trademark of Apple Computer Inc.

The Micromodem II can also be used with the Bell & Howell computer.



internal software. The remaining 4 bits are used to indicate the status of the transport.

The TTL-compatible I/O lines of the 8741A provide an uncomplicated interface to the CM-600 Mini-Dek minicassette transport (Mini-Dek is a registered trademark of Braemar Computer Devices Inc). The I/O lines can be divided into three groups: motor control, data control, and cassette status. These I/O port lines are shown in the 8741A interface schematic in figure 4 on page 78. The motor-group controls are go/stop, fast/slow, and forward/reverse. The data controls are read/write, data-in, and data-out. The remaining group of outputs reflects the CM-600's status: clear leader, cassette present, file protected, and cassette side.

The Braemar CM-600 Mini-Dek transport is representative of digital minicassette transports. The transport is compact, requiring only 3 by 3 by 2½ inches for mounting. It has a single read/write head and uses only one drive motor. Operating from a 5 V supply, it has modest power-supply requirements, needing only 200 mA during a read or write.

Tape speeds are 3 ips (inches per second) during read/write, 5 ips for fast forward, and 15 ips during rewind. Calculating the data-transfer rate based on the read/write speed and the maximum recording density of 800 bpi (bits per inch) yields a maximum data-transfer rate of 2400 bps (bits per second). A more useful representation illustrating the significance of this number is obtained by inverting it. This yields the bit-cell period: 416 μ s. This control requirement is easily met by the 8741A, its timer having a minimum resolution of 80 μ s. If finer resolution were required, software-timing loops would have to be used. The maximum resolution is limited to the instruction-cycle time of the 8741A, 2.5 μ s, necessary for transfer rates of 8000 bps.

Recording Format

Since the CM-600 does not provide any data formatting, the 8741A must perform this additional low-level task. A multitude of encoding techniques are available from which the user may choose [ie: NRZ1 (Non-return to Zero, change if 1), Phase, GCR (Group Code Recording)]. For

this application, a "self-clocking" phase-encoding scheme similar to that used in floppy disks was selected. Phase encoding provides easy encoding and decoding of the serial data, embedding the timing information and data bits together in the recorded bit cells on the tape. This is an effective means of compensating for speed variations of the drive. Reading the data is accomplished by using the clocking information of the bit cell to synchronize the sampling of the data bit coming from the transport.

Figure 5 on page 78 illustrates this encoding technique as applied to the hexadecimal character 3A (all characters referenced in this article are hexadecimal). Notice that each bit cell begins with a transition to a logic level opposite the level of the preceding bit-cell level. Decoding the data is simply a matter of starting a timer on this "clocking" transition of the cell, waiting 3/4 of a bit-cell period, and determining whether a mid-cell transition occurred. Cells with no mid-cell transitions are 0s; cells with transitions are 1s. Besides the encoding

Text continued on page 80

Introducing...

MINI-FLEXTM

Designed Specifically to Protect 5" Diskettes

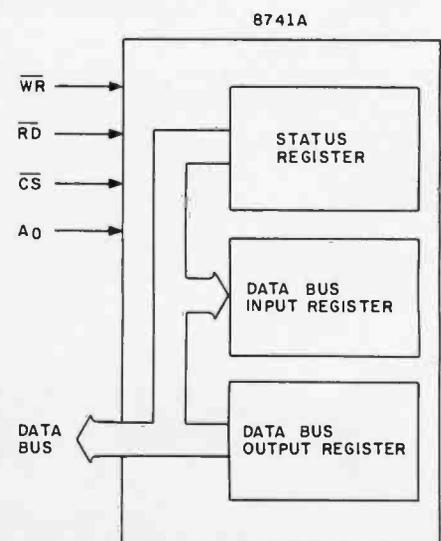


The Newest Member of The Advance Access Diskette Protection Family

For Further Information
CALL TOLL FREE
800-323-3412



ADVANCE ACCESS GROUP
2200 S. Main St., Lombard, IL 60148 312-629-5800
"Manufacturers of Information Processing Supplies"



CS	RD	WR	A ₀	REGISTER
0	0	1	0	DBBOUT
0	0	1	1	STATUS
0	1	0	0	DBBIN (DATA)
0	1	0	1	DBBIN (COMMAND)
1	X	X	X	NONE

Figure 2: 8741A system-bus interface and register decoding as seen by the host processor.

First compare quality. Then compare cost.

Morrow Designs' 10 megabyte hard disk system: \$3,695.

MORE MEMORY. LESS MONEY.

Compare Morrow Designs' DISCUS™ M26™ hard disk systems to any system available for S-100 or Cromemco machines. First, compare features. Then, compare cost per megabyte. The M26 works out to under \$200 a megabyte. And the M10 is about half the cost of competing systems.

COMPLETE SUBSYSTEMS.

Both the M10 (8"), and the M26 (14"), are delivered complete with disk controller, cables, fan, power supply, cabinet and CP/M® operating system. It's your choice: 10 Mb 8" at \$3,695 or 26 Mb 14" at \$4,995. That's single unit. Quantity prices are available.

BUILD TO FOUR DRIVES.

104 Megabytes with the M26. 40+ megabytes with the M10. Formatted. Additional drives: M26: \$4,495. M10: \$3,195. Quantity discounts available.

S-100, CROMEMCO AND NORTH STAR*

The M26 and M10 are sealed-media hard disk drives. Both S-100 controllers incorporate intelligence to supervise all data transfers through four I/O ports (command, 2 status and data). Transfers between drives and controllers are transparent to the CPU. The controller can also generate interrupts at the completion of each command ... materially increasing system throughput. Sectors are individually write-protectable for multi-use environments. North Star or Cromemco? Call Micro Mike's, Amarillo, TX, (806) 372-3633 for the software package that allows the M26 and M10 to run on North Star DOS. MICAH of



Morrow Designs' 26 megabyte hard disk system: \$4,995.



Sausalito, CA, (415) 332-4443, offers a CP/M expanded to full Cromemco CDOS compatibility.

AND NOW, MULT-I/O.™

Mult-I/O is an I/O controller that allows multi-terminal and multi-purpose use of S-100 and Cromemco computers. Three serial and two parallel output ports. Real time clock. Fully programmable interrupt controller. Designed with daisy-wheel printers in mind. Price: \$299 (kit), \$349 assembled and tested.

MAKE HARD COMPARISONS.

You'll find that Morrow Designs' hard disk systems offer the best price/performance ratios available for S-100, Cromemco and North Star computers. See the M26 and M10 hard disk subsystems at your computer dealer. Or, write Morrow Designs. Need information fast? Call us at (415) 524-2101.

**Look to Morrow
for answers.**

MORROW DESIGNS

5221 Central Avenue
Richmond, CA 94804

*CP/M is a trademark of Digital Research Corp.
*Cromemco is a trademark of Cromemco, Inc.
*North Star is a trademark of North Star Computers, Inc.





SYSTEMS

- A. APPLE II PLUS 16K 1049
- APPLE II PLUS 48K (APPLE Memory) 1189
- APPLE II STANDARD MODELS CALL
- These are the newest models with FCC type approval to prevent RF interference.
- B. DISK II DRIVE & CONTROLLER 529
- This model includes DOS 3.3 16 sector
- DISK II DRIVE ONLY (ADD-ON) 445
- C. CHALLENGER 4P by OHIO SCIENTIFIC 699
- C4PMF (MINI FLOPPY SYSTEM) 1599
- CIP MODEL II 449
- SARGON II (DISK OR CASSETTE) 35
- FIG FORTH (DISK ONLY) 69
- D. PMC-80 THE 'TRS-80 WORKALIKE' 629
- 16K LEVEL II W/PROGRAM RECORDER
- CALL OR WRITE FOR MORE INFORMATION
- E. EXIDY SORCERER II CALL
- AVAILABLE IN 16K, 32K & 48K MODELS
- 5-100 EXPANSION UNIT 375
- WORD PROCESSING PAC 179
- DEVELOPMENT PAC 89
- F. ATARI 800 16K 799
- ATARI 400 16K 499
- 810 DISK DRIVE 499
- 410 PROGRAM RECORDER 69
- 850 INTERFACE MODULE 175

PRINTERS

- ANADEX DP-9500 W/2K BUFFER 1375
- ANADEX DP-9501 W/2K BUFFER 1450
- BASE 2 800-D 599
- C. ITOH STARWRITER 25 CPS 1750
- C. ITOH STARWRITER 45 CPS 2450
- A. CENTRONICS 737 825
- EPSON MX-70 W/GRAPHICS 449
- B. EPSON MX-80 132 col. 620
- PAPER TIGER IDS-445 W/DOT PLOT 749
- C. PAPER TIGER IDS-460 W/DOT PLOT 1195
- PAPER TIGER IDS-560 W/DOT PLOT 1495
- D. QUME SPRINT 5/45 2550
- SILENTYPE W/INTERFACE 549



VIDEO MONITORS

- A. AMDEX/LEEDEX VIDEO-100 12" BGW 139
- HITACHI 13" COLOR 389
- B. NEC 12" P31 GREEN PHOSPHER CALL
- PANACOLOR 10" COLOR 375
- SANYO 9" BGW 179
- C. SANYO 12" BGW 255
- SANYO 12" P31 GREEN PHOSPHER 295
- SANYO 13" COLOR 445

SHOPPING MAIL ORDER? CALL US TODAY!

We probably have what you're looking for in stock at an incredible price. Our company is an authorized dealer for sales and service for Apple Computer, Atari and Ohio Scientific. If you receive a defective product from us we will repair or replace (at our option) any product in warranty. Our Service Center will repair all Apple Computer products. In or out of warranty, whether it was purchased from us or another dealer. (call for more details)

PHONE ORDERS IN CALIFORNIA, ALASKA, HAWAII & FOREIGN (714)698-8088
 SHIPPING INFORMATION OR BACKORDERS PLEASE CALL (714)698-0260
 SERVICE CENTER AND FOR TECHNICAL INFORMATION (714)460-6302

Order Dept.
Open Every Day
9 a.m. - 6 p.m.
P.S.T.

TOLL FREE ORDER LINE

800-854-6654



APPLE HARDWARE

TOP FIVE SELLERS

LANGUAGE SYSTEM W/PASCAL . . .	425
SILENTYPE PRINTER W/INTERFACE . . .	549
HAYES MICROMODEM II . . .	319
VIDEX VIDEOTERM 80 w/graphics . . .	335
Z-80 MICROSOFT CARD . . .	299

APPLE COMPUTER INC.

DISK II DRIVE ONLY . . .	445
INTEGER OR APPLESOFT II FIRMWARE CARD . . .	155
GRAPHICS TABLET . . .	649
PARALLEL PRINTER INTERFACE CARD . . .	155
HI-SPEED SERIAL INTERFACE CARD . . .	155
COMMUNICATIONS INTERFACE CARD . . .	185
SMARTERM 80 COLUMN VIDEO CARD . . .	335

MOUNTAIN COMPUTER INC.

MUSIC SYSTEM (16 Voices) . . .	479
A/D + D/A INTERFACE . . .	319
EXPANSION CHASSIS . . .	555
INTROL/X-10 SYSTEM . . .	249
CLOCK/CALENDAR CARD . . .	239
SUPERTALKER 5D-200 . . .	249
ROMPLUS+ CARD . . .	135
ROMWRITER CARD . . .	155

CALIFORNIA COMPUTER SYSTEMS

CLOCK/CALENDAR MODULE . . .	109
GPIB IEEE-488 CARD . . .	259
ASYNCHRONOUS SERIAL INTERFACE CARD . . .	129
CENTRONICS PARALLEL INTERFACE CARD . . .	99
We carry all CCS hardware. Please call	

MISC. APPLE HARDWARE

16K RAM UPGRADE (Apple, TRS-80, Exldy) . . .	189
16K RAM CARD MICROSOFT . . .	189
ABT NUMERIC KEYPAD (old or new kybrd) . . .	115
ABT BAR CODE READER WAND . . .	179
ALF 3 VOICE MUSIC CARD . . .	229
ALF 9 VOICE MUSIC CARD . . .	169
ALPHA SYNTAURI KEYBOARD SYSTEM . . .	1399
BIT 3 FULL VIEW 80 CARD . . .	349
CAT NOVATION ACOUSTIC MODEM . . .	169
CORVUS 10MB HARD DISK . . .	CALL
LAZER LOWER CASE PLUS . . .	50
MICRO-SCI DISK DRIVES . . .	CALL
PAYMAR LOWER CASE (old or new kybrd) . . .	55
RADCOM AMATEUR RADIO INTERFACE CARD . . .	189
SPEECHLINK 2000 HEURISTICS . . .	229
SSM AIO SERIAL/PARALLEL CARD A&T . . .	189
SUP-R-TERMINAL 80 COL. CARD . . .	339
SVA 8 INCH FLOPPY DISK CONTROLLER . . .	345
VERSAWRITER DIGITIZER PAD . . .	229
VIDEX KEYBOARD ENHANCER . . .	115
We stock much more than listed. Please call.	

APPLE SOFTWARE

APPLE COMPUTER INC.

DOS TOOLKIT . . .	65
APPLEPLOT . . .	60
TAX PLANNER . . .	99
APPLE WRITER . . .	65
APPLE POST . . .	45
DOW JONES PORTFOLIO EVALUATOR . . .	45
DOW JONES NEWS & QUOTES REPORTER . . .	85
APPLE FORTRAN . . .	165
APPLE PILOT . . .	129
DOS 3.3 UPGRADE . . .	49
MUSIC THEORY . . .	45
THE CASHIER Retail Mngmnt & Inv. . . .	199
THE CONTROLLER Gen. Bus. Sys . . .	519

MISC APPLICATIONS PACKAGES

VISICALC . . .	125
DESKTOP PLAN II . . .	169
CCA DATA MANAGEMENT DMS . . .	85
EASYWRITER WORD PROCESSOR . . .	225
EASYMOVER MAIL SYSTEM . . .	225
EASYMAILER LETTER WRITER . . .	225
ASCII EXPRESS . . .	65
MICROSOFT FORTRAN . . .	185
MICROSOFT COBOL . . .	695
MICROSOFT BASIC COMPILER . . .	375
SUPER TEXT II . . .	139
PROGRAMMA APPLE PIE . . .	119
THE LANDLORD Apt Mngmnt package . . .	649
PEACHTREE BUSINESS SOFTWARE . . .	CALL
TAX PREPARER by HowardSoft . . .	89
APPLEBUG ASSEM/DISASSM/EDITOR . . .	75
3-D GRAPHICS By Bill Budge . . .	53
SUPER FORTH . . .	49

TOP TEN GAMES

APPLE GALAXIAN . . .	23
FLIGHT SIMULATOR . . .	34
THE WIZARD AND THE PRINCESS . . .	32
COSMOS MISSION (SPACE INVADERS) . . .	24
SARGON II CHESS . . .	32
HI-RES FOOTBALL . . .	39
COMPUTER QUARTERBACK . . .	39
ADVENTURE BY MICROSOFT . . .	27
PHANTOMS FIVE . . .	39
REVERSAL (OTHELLO) . . .	34

**CALL OR WRITE
FOR A COMPLETE
SOFTWARE LIST**

ORDERING INFORMATION: Phone Orders invited using VISA, MASTERCARD, AMERICAN EXPRESS, DINERS CLUB, CARTE BLANCHE or bank wire transfer. Credit cards subject to service charge: 2% for VISA & MC, 5% for AE, DC & CB. Mail Orders may send credit card account number (include expiration date), cashiers or certified check, money order or personal check (allow 10 days to clear). Please include a telephone number with all orders. Foreign orders (excluding Military PO's) add 10% for shipping all funds must be in US dollars. Shipping handling and insurance in US add 3% (minimum \$4.00). California residents add 6% sales tax. We accept COD's under \$500. OEM's, Institutions & Corporations please send for written quotation. All equipment is subject to price change and availability without notice. All equipment is new and complete with manufacturer warranty (usually 90 days). We cannot guarantee merchantability of any products. We ship most orders within 2 days.

**WE ARE A MEMBER OF THE BETTER BUSINESS BUREAU AND THE CHAMBER OF COMMERCE
SHOWROOM PRICES MAY DIFFER FROM MAIL ORDER PRICES.
PLEASE SEND ORDERS TO:**

CONSUMER COMPUTERS MAIL ORDER 8014 PARKWAY DRIVE, GROSSMONT SHOPPING CENTER NORTH LA MESA CALIF. 92041

10 DAY FREE RETURN

NEC THE FIRST NAME IN LETTER QUALITY PRINTERS.

Compumart offers beautiful print quality with NEC Spinwriter terminals. Both KSR and RO versions give unsurpassed hard copy output. CALL



CENTRONICS PRINTERS

The incredible Model 737. The closest thing to letter quality print for under \$1,000. 737-1 (Parallel Interface)—\$899.

NEW FROM INTEGRAL DATA—THE IDS 560 PRINTER. 132 column graphics printer. \$1,695

IDS 445. Priced lower than the 440 and equipped with a better print head. IDS 445 w/graphics \$894. IDS 445 w/o graphics \$795.

IDS 460 \$1,295

The 460's features include: Correspondence quality printing, high resolution graphics capability, programmable print justification.



Omni Printers from Texas Instruments

The 810—List \$1895. SALE! \$1795. The 820 (Ro) Package—Includes machine-mounted paper tray and cable. A compressed print option and device forms control are standard features \$2,155. The 820 (KSR) Package—Includes full ASCII Keyboard plus all of the features of the RO \$2,395.

Dysac Diskettes—Single side. Single density. Hard or Soft Sector \$5. ea.

Memorex 3401's—5 1/4 discs \$3.25 with hub ring for Apple \$3.50.

Memory Integrated Circuits—

Call for qty. discounts when ordering over 50 units. **Motorola 4116** (200 Nanosecond. Plastic) \$4.50 ea. **Fairchild 2114** (Standard Power. Plastic) \$4.50 ea.

Super Selling Terminals

We have the following **Lear Siegler** Terminals in stock at prices too low to print—Call for quotes.

ADM—3A Industries favorite dumb terminal for some very smart reasons.

ADM—3A + NEW from Lear Siegler. CALL! **IT IS HERE!**—It is the new Intermediate Terminal from Lear Siegler. Call for details.



We have the following best-selling **Hazeltine** terminals in stock at prices much too low to print.

(410, 1420, 1500, 1520, 1552) Call COMPUMART Now for our lowest prices ever.



COMPUMART's Microflex 65 System for your AIM Includes Adapter Buffer Module w/4-slot module stack, 8K RAM module, 16K PROM/ROM module, Asynchronous communications Interface, and Power Supply \$1,299 Call or write for our complete Microflex 65 brochure



ROCKWELL AIM 65

Our AIM system includes 4K AIM with BASIC interpreter assembler. Power Supply, Cassette recorder & Enclosure \$799. 4K AIM-65 \$499. PL65 High Level Language \$125. Paper for the AIM (roll) \$25.00. Rockwell's 4-slot Motherboard (sale) \$175. Fourth for Rockwell AIM 65 \$175.

NEW IN STOCK. The PMC-80. The new computer that's software compatible with the TRS-80.

Level II 16K at \$645.

ACCESSORIES FOR PMC—80

EXP-100 S-100 Bus Expander \$410.

S-32K S-100 Bus 32K RAM Board \$295

for EXP-100

CAB-40 Cable 12" long ribbon cable

for EXP-100 \$25.



Visit our giant

ANN ARBOR STORE

1250 North Main Street Ann Arbor, Michigan

COMPUMART stocks the complete line of **MATROX PRODUCTS**. Call for specs.

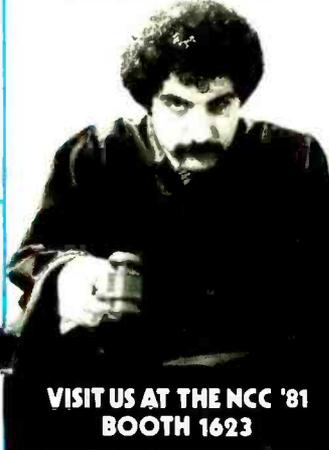
COMPUMART now offers the ENTIRE **DEC LSI-11 PRODUCT LINE**. Call for prices & delivery.

NOVATION CAT™ ACOUSTIC MODEM

Answer Originate, 300 Baud, Bell 108, Low Profile Design. \$179.00

NEW! D-CAT

Direct Coupler from Novation \$199.



VISIT US AT THE NCC '81 BOOTH 1623

SEND FOR OUR FREE CATALOG

HP-41C Calculator \$239.00

Memory Modules. For storing programs or up to 2,000 lines of program memory \$29.95

"Extra Smart" Card Reader. Records programs and data back onto blank magcards \$199.00

The Printer. Upper and Lower case. High resolution plotting. Portable Thermal operation \$355.00

Application Modules \$29.95

NEW SUPER 41-C Systems with Quad RAMS built-in. (Maximum memory on-board leaves slots open for Application Pacs and peripherals. The HP 41-C \$325.00 HP 41-C Plus Card Reader \$495.00

HP 41-C Plus Card Reader & Printer \$845.00 Quad RAMS for the 41-C (Equivalent to four Memory Modules all packed into one) \$95.00



HP-85—Hewlett-Packard's Personal Computer for Industry. This extremely portable computer features extended BASIC to solve your problems quickly and efficiently along with an advanced graphics system to enhance communication.

HP-85 ACCESSORIES—We carry HP. Peripherals (Disk Drives to Graphics Plotters) Enhancements (BASIC Training, General Statistics, Financial Decision, Math, Linear Programming \$95 ea.). HP-85 Accessories (Enhancement ROMs, ROM drawer, Overhead Transparency Kit), Supplies (Plotter Pens, Tape Cartridges), Interface Modules (HP-IB Interface, HP-IB Interconnect Cables, Senal (RS-232C) Interface Module). We can get you every HP peripheral made for the HP-85.

VISICALC PLUS FOR HP-85 Everything you ever wanted from Visicalc plus plotting. \$200.

HP83 VIRGO Has the same computing power as the HP85 without the added cost of tape drive and printer, for use with disc drives and optional printer/plotter accessories. CALL FOR COMPLETE DETAILS & SPECS.

COMPUMART exclusive ATARI SPECIALS—ATARI 800 Personal Computer System—Comes with 800 operators Manual, 16K Rany Memory module, 10K ROM Operating System, Power Supply, TV Switch Box \$950.



PERIPHERALS

Atari 410 Program Recorder \$89.95

Atari 810 Disk Drive (\$100 off with purchase) \$699.95

NEW Dual Disk double density \$1499.95

825 Printer (Centronics 737) \$995.00

RS232 Interface w/Cable \$249.95

NEW! Light Pens \$74.95

NEW! Visicalc for Atari \$199.00

Educators Take Note. Atari has extended its 3 for 2 deal until 6/30/81. Any educational institution that buys two Atari 800's will receive an Atari 400 computer absolutely FREE. Call our sales dept. for complete details.

IMPORTANT ORDERING INFORMATION All orders must include 4% shipping and handling. Mass residents add 5% sales tax. Michigan residents 4% for sales tax. Phones open from 8:30 a.m. to 7:00 p.m. Mon-Fri. 11:00 a.m. to 4:00 p.m. Sat. P.O.'s accepted from Dun & Bradstreet rated companies—shipment contingent upon receipt of

signed purchase order. Sale prices valid for month of magazine date only—all prices subject to change without notice. Our Ann Arbor retail store is open 11:00 a.m. to 7:00 p.m. Tues-Fri. 10:00 a.m. to 5:00 p.m. Saturdays

APPLE II

We carry the most complete inventory of Apple computers, peripherals, and software. CALL! **Our Best Selling Apple System. Save over \$250** on our most popular Apple System. System includes a 48K Apple II, Apple Disk, DOS3.3, & Controller, and a Sup R. Mod RF Modulator.

List: **\$2209.**
COMPUMART Sale Price: \$1895.

SOFTWARE FROM APPLE

Apple Plot The perfect graphic complement for Visicalc. **\$70**
 Dow Jones News & Quotes **\$95**
 Adventure (Uses 48K) **\$35**
 DOS Tool Kit **\$75**
 Apple Fortran **\$200**
 Tax Planner **\$120**

FROM PERSONAL software

Visicalc **\$149**
 Desk Top Plan **\$99**
 NEW FROM MUSE
 The Voice **\$39.95**
 Super Text **\$150**
 Address Book **\$49.95**

Miscellaneous Apple II Accessories:

Easy Writer (80 col. need a Videx) **\$249**
 Easy Mover **\$49**
 Easy Mailer **\$69**

NEW from Apple for the Apple II

DOS 3.3 Convert disks to 16 sector format for 23% more storage and faster access **\$60.**

NEW for the Apple II

From MicroSoft
 16K RAM Board **\$195.00**
 FORTRAN **\$175.00**
 COBOL **\$750.00**
 Card Reader from Mountain Hardware **\$1,195.00**
 Hi-Res Dump for 460 Printer from the Computer Station **\$49.95**

HARDWARE ACCESSORIES FOR APPLE

Silentype Printer w/x face **\$635**
 Super Sound Generator (mono) **\$159 (stereo) \$259**
 Light Pen **\$249**
 X-IO Controller (plugs into pad. die port) **\$49**
Mountain Computer—Expansion accessories for your Apple
 Intro-IO System **\$289**
 Super Talker **\$299**
 The Music System **\$545**
 ROM plus board w/Keyboard filter **\$199**
 Clock Calendar **\$280**
 16 Channel A to D Converter **\$350**

Apple Expansion Chassis **\$650**
 ROM Writer **\$175**

From VIDEKI—Video Term.
 80 Col. x 24 line, 7 x 9 Matrix plug in compatible board for the Apple II. Price **\$325** without graphics EPROM. With graphics EPROM **\$350.**
 SSM. Serial & Parallel Apple Interface **\$225**
 ABT's Numeric Key Plan **\$110**
 California Microcomputer Keyboard **\$195**

Apple III is in stock—CALL!

Commodore Strikes Back!

CompuMart carries the entire Commodore line of computers, peripherals, and accessories— call our sales force today for complete prices and specs

The CompuMart/Commodore Word Processing System

Get crisp, letter quality output and ease of operation that's unsurpassed. This system includes a Commodore 8032 32K CPU, a 4040 Dual Disk, a C-Itoh printer and X/face, and Word Pro 4 Plus (all cables included). Call for details and low prices. List \$5685 **COMPUMART \$4995.**

A complete system including a Dual Disk Drive, Tractor Printer, and an 80 column 32K CPU for under \$4,000. No interfaces needed. Cables included. List \$3,985 **CompuMart \$3635**

New accessories from Commodore for Commodore

Visicalc **\$199**
 Word Pro 4 **\$299**
 Ozz the Information Wizard **\$395**
 Wordcraft 80 **\$395**
 Tax Preparation Planner **\$495**
 Dow Jones Portfolio Management System **\$149**
 Personal Tax Calculator **\$69**
 PASCAL Development Package **\$295**
 Assembler Development Package **\$99**

Educators Take Note! Commodore has extended its 3 for 2 deal until 6-30-81.



Complete Word Processing System for Under \$5,000!

COMPUMART has been serving the computer needs of industry since 1971.

We stock, for immediate shipment, only those products from the finest micro-computer manufacturers.

And any product, except software, can be returned within 10 days for a full refund—even if you just change your mind.

We also honor all manufacturers' warranties. Our expert technicians will service any product we sell that cannot be better, or faster, serviced by the manufacturer's local service center.

Call us for more information on products, product configuration and service. Our phones are open Monday thru Friday, 8:30 a.m. to 7:00 p.m. and Saturday 11:00 a.m. to 4:00 p.m.

We have a staff of highly knowledgeable sales people waiting to hear from you, and to help.

Because service is what we're all about.



800-343-5504

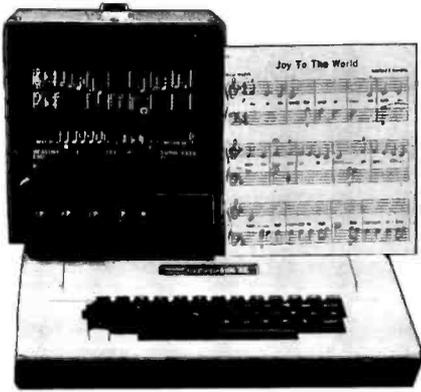
In Mass. Call 617-491-2700



COMPUMART

65 BENT STREET, DEPT. 115, P.O. BOX 568
 CAMBRIDGE, MA 02139

The joy of music —
without years of practice!



ALF offers the very finest in music hardware and software for the Apple® II. You can enter your own songs from sheet music and play them back very easily — our detailed manual shows you how, step by step. And there's a growing library of preprogrammed songs available too — now over 115 songs on 7 "albums", priced under \$15 each. ALF's highly acclaimed music software has many features found on no other Apple music product — and no customer has ever reported a "bug" or error.

Whether you pick our exciting 9-voice MC1 music card at just \$195, or our gourmet 3-voice MC16 card at \$245, you'll get ALF's top-quality hardware that's famous for reliability and clean sound (we've been designing computer-controlled musical instruments since 1975).

So see your Apple dealer today, and be sure to specify ALF music cards for the best performance. When you've seen ALF's total music package, you'll know why some music cards are more equal than others!

Please mention this magazine when requesting information from:

A L F Products Inc.
1448 Estes Denver, CO 80215 (303) 234-0871
Apple is a trademark of Apple Computer Inc.

EAR TRAINING

Four programs (pitch discrimination, interval recognition, chord recognition, and scale recognition) for the ALF MC16 music card (described above) are available on disk (or cassette). Under \$50 for the set, see your local Apple dealer.

For more information write:

A L F Products Inc.
1448 Estes Denver, CO 80215
(303) 234-0871

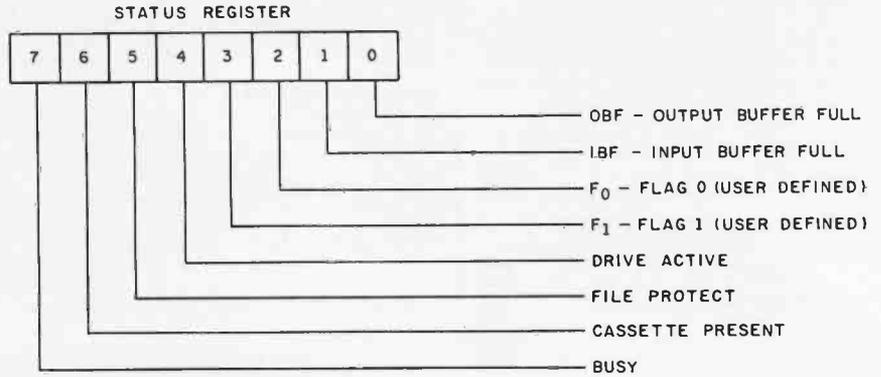


Figure 3: Definitions of the status-register bits; Flag 0 and Flag 1 may be controlled by the user via the internal software.

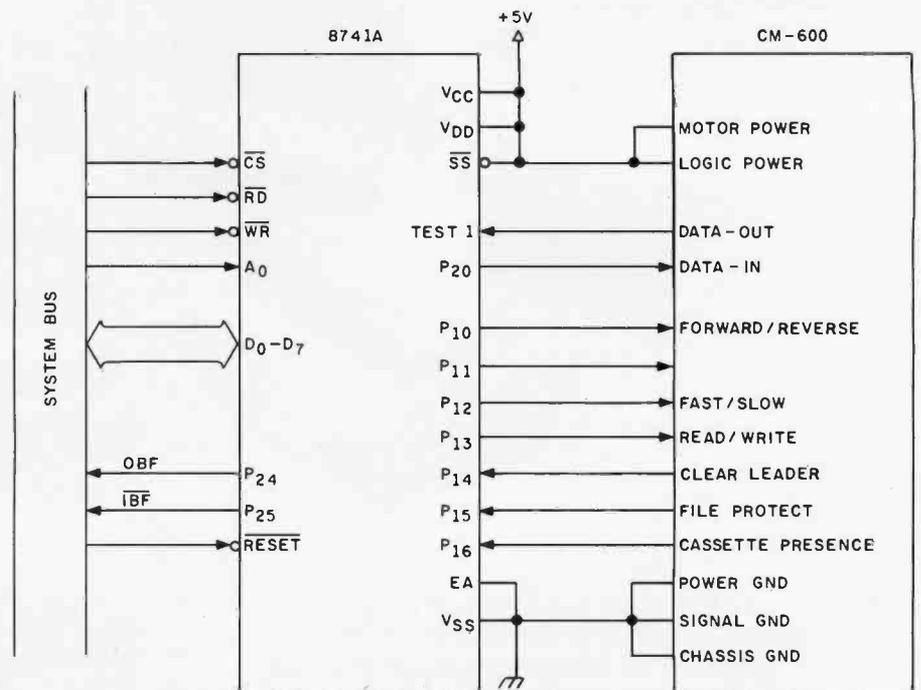


Figure 4: The interface between the CM-600 Mini-Dek, the 8741A, and the host system.

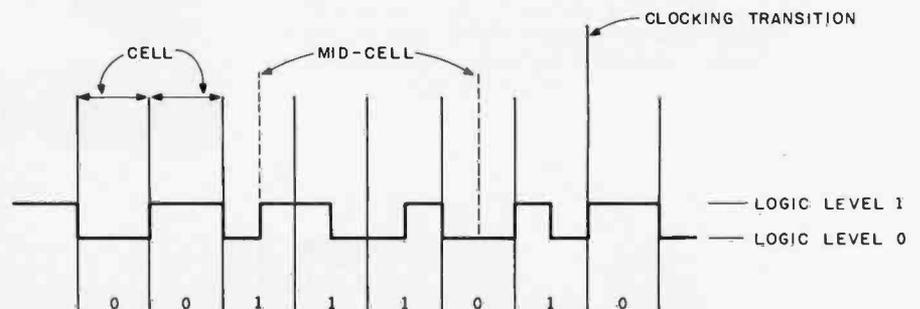


Figure 5: The hexadecimal character 3A phase-encoded. This is the algorithm used with the minicassette controller. It is not the logic level of a bit cell that determines its value, but the presence or absence of a mid-cell transition.

In this age of runaway inflation...

Look what \$795* will buy



The HIPAD™ digitizer

Inexpensive input to your computer

The HIPAD™ digitizer can be used for both converting graphic information into digital values and as a menu. Utilizing either the stylus or the optional cursor, the operator can input graphic data into the computer by locating individual points on the digitizers 11" x 11" (28cm x 28cm) active area. In the "stream mode" a continuance of placements of coordinate pairs may be input.

Not a kit, the HIPAD™ comes complete with both RS-232C and parallel interfaces and has its own built-in power source. The origin is completely relocatable so coordinates may be positive or negative for a true reference value and oversized material may be input by simply resetting the origin.

Accurate positional information, free form sketches, even keyboard simulation

All can be entered using the multi-faceted HIPAD™ digitizer. Its capabilities and low price make the UL listed HIPAD™ a natural selection over keyboard entry, inaccurate joysticks, or expensive approximating light pens. It's perfect for inputting isometric drawings, schematics, X-rays, architectural drawings, business graphs, and many other forms of graphic information, as well as creating your own graphics.

Use it with Apple II™, TRS-80 Level II™, PET™ or other popular computers

The HIPAD's™ built-in RS-232C and parallel 8 bit interfaces make it all possible. (For Apple II order DT-11A, for TRS-80 or PET order DT-11). Furthermore, you get English or metric scaling, data format (Binary/BCD/ASCII), selectable baud rates, and resolution of either .005" or .01".

For complete information contact Houston Instrument, One Houston Square, Austin, Texas 78753. (512)837-2820. For rush literature requests, outside Texas call toll free 1-800-531-5205. For technical information ask for operator #5. In Europe contact Houston Instrument, Rochesterlaan 6, 8240 Gistel, Belgium. Telephone 059/27-74-45.



The ideal input device for the small system user.

MODEL	LIST PRICE	MODEL	LIST PRICE	MODEL	LIST PRICE
HI-11-A	\$475.00	HI-11-B	\$475.00	HI-11-C	\$475.00
HI-11-D	\$475.00	HI-11-E	\$475.00	HI-11-F	\$475.00
HI-11-G	\$475.00	HI-11-H	\$475.00	HI-11-I	\$475.00
HI-11-J	\$475.00	HI-11-K	\$475.00	HI-11-L	\$475.00
HI-11-M	\$475.00	HI-11-N	\$475.00	HI-11-O	\$475.00
HI-11-P	\$475.00	HI-11-Q	\$475.00	HI-11-R	\$475.00
HI-11-S	\$475.00	HI-11-T	\$475.00	HI-11-U	\$475.00
HI-11-V	\$475.00	HI-11-W	\$475.00	HI-11-X	\$475.00
HI-11-Y	\$475.00	HI-11-Z	\$475.00		

Available with stylus or optional cursor.



Available with optional display.

*U.S. Suggested retail price

TM HIPAD is a trademark of Houston Instrument
 TRS-80 is a trademark of Tandy Corporation
 APPLE is a trademark of Apple Computer Inc.
 PET is a trademark of Commodore Business Machines, Inc.

Circle 53 for literature
 Circle 54 to have representative call

houston instrument

GRAPHICS DIVISION OF

BAUSCH & LOMB



Text continued from page 72:

scheme, the data format is also up to the user. The 8741A reads and writes blocks of variable length with an 8-bit checksum for error detection automatically appended. An option is to use the 8741A to check for errors by generating a CRC (cyclic redundancy check) code instead of a checksum, as in the CRC-16 error code used for floppy disks.

A block starts with a Sync character (hexadecimal AA), followed by the data (up to 64 K bytes), which is in turn followed by the checksum byte and trailing Sync

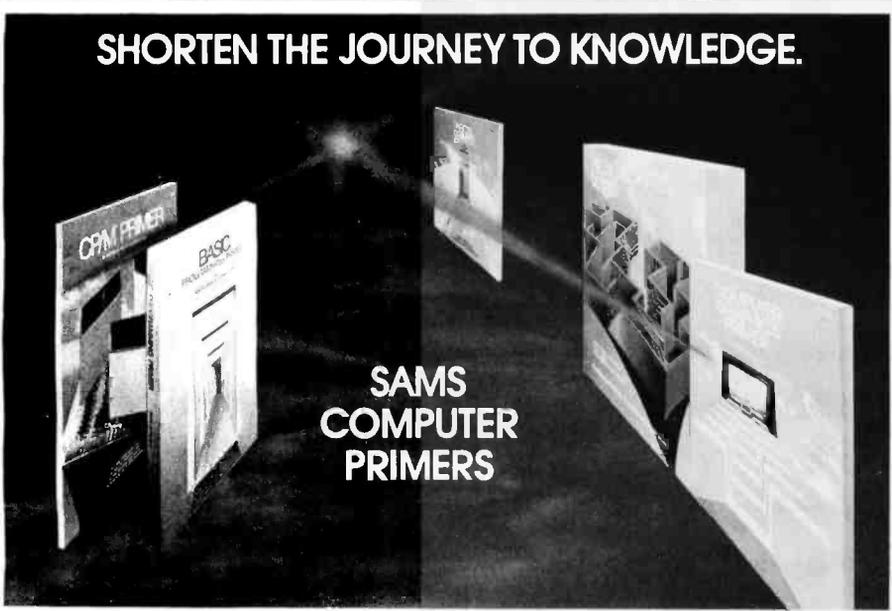
character. Blocks of data are separated by an IRG (inter-record gap). The IRG is such a length that the transport can stop and start within an IRG. The CM-600 drive specification calls for a worst-case start or stop time of 150 ms. A 450 ms IRG was selected for the 8741A to allow plenty of margin for both controlling the transport (ie: starting and stopping) and detecting an IRG during the SKIP operation.

The 8741A Controller Software

The goal of the software design for this application was to make the UPI-

41A microcomputer into an intelligent cassette-control processor. The host microprocessor (8085A, 8080A, 8088, etc) issues a high-level command such as READ or WRITE to the 8741A, which accepts the command and performs the requested operation. Upon completion, it returns a result code notifying the microprocessor of the outcome (eg: Good-Completion, Sync Error, etc). Table 1 on page 92 lists the high-level command and result codes for the functions performed by the minicassette controller.

The internal 8741A software can be roughly divided into the various command functions. At the top of the hierarchy is the command recognizer. Its job is to get a command from the



The popular Sams series of Computer Primers provide a working knowledge of computers without being dry and complex. The Primer Books guide you through the subject at an easy pace. Your journey to understanding is short, exciting, and fun. The Sams Primers offer good graphics . . . a good balance of data . . . an upbeat, positive style . . . and are organized so that you can read them straight through like a novel.

CP/M™ PRIMER, by Mitch Waite and Stephen Murtha. A non-technical discussion of CP/M disk operating systems for 8080 and Z-80-based microcomputers. No. 21791. \$11.95.

PASCAL PRIMER A complete guide to the hottest new language in computers by Mitch Waite and David Fox. No. 21793. \$16.95.

COMPUTER GRAPHICS PRIMER An easy-to-understand guide to creating drawings, plans, maps, and schematics on a computer monitor. By Mitch Waite. No. 21650. \$12.95.

MICROCOMPUTER PRIMER (Second Edition) Up-to-date facts on popular microcomputers. Don't buy a computer without reading this book by Mitch Waite and Michael Pardee. No. 21653. \$11.95.

BASIC PROGRAMMING PRIMER A valuable guide to BASIC, today's most widely used microcomputer language. By Mitch Waite and Michael Pardee. No. 21586. \$10.95.

Sams Books®

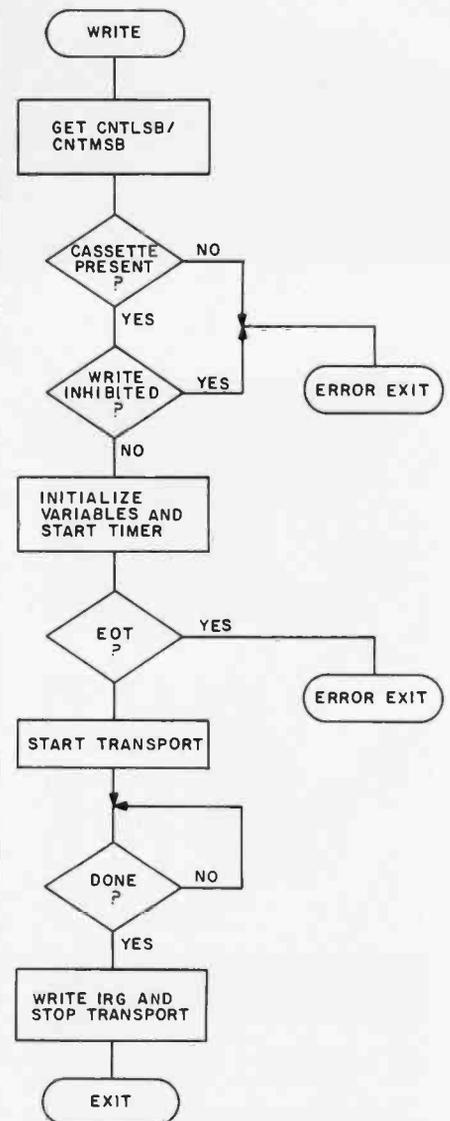


Figure 6: Flowchart of the WRITE command sequence.

Mail To: Howard W. Sams & Co., Inc.
4300 West 62nd Street P.O. Box 7092 Indianapolis, IN 46206

Save 10% on Orders of \$20 or More! _____ Quantity _____

CP/M Primer No. 21791 \$11.95 _____

PASCAL Primer No. 21793 \$16.95 _____

Computer Graphics Primer No. 21650 \$12.95 _____

Microcomputer Primer No. 21653 \$11.95 _____

BASIC Programming Primer No. 21586 \$10.95 _____

Amount of order \$ _____

Deduct 10% if order is \$20 or more \$ _____

Add local sales tax where applicable \$ _____

Shipping & handling costs \$2.00

Total amount of order \$ _____

Payment Enclosed _____ Check _____ Money Order _____

VISA _____ MasterCard Interbank No. _____

Account No. _____ Expiration Date _____

Name (print) _____

Signature _____

Address _____

City _____

State _____ Zip _____

Prices good in U.S.A. only. Prices subject to change without notice.

CALL TOLL-FREE 1-800-428-3696 for the name of your local Sams Book outlet or to order by phone.

Offer expires 7/31/81 AD081

SEE THE COMPLETE SAMS LINE AT NCC. BOOTH #5209. Circle 55 on inquiry card.



New power at your fingertips.

Konan presents Hard Disk Control, Tape Control, and Serial I/O Boards for S-100 computers.

Konan, known throughout the industry for its leading, innovative, guaranteed controllers for S-100 systems, does it again. Now, it offers you more of the expanded capabilities you want.

Take your pick to suit your needs. There's the SMC-100™ storage module (SMD or CDC 9760 interface) hard disk controller. There's the HARDTAPE™ subsystem which offers Winchester hard disk control with tape back up. Or maybe you could use Konan's new KNX-500, software compatible with the AM-500*, for 10 megabyte fixed/removable media hard disks. The "DAVID" is Konan's new error-correcting intelligent disk controller for 5 1/4" and 8" Winchester hard disk drives. And the "ENHANCER" is an intelligent reel-to-reel tape controller with high speed printer port for spooling, offline sorts, copies, etc. Watch for new controllers coming soon!

Also, Konan introduces OCTOPORT™ and OMNIPORT™—two new serial I/O boards. OCTOPORT™, the 8-port board, offers a real time clock and full interrupt control. And the 16 port OMNIPORT™ offers you an efficient, economical board where more than 8 ports are needed.

With these and other quality products, Konan shows again that when it comes to S-100 systems, it is definitely in control. (And all at attractive O.E.M. and dealer prices.)

**Call Konan's toll-free order line:
800-528-4563.**

Or write to: Konan Corporation
1448 North 27th Avenue
Phoenix, AZ 85009
TWX/TELEX 9109511552

*Alpha Micro AM-500 is a trademark of Alpha Micro Systems
IN CONTROL, SMC-100, HARD TAPE, KNX-500, OCTOPORT, and OMNIPORT are trademarks of Konan Corporation.



NEW! S-100 **ads**
PROM BLASTER

PROGRAMS MOST FAMILIES OF EPROMS!

- ACCEPTS 1K/2K/4K OR 8K EPROMS!
- EXTENDED DEVICE OPTION
- PHANTOM SLAVE OPTION
- ALL PROGRAMMING CHARACTERISTICS SOFTWARE CONTROLLED!
- ACCEPTS SINGLE OR 3 SUPPLY PARTS
- DEVICE ADDRESS SWITCH SELECTABLE
- ON-BOARD WAIT STATES

Put your frequently used routines into EPROM!

Bare board \$59.95
Software \$55.00
Together \$99.95
+ 2.5% for shipping

NEW! S-100
KLUGE CARD

SIMPLIFY YOUR PROJECTS WITH A PROTOTYPE BREADBOARD WITH EXTRAS!

- 4 ON-BOARD PWR. SUPPLIES UP TO 3 OF WHICH CAN BE +5, or +5, +12
- SWITCH SELECTABLE MEMORY OR DEVICE ADDRESS
- ON-BOARD ADDRESS/ DEVICE DECODING
- BI-DIRECTIONAL DATA BUS BUFFERING
- ON-BOARD WAIT STATES
- LARGE BREADBOARD AREA

Bare board \$39.95
+ 2.5% for shipping

MASTERCARD/VISA
CHECK OR MONEY ORDER
ILL. RES. ADD SALES TAX

ACKERMAN
DIGITAL SYSTEMS, INC.
110 N. YORK RD., SUITE 208
ELMHURST, ILLINOIS 60126
(312) 530-8992

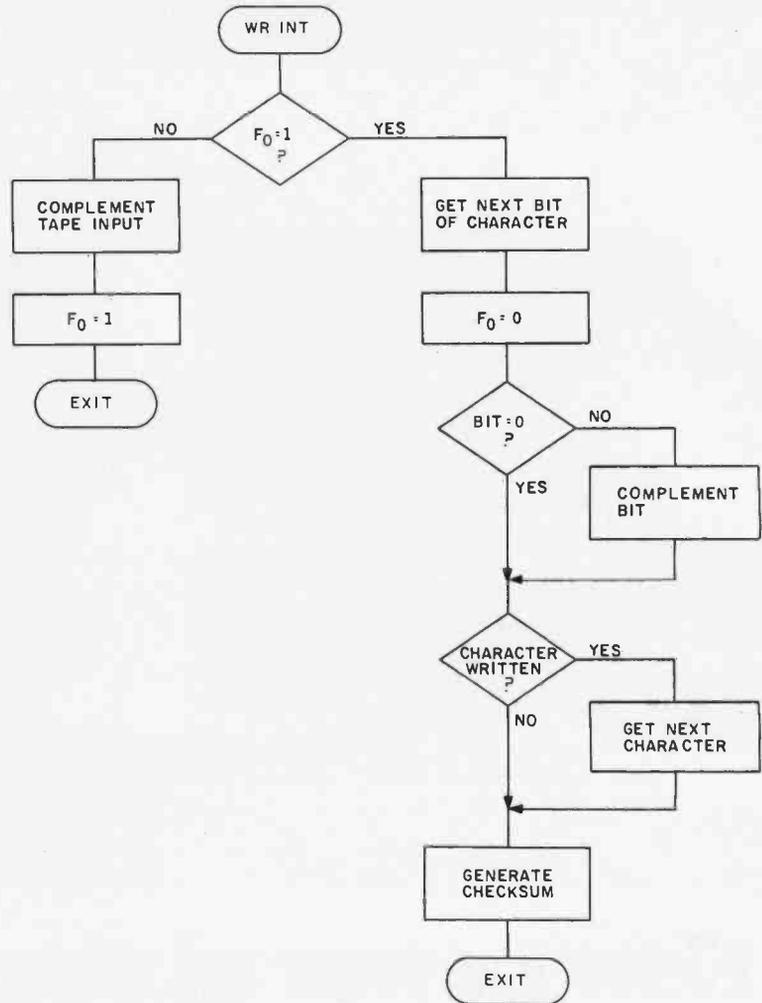


Figure 7: Flowchart of the WRITE interrupt routine.

microprocessor and branch to the appropriate command routine, executing until either the operation specified by the command is complete or aborted by the microcomputer or CM-600. The command routine then returns to the command recognizer to await the next command. Since only one command routine can be in execution at any one time, the working registers can change function based upon which command is active. These register names were assigned according to their function to aid program clarity. To understand the operation of the controller, let us examine the flow of the various commands in greater detail.

WRITE Command

When the WRITE command is issued by the microprocessor, the 8741A expects a 16-bit unsigned number specifying the number of bytes to be written onto the tape to

follow immediately. The controller requests only the desired number of data bytes by keeping track of the transfer count internally. All data transfers to and from the computer are double buffered. Before starting the transport, the 8741A checks the transport's status, verifying that the cassette is present and writing to the tape is not inhibited. If the drive is not ready for the data transfer, an appropriate error code will be returned; otherwise, the transfer will commence. The flowchart of this function is diagrammed in figures 6 and 7.

The controller begins the block transfer by writing a 450 ms IRG, followed by the leading Sync character, the data, the checksum character, and the final Sync character. The data is encoded with the phase-encoding algorithm described earlier before being written onto the tape. The internal timer is

Text continued on page 86

When You Have To Face A Deadline



Arm Yourself With Pascal/MT+®

NOW! THE PACKAGE INCLUDES OUR EXCLUSIVE PASCAL ORIENTED SCREEN EDITOR.

You know what a monster a deadline can be if you have to face it without the proper tools. Arm yourself with an integrated set of programs, designed from the beginning for production use, all tuned to the single goal of producing reliable software. Pascal/MT+ is a fully integrated program production system including our compiler, debugger, disassembler and linker.

Used by many companies, large and small, Pascal/MT+ produces high quality reliable products in an amazingly short amount of time. Our run-time library contains all the tools needed to begin program construction immediately. Pascal/MT+ produces efficient, small native machine code demanded by today's product developers. All of our library routines and features work exactly the same on 16-bit systems as they do on 8-bit systems so you can increase your capability without re-writing any of your software. Your production quality products demand production quality tools. Order Pascal/MT+ now, call us today!

Pascal/MT+ Features:

An International Standard:

Pascal/MT+ conforms to the ISO Standard for Pascal, our competition doesn't even come close! A report on the performance of Pascal/MT+ on the Pascal validation suite is included with each compiler.

Modular Program Compilation:

The Pascal/MT+ modular compilation mechanism allows construction of fully coupled modules and programs allowing the modularization of large programs without any sacrifice in either space or time efficiency.

Efficient Native Code:

All versions of Pascal/MT+ produce efficient, compact NATIVE OBJECT CODE. In an independent benchmark Pascal/MT+ outperformed all other Pascal compilers on our target machines. In addition it produced the smallest final programs by including only the minimum run-time overhead necessary.

Totally Portable:

Pascal/MT+ has been designed from the beginning to generate code for many different microprocessors. Pascal/MT+ programs you create today can be re-compiled to run on a more powerful machine tomorrow. All of the extended language features are present in every version of the compiler. This means you won't have to start over when the customer demands more, more and more.

Extensions:

Pascal/MT+ has many extensions to the Pascal language too numerous to describe in detail here. Our 160 page user's guide describes the features and gives examples of how to use them. A short summary of features is listed below: dynamic strings, BCD and Floating point reals, AMD9511 support, bit, byte and unsigned word manipulation, I/O port access, a full implementation of the NEW and DISPOSE heap and many others.

Target Machines:

Available now 8080, 8085 and Z80
Available soon 8086, 8088
Coming 68000, 6809 and Z8000

Pricing:

8080/Z80 — \$250.00
As of 4/7/81 — \$475.00
Others Call

Communication Arts, Huntington Beach, CA

See us at West Coast Computer Faire, booth 1608

MT Micro SYSTEMS

1562 Kings Cross Drive
Cardiff, California 92007 (714) 755-1366

Payment Terms:

Cash, Check, UPS, C.O.D.,
Mastercard, VISA,
Company P.O.

"BEST PRINTER VALUE IN THE WORLD"
Check our prices on THE ULTIMATE IN QUALITY

Epson Printers

APPLE & MOST OTHER COMPUTERS

NEW! MX80
40, 80, 132 columns

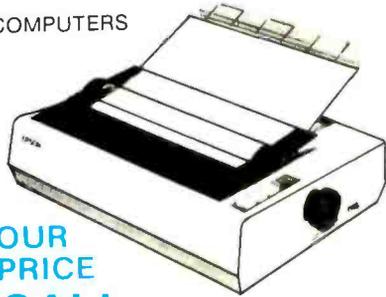
LIST ~~\$645~~

TX 80 w/Graphics

LIST ~~\$799~~

Apple Controller & Card
& Cable

LIST ~~\$110~~



**OUR
PRICE
CALL**

- Most reliable small printers ever sold!
- Uses standard printed paper.
- Graphics option transfers screen image directly to paper.



ATARI 800
PERSONAL COMPUTER SYSTEM

\$798

IF
ATARI
MAKES
IT, WE
SELL IT

Assembler/Editor	45
Atari 400 Computer	439
Atari 820 Printer	429
Atari 810 Disk Drive	499
Atari 410 Program Recorder	69
Atari 16K RAM Module	149
Atari Basic ROM	45
Atari Visicalc	180
Basketball	30
Video Easel	30
Super Breakout	30
Music Composer	45
Computer Chess	30
Star Raiders	39
3D Tic-Tac-Toe	30
850 Interface	169
825 Printer	795

PRINTERS, MONITORS, DISCS

Anadex DP8000	850	Paper Tiger 445G w/Graphics	725	Dysan disks (pkg. 10)	50
Anadex DP8000AP	850	Paper Tiger 460 w/Graphics	1195	Memorex disks (pkg. 10)	40
Color Monitor	375	Silentype w/interface Cd.	540	Opus disks (pkg. 10)	35
Daisy Wheel Printer	1795	Sanyo 9" B&W	169	Televideo 912C	699
MPI 88T	595	Sanyo 15" B&W	259	Televideo 920C	749
NEC Spinwriter #5510	2595	NEC Green Screen 12"	239	Verbatim disks (pkg. 10)	30

LEEDEX VIDEO 100
12" Black & White \$119

*** MONTHLY SPECIALS ***

CENTRONICS 737
cable extra **\$737**

THE
POPULAR
INTERTEC

SUPERBRAIN

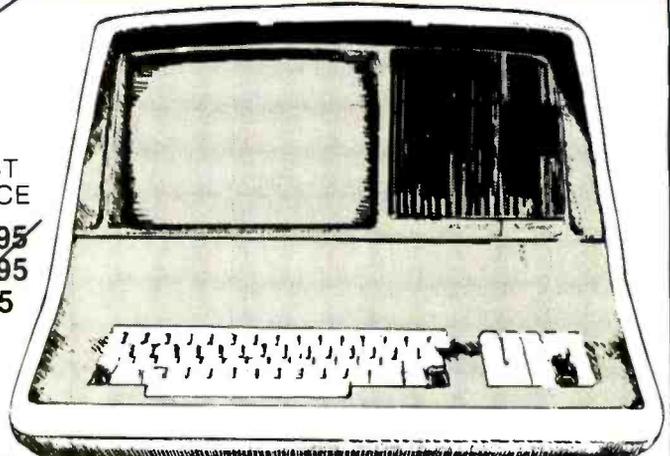
LIST
PRICE

32K Double Density ~~2995~~
64K Double Density ~~3495~~
64K Quad. Density ~~3995~~

OUR PRICE CALL

MEMBER BETTER BUSINESS BUREAU

LARGE STOCK OF SOFTWARE & ACCESSORIES



TO ORDER: Phone orders invited using Visa, Mastercard, or bank wire transfers. Visa & MC credit card service charge of .%. Mail orders may send charge card number (include expiration date), cashiers check, money order, or personal check (allow 10 business days for checks to clear). Please include phone number. Include 3% (\$5.00 minimum) shipping, handling, and insurance in USA. Shipments

within Calif. add 6% sales Tax. Foreign orders include 1% handling — shipped freight collect. Foreign orders over \$1000 allow 6 weeks extra and include \$25 license fee. All equipment is in factory cartons with the manufactures warranty. Equipment is subject to price change and availability. We ship the same day on most orders. No C.O.D.s or P.O.s accepted. Retail store prices differ from mail order prices.



(714) 579-0330 • MAIL TO: 1251 BROADWAY, EL CAJON, CA. 92021

AUTHORIZED
APPLE
SALES &
SERVICE

COMPUTER



SPECIALTICS

DIV. OF
COMPUTER
METRICS
INC.

EXCITING DISCOUNTS

apple II
16K computer

DISK with CONTROLLER
NEW DOS 3.3 \$535
without . . . \$446
Nearly Everything
for Apple

\$1099



WE WILL BEAT
ANY ADVERTISED PRICES
ON MOST ITEMS IF MERCHANDISE
IN STOCK

APPLE II 48K
\$1199

APPLE COMPUTER
INTERFACE CARDS

HiSpeed Serial Int. Cd.	155
Applesoft II Firmware Cd.	149
Centronics Interface Cd.	179
Apple Clock/Calendar Cd.	
by Mtn. Comp.	225
Comm. Cd. & DB25 Cable.	179
Integer Basic Firmware Cd.	149
Parallel Printer Cd.	139
CCS Parallel Print Cd. 7720A.	155
ROMPLUS w/keyboard filter.	165
ROMPLUS (keyboard filter extra) ...	159
SSM AIO Serial/Parallel I/O	
Assembled & Tested.	189
Serial Interface Cd.	139
CCS Asynchronous 7710A.	139

APPLE SOFTWARE

ALS Smarterm.	324	DOS 3.3 Upgrade.	49
Adventure by Microsoft.	29	Dow Jones Portfolio Evaluator.	45
Apple Bowl.	19	Fastgammon.	23
Apple Stellar Invaders.	19	Forth II by Softape.	45
Assembler/Disassembler.	69	Fortran for Language Sys.	159
Applebug Debugger.	29	Head-on.	25
AppleGraph & Plot Sys.	59	Integer Basic Cassette Demos.	29
Applepost Mailing List Sys.	44	Lazer Systems Lower Case + Plus. ...	59
Applesoft Cassette Demos.	29	Microsoft 16K Ramcard.	179
Applesoft Util. Prog. — Hayden.	29	PASCAL Language Sys.	459
Applewriter Word Processor.	65	Sargon II Chess Game disk.	34
Asteroids in Space.	19	Shell Games.	29
Autostart ROM Pkg.	59	Single Disk Copy Routines.	35
Battleship Commander.	19	Space Invader.	25
Bill Budes Space Game Album.	39	Star Cruiser.	24
Bill Budes 3-D Graphics/Tool.	39	Stellar Trek.	23
Bill Budes Trilogy of Games.	29	Sub-Logic FS-1 Fit. Sim./disk.	34
Cashier Retail Mgmt. Sys.	199	Tax Planner.	99
Checkbook Cassette.	19	The Correspondent.	35
Contrib. Vols. 1-5 w/man.	29	Tranquility Base.	24
Controller Bus. Pkg.	514	Visicalc by Personal Sftwe.	119
Cosmos Mission/Disk.	25	Complete Peachtree Business	
CCA Data Mgmt. Sftwe.	84	Package for Apple	
3-D Animation Pack.	55		
Desktop Plan Sftwe.	79		
DOS Tool Kit.	65		

ACCESSORIES

Apple Joystick.	47
ABT Numer. Input Keyboard A or B.	114
A/D D/A Board by Mtn. Comp.	319
Arith. Processor 7811 A or B.	339
Clear Cover for Apple Computer.	25
COPYROM by Mtn. Comp.	51
Corvus 10MByte Disk w/pwr. supp.	4395
Dan Paymar L.C. Kit 1 or 2.	59
Extender Board.	27
GPIO by CCS model 7490A.	259
Graphics Input Tablet.	649
Hayes Micromodem.	319
Introl X-10 Remote Control Sys.	239
Introl X-10 Controller Only.	169
M&R Sup-R-Term 80 column board.	329
Microsoft Z-80 Soft Card.	295
Novation Cat Modem.	159
Programmable Timer CCS 7440A.	159
Prototyping Hobby Card.	22
ROMWRITER by Mtn. Comp.	149
Speechlink 2000/64 Word Vocab.	215
SuperTalker Speech Synthesizer.	239
Symtec Light Pen.	214
Versa-Writer Digitizer	
Drawing System.	209
Videx Videoterm.	319

AND MUCH MORE . . .



CALL 1-800-854-2833

PHONE ORDERS

MON. - SAT. 8 to 6 P.S.T.

Circle 57 on inquiry card.

AUTHORIZED
APPLE
SALES &
SERVICE

COMPUTER



SPECIALTIES

DIV. OF
COMPUTER
METRICS
INC.

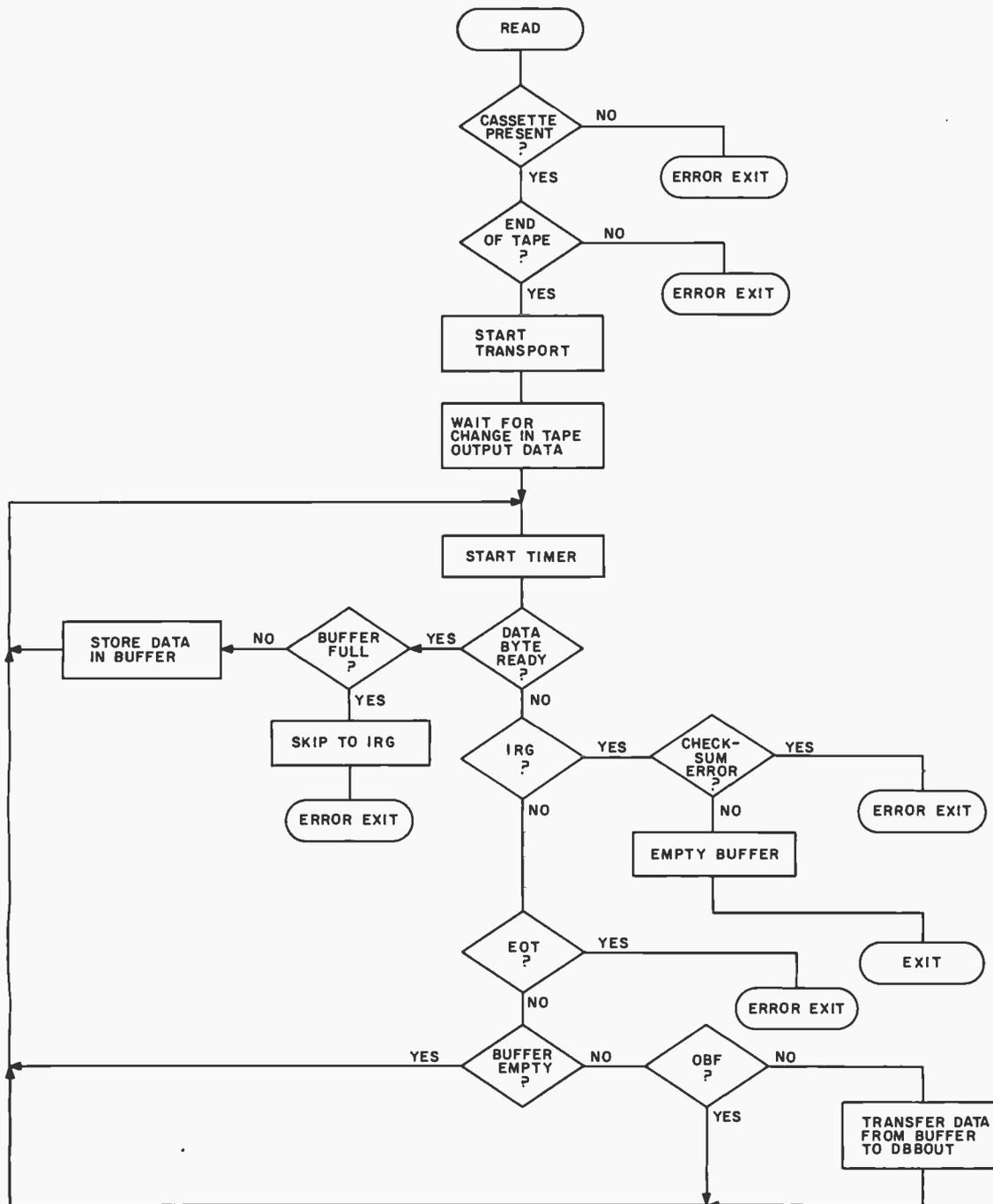


Figure 8: Flowchart of the READ command sequence.

Text continued from page 82:

used to signal both the initial cell transition and the mid-cell transition, generating an internal interrupt every 208 μ s. Thus, a byte is written every sixteen timer interrupts, or 3.3 ms. If nothing unusual happens during the operation, it returns a Good-Completion result code (hexadecimal 00) to the host.

If an error occurs, the 8741A minicassette controller provides error

wrap-up facilities, protecting the information on the tape from being corrupted. For example, if the clear leader of the tape is found during a write operation, the transport is halted immediately. Another error results from the processor being late in supplying data to the controller, causing a data-underrun error and aborting the data transfer. A 450 ms IRG is then written onto the tape before the transport is halted.

READ Command

The READ command provides error checking similar to the WRITE command. Once the READ command is issued by the microprocessor, the controller checks for cassette presence and starts the transport. The data output from the transport is then examined and decoded continuously. This function is shown in the flowcharts of figures 8 and 9. The first character must be a Sync, or the

Introducing quality print at matrix speed. For only \$1295*.

Until now, word processing output was a slow, expensive proposition. You could pay thousands for a slow, letter-quality character printer. Or give up print quality for matrix speed and price.

But that was before Paper Tiger™ 460 offered you a better choice.

The new Paper Tiger 460 is the first matrix printer with high-density dot matrix characters plus high speed. At a low price.

The secret? A unique nine-wire, staggered matrix head provides overlapping dots in both horizontal and vertical planes. The result is dense, high-quality characters you'll be proud to show off.

What's more, Paper Tiger 460 gives you a combination of features simply not available on any other printer, at any price. Like bi-directional, logic-seeking printing at speeds in excess of 150 characters per second. Micro-processor electronics, with built-in diagnostics and self-test. Proportional spacing. Automatic text justification. DotPlot™ high

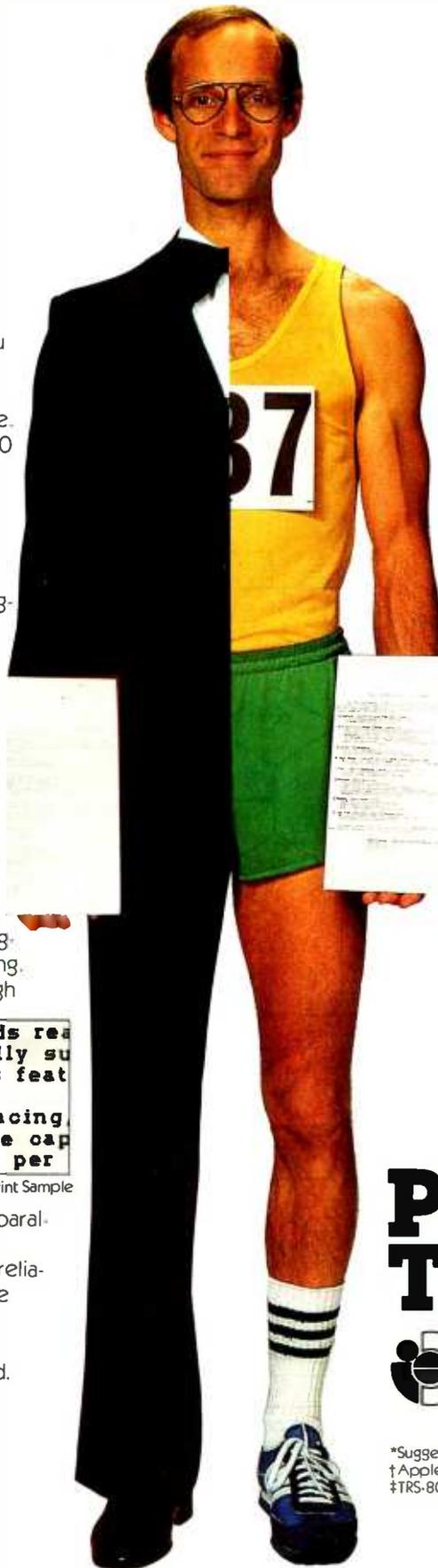
Integral Data Systems stands ready to provide you with the best performance printers ideally suited to your needs. In fact, the printer, the IDS 460, offers features

Automatic proportional spacing, high resolution graphics option, RS232 and parallel interfaces. And more.

Paper Tiger 460 Print Sample

resolution graphics option. RS232 and parallel interfaces. And more.

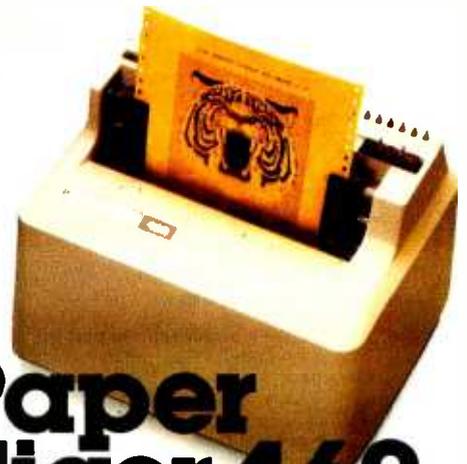
But its most important feature is high reliability. Paper Tiger 460 is designed to be tough and dependable. It has rugged, stepper-motor head and paper drives. A new rugged ballistic-type print head.



And its simple, chassis-mounted cartridge ribbon lasts up to four times longer than cassette or spool ribbons.

Paper Tiger 460 is the one printer that gives your Apple,† TRS-80,‡ or other small business computer both data processing and word processing output. At a price you can afford.

Get your paws on Paper Tiger 460, and join the tens of thousands of satisfied Integral Data Systems users. For the name of the Paper Tiger dealer nearest you. Call us toll-free: 800-258-1386. (In New Hampshire, Alaska, and Hawaii, call (603) 673-9100.) Or, write for complete specifications. Integral Data Systems Inc., Milford, New Hampshire 03055.



Paper Tiger 460



Integral Data Systems, Inc.

*Suggested single-unit U.S. retail price.

†Apple is a trademark of Apple Computer Inc.

‡TRS-80 is a trademark of Radio Shack, a division of Tandy Corp.

MODEL III DRIVES

Save up to 34% compared to Radio Shack
Now, add mini-disk drives to your TRS-80
Model III™ and get FREE INSTALLATION.

Fully compatible with Radio Shack's
operating system TRSDOS.

- One, two, three, four drive configurations
- 134K to over 1 Meg of storage
- 40 track and 80 track available
- 90 day warranty, 100% parts and labor
- Extended warranty available

Complete upgrade includes one mini-disk
drive, power supply, controller, and
mounting hardware. IMMEDIATE
DELIVERY.

	OUR PRICE	RADIO SHACK	SAVINGS
Complete one drive kit	\$599.	\$849.	29%
Additional internal drive	265.	399.	34%
External drive 80 track drives (incl. patch) add 250. ea.	340.	499.	32%
16K memory (required to use drives)	49.	119.	59%
Model III 32K w/ VR Data Drives	1812.	2380.	24%

Add-on SuperBrain Drives

AVAILABLE ONLY FROM VR DATA!

Increase the storage capacity of your
SuperBrain™ to 700K with two extra 40
track drives, or over 1 Meg with QD drives.

- Fully compatible with SuperBrain
operating system
- Fully compatible with all SuperBrain
drives
- Easy plug-in installation
- Includes patch program
- 90 day warranty, 100% parts and labor
- Extended warranty available

Complete two drive kit (incl. cable and patch)	789.
QD drives	1339.
If two extra drives aren't enough try our 6.3 Meg Winchester Assembly (complete with software patch)	\$3495.

SuperBrain Parallel Printer Port

Available only from VR Data!

Now, you can add a parallel printer port to
your SuperBrain and use Centronics -
compatible parallel printers.

- designed exclusively for the SuperBrain
by VR Data
 - easy, plug-in installation
 - 90 day warranty, 100% parts & labor
 - complete \$99.95
- VR Data, a manufacturer of innovative
computer products, is known world-wide
for quality, dependability and prompt,
personal service since 1972.

To order call toll free (800) 345-8102,
or (215) 461-5300 in PA.



777 Henderson Blvd.
Folcroft, PA 19032

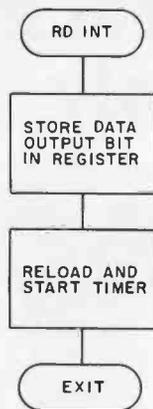


Figure 9: Flowchart of the READ interrupt routine.

controller will abort the read operation, return a Bad-First-Sync result code (hexadecimal 42), and advance to the next IRG of the tape. If the Sync character is correct, succeeding characters are read into an internal 30-character FIFO (first-in, first-out) buffer, allowing the processor over 99 ms of service latency before a data-overflow condition occurs. Whenever the DBBOUT register is empty, data is transferred to it from the FIFO buffer. This continues until an IRG is encountered, at which point the transport is stopped. The controller then tests the last character. If it is a Sync, the controller compares the ac-

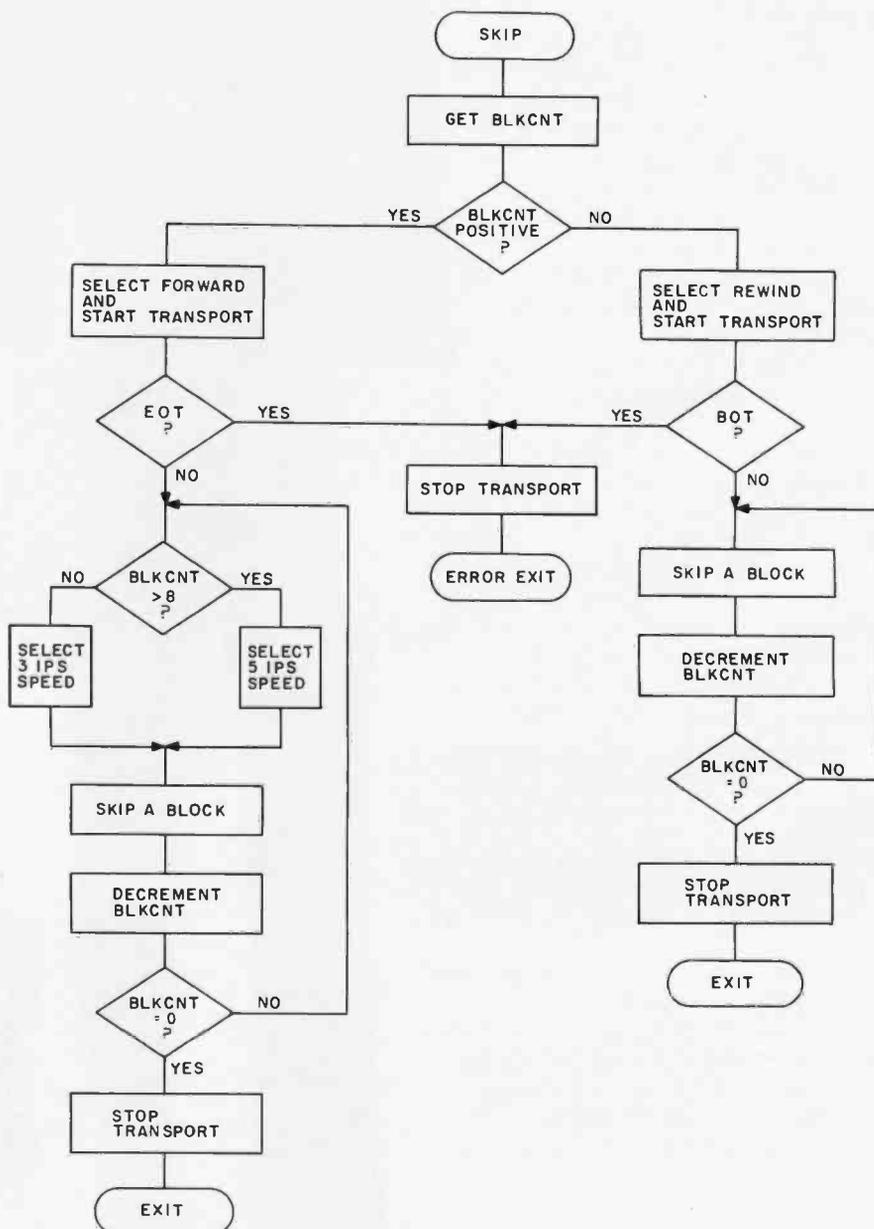
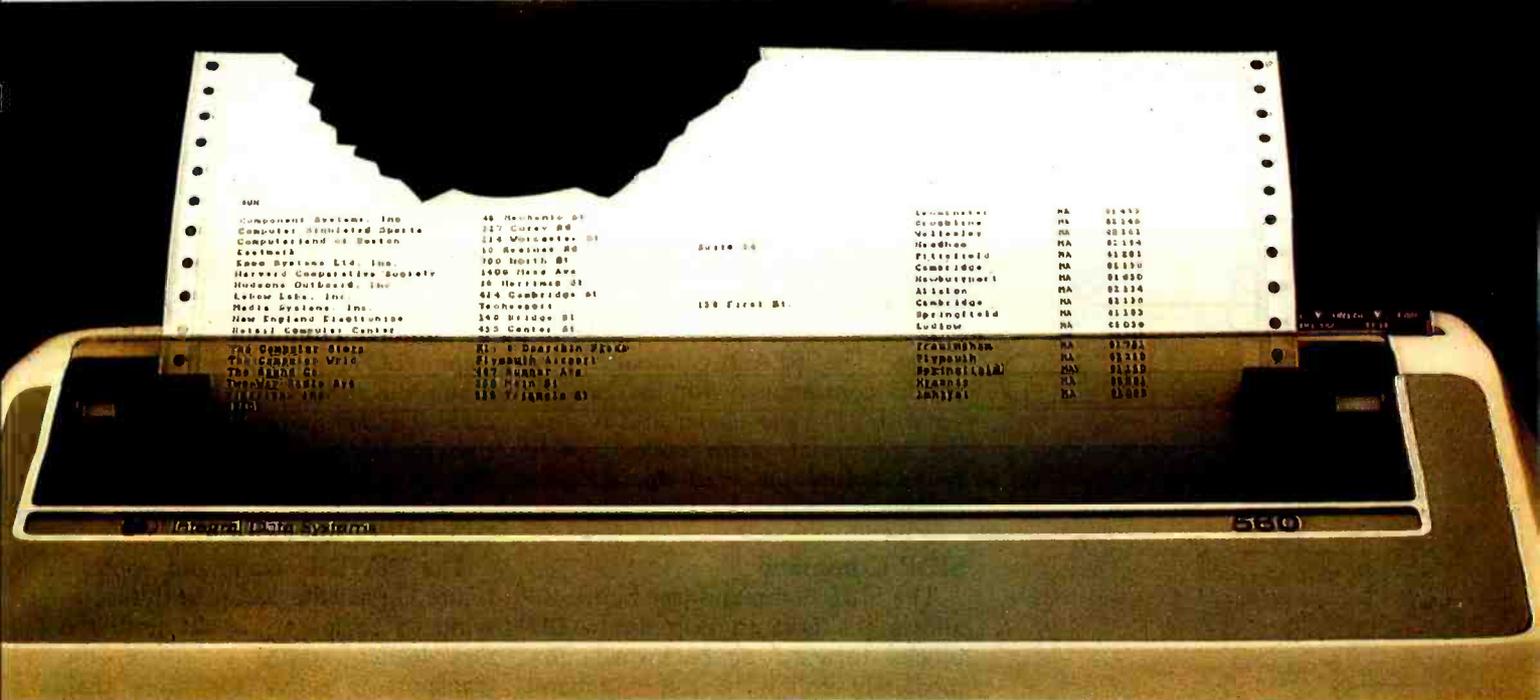


Figure 10: Flowchart of the SKIP command sequence.



Meet the Tiger with a bigger bite.

Introducing the remarkable 132-column Paper Tiger™ 560. The first full-width matrix printer to give you fully formed characters for a low \$1695.*

The new 560 features a staggered nine-wire ballistic type print head that overlaps dots in both horizontal and vertical planes. It bi-directionally prints up to 150 dense, text quality characters per second.

The 560 also features a reliable cartridge ribbon that lasts up to four times as long

presents a breakthrough in matrix printing, offering the user excellent print quality with the appearance of a matrix printer. Employing a unique "red column" head manufactured by Integral Data Systems, Inc., the 560 creates high quality printouts by overlapping dots in both horizontal and vertical planes.

Paper Tiger 560 Print Sample

as spool and cassette ribbons, separate heavy-duty stepper motors to drive the print head and advance the paper, plus true tractor feed.

And famous Paper Tiger performance comes with every new 560. Like fixed or proportionately spaced text, programmable tabbing and business forms control, automatic text justification, print formats to 220

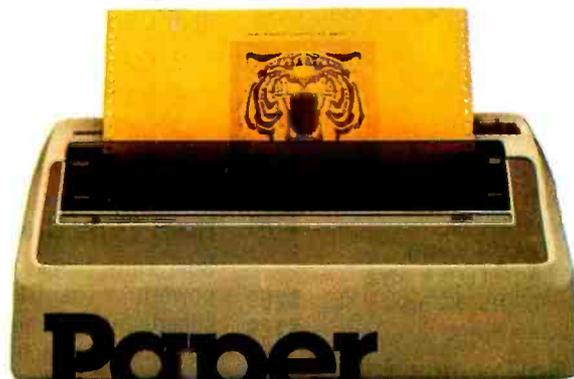
columns, parallel and serial interfaces, self-diagnostics, and more. All inside the most compact printer of its kind.

Need more stripes? Dotplot™, our high-resolution raster graphics package, is standard on every 560.

For data processing, word processing and small business applications, this is your Tiger. The business-sized Paper Tiger™ 560.

It's a Tiger you can count on.

Call TOLL FREE 800-258-1386 (In New Hampshire, Alaska and Hawaii, call 603-673-9100.) Or write: Integral Data Systems, Inc., Milford, NH 03055.



Paper Tiger 560

 Integral Data Systems, Inc.

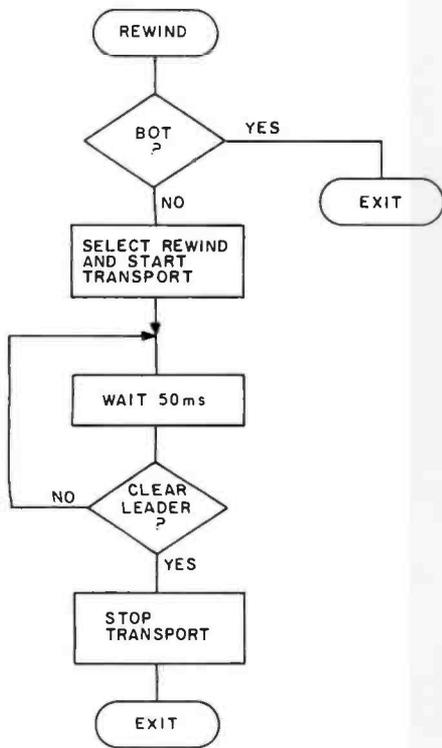


Figure 11: Flowchart of the REWIND command sequence.

accumulated internal checksum to the block's checksum, the last character of the block. If they match, a Good-Completion result code (hexadecimal 00) is returned to the host. Otherwise, the appropriate error-result code is returned (ie: Bad Sync2 or Checksum error). The READ command also checks continuously for the End-of-Tape (EOT) clear leader and returns the appropriate error code if it is found before the read operation is complete.

SKIP Command

The SKIP command (see figure 10) allows the host to skip up to 127 blocks forward or backward. Immediately following the command byte, the controller expects an 8-bit signed-magnitude byte specifying the number of blocks to skip. The most significant bit of this byte selects the direction of the skip (0=forward, 1=reverse). SKIP provides two search speeds in the forward direction. If the number of blocks to skip is greater than 8, the controller uses fast forward (5 ips) until it is within 8 blocks of the desired location, then

switches to the normal read speed of 3 ips to allow accurate placement of the tape.

The reverse SKIP uses only the rewind speed (15 ips). Like the READ and WRITE commands, SKIP also checks for EOT and Beginning-of-Tape (BOT) depending upon the tape's direction, returning an error code if either is encountered before the specified number of blocks have been skipped.

REWIND Command

The REWIND command routine, figure 11, sets the transport to fast rewind of 15 ips and waits until the clear-leader status input of the transport is active for more than 50 ms. (There is a hole at each end of the tape. It is guaranteed not to cause the clear-leader input to be active for more than 50 ms.) Once the clear leader is found, the CM-600 is stopped and a Good-Completion result code is loaded into DBBOUT.

ABORT Command

The final command, ABORT, is not a stand-alone command like the

From Ballet on Broadway to Billiards in Dallas...

... people are finding unique ways to use the Powerful SciTronics REMOTE CONTROLLER



Whether it's the intricate lighting for a Broadway Ballet or the simple remote lighting of pool tables in a Dallas billiards hall, people are finding out SciTronics Remote Controller can meet their needs.

Here's Why:

- Controls 256 BSR remote switches—not just 16
- Hardware driven—requires minimum software
- No ultrasonic link—prevents erratic operation
- No BSR command module necessary

S-100 CONTROLLER BOARD	\$159.
S-100 REAL TIME CLOCK BOARD	\$159.
ENCASED CONTROLLER (TRS-80, Apple II etc.)	\$184.
ENCASED CONTROLLER & REAL TIME CLOCK (TRS-80, Apple II etc)	\$269.
APPLE II CLOCK BOARD	\$129.

Real Time Clock gives Remote Controller an added dimension!

Real Time Clocks are now available to make your remote controller even more powerful. The RTC feature allows for energy consumption scheduling, event scheduling and much more. Your imagination is your only limitation when it comes to the ways which this RC/RTC combination can be used.

Real Time Clocks feature:

- Lithium battery back-up
- Crystal controlled accuracy (.002%)
- Clock generates interrupts (seconds, minutes, hours) for foreground/background operation
- Complete software in BASIC to Set and Read clock

Send check or money order to:
SciTronics Inc.
 523 S. Clewell St., P.O. Box 5344
 Bethlehem, PA 18015
 (215) 868-7220

Please list system with which you plan to use peripheral. Master Charge and Visa accepted. PA residents add sales tax. COD's accepted.

Big Savings for SS-50 Bus Computerists



LFD-400 Mini-Disk System

\$459.95

The choice of knowledgeable 680X computerists since 1977 • Proven clock-data separation circuitry and other superior design features • Reliable hard-sector diskette formatting • Stores up to 102 Kbytes of formatted data on 40 tracks • Comes complete with 4-drive controller, drive assembly, 6800 or 6809 ROM disk operating system, interconnecting cable and comprehensive users manual • Add-on drives cost only \$399.95 each. Circle 363

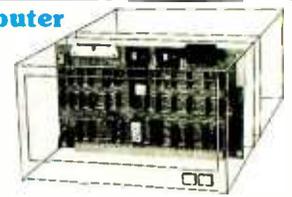
Save \$140!

REGULAR \$599.95

SBC/9 Single-Board Computer

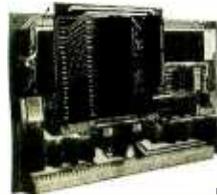
\$139.95

A computer or a fully compatible SS-50 bus MPU card • Interchangeable 6802 or 6809 processor • Extendable 1-Kbyte ROM monitor • Parallel and serial I/O ports — selectable, full-range bit rate generator for serial I/O • Extendable addressing • On-card 1-Kbyte RAM • Provision for additional EPROM • On-card voltage regulator circuits Circle 364



Save \$60!

REGULAR \$199.95



6809 MPU Upgrade Adapter

\$39.95

Upgrades 6800 MPU cards to 6809 processing power • Configured for SWTP MP-A2 MPU card but may be used with other MPUs • Plug-in installation requires no trace cutting or soldering — easy to restore MPU to original configuration • Assembled and tested • Includes user instructions • 6809 ROM operating system, PSYMON/A2, for use with the 6809 MPU Adapter — \$69.95. Circle 365

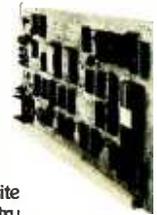
Save \$30!

REGULAR \$69.95

The ELECTRIC WINDOW¹

\$169.95

Memory-mapped instant display updating • Software-defined display formats • Expandable 128-symbol character generator — characters are fully formed and feature true baseline descenders • On-card display RAM can be remapped • Video output can be composite or separate sync-video • Voltage regulation circuitry included on card. For an application review of the ELECTRIC WINDOW; see Peter Stark's comments on page 87 of the January 1981 issue of *Kilobaud/MICROCOMPUTING*. Circle 366



Save \$80!

REGULAR \$249.95

Percom Price-Slashing, Profit-Zapping Fifth Anniversary Sale!

After five years of solid accomplishments, it's time to celebrate. So we've slashed prices for a gigantic 5th anniversary sale. Now, for a limited time, you can get Percom design and Percom quality at enormous savings. But don't wait. Sale ends April 30th and quantities are limited to stock on hand.

Save \$100.00 on fully assembled, tested and burned-in RAM cards! Hurry, regular prices in effect after April 30th.

These RAM cards feature 1-Mbyte extended addressing; buffered data, address and control lines; and, on-card voltage regulation. Cards are fully tested and burned-in. User manuals include 6800 & 6809 diagnostic memory test programs.

M24SS 24-Kbyte STATIC RAM CARD

\$399.95 REGULAR \$499.95

Save \$100!

Memory is organized as three independent 8-Kbyte blocks. Each block may be located at any 8-Kbyte boundary of a 64-Kbyte address space • Also



available in 8- and 16-Kbyte versions at regular prices. 8-Kbyte RAM expansion kit includes extra RAM chip, plus sockets and other parts. Kit price is \$139.95. • Uses 2114L RAM chip. Circle 367

M48DSS 16-Kbyte DYNAMIC RAM CARD

\$399.95 REGULAR \$499.95

Save \$100!

Expandable to 48 Kbytes • Memory is organized as three independent 16-Kbyte blocks. Each block may be located in any of the four 16-Kbyte zones of a 64-Kbyte address space • Special "map-out" strapping can be used to depose any 8-Kbyte block from upper 32-Kbyte memory • Uses type 4116 RAM chips • 16-Kbyte RAM expansion kit includes extra RAM chip, plus sockets and other parts. Kit price is \$99.95. Circle 368

Watch for the COLORAMA-50!

This soon-to-be-announced color VDG card for the SS-50 bus features eleven colorful display formats in 2 to 8 colors, plus 2-color alpha-numeric; full graphic resolutions from 64X64 pixels to 256X192 pixels; memory-mapped instant display control; low-cost modulator option for TV interface; 1-Mbyte extended addressing; cassette I/O option; and, operating software. Introductory price is only \$219.95.



PERCOM DATA COMPANY, INC.
211 N. KIRBY GARLAND TEXAS 75042
(214) 272-3421

PRICES AND SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.
PRICES DO NOT INCLUDE SHIPPING AND HANDLING.

COLORAMA-50, ELECTRIC WINDOW, LFD-400, PSYMON and SBC/9 are trademarks of Percom Data Company, Inc.

Nobody supports the SS-50 bus like Percom

Our field-proven software for 680X computers includes monitors, operating systems, drivers, editors, assemblers, debuggers and high-level languages like Super BASIC — our popular extended disk BASIC interpreter.

Some of the other hardware products available include versatile prototyping cards in both 30- and 50-pin versions, extendable 50-pin motherboards and 30-pin I/O card motherboards. Function cards, prototyping cards and motherboards are optionally available with gold-plated bus connectors. Also, most function cards are available in 86-pin, EXORciser bus compatible versions.

Quality Percom products are available at Percom dealers nationwide. **Call toll-free, 1-800-527-1592, for the address of your nearest dealer, or to order direct from Percom.**

EXORciser is a trademark of Motorola Corporation.

others. Instead, the ABORT function is part of each of the other commands, allowing the microcomputer to abort the current operation. If a command is found in DBBIN register during the operation of one of the

other commands, the command is compared to the ABORT command code. If it matches, the routine in execution is terminated. The Abort-Complete result code is then placed in DBBOUT to acknowledge the abort.

The aborted routine will, however, exit gracefully. An aborted READ or SKIP advances to the next IRG before terminating. An aborted WRITE command will record an IRG before terminating execution. This protection helps insure the integrity of data stored on the minicassette tape.

Conclusion

This application illustrates how the 8741A device can provide intelligent peripheral interfaces between a computer and a peripheral device such as the CM-600 Mini-Dek transport. This benefits the microprocessor system by divorcing it from the close management required by the peripheral. It interfaces to the 8741A controller producing a high-level I/O interface. The 8741A provides all the low-level peripheral-control functions. Another benefit of this task modularity is that it allows the software to be modified and upgraded without affecting the computer system software. In fact, the 8741A software could be adapted to control other cassette transports without affecting the microprocessor. ■

Command	Hexadecimal Representation	Result-Codes Returned	Hexadecimal Representation
READ	01	Good-Completion	00
		Buffer Overrun Error	41
		Bad Sync1 Error	42
		Bad Sync2 Error	43
		Checksum Error	44
		Command Error	45
		End-of-Tape Error	46
REWIND	04	Good-Completion	00
SKIP	03	Good-Completion	00
		End-of-Tape Error	47
		Beginning-of-Tape Error	48
WRITE	02	Good-Completion	00
		Buffer Underrun Error	81
		Command Error	82
		End-of-Tape Error	83

Table 1: Commands issued by the host processor and possible resultant codes returned to it when the EPROM in the 8741A is programmed with the software described in this article.

Omikron's Mapper + NEWDOS/80 8" Drives for the TRS-80

NEWDOS/80 is Apparat's latest upgrade to NEWDOS. Features include variable length records, chaining, and drivers specifically configured for Omikron's MAPPER II. \$150.

MAPPER II adapts the TRS-80 to run both 5" and 8" drives. With NEWDOS/80, storage is increased to 300K per 8" drive. \$99 plus \$50 per cable connector.

MAPPER I adapts the TRS-80 to run the vast library of CP/M software as well as the TRS-80 software. All Lifeboat Software may be ordered for the MAPPER I. All MAPPER I CP/M software is compatible with the CP/M for the Model II. With MAPPER II and 8" drives, the Model I becomes disk compatible with the Model II.

Standard features include lower case support, serial and parallel printer drivers, and an addressable cursor. MAPPER I is supplied with complete utilities including a memory test, a disk test, a copy program, and a proprietary program for converting TRS-DOS files to CP/M files. \$199.

WORD PROCESSING—MAPPER I supports professional word processors like the Magic Wand and Word Star (see reviews in June 80 Kilobaud). Omikron's implementation includes a blinking cursor, auto repeat, shift lock, debouncing, and an input buffer that eliminates missed characters. Magic Wand super discount price \$299.

FIELD PROVEN DESIGNS—After one year of MAPPER production, Omikron has established an impeccable reputation for reliability, integrity, and user support. Omikron's customers include the US Government, major corporations, universities, medical doctors, and professionals in all fields.

SYSTEMS—Omikron sells complete systems featuring Model II compatible Shugart disk drives. Call for prices and delivery.

FOREIGN ORDERS must include full payment in US funds plus \$25 for air shipping and handling.

See review in July 80 BYTE By Jerry Pournelle.



OMIKRON

Products that set Precedents.
1127 Hearst St Berkeley, CA 94702 (415) 845-8013

COMPUTER WAREHOUSE

CALL TOLL FREE **1-800-528-1054**

ATARI

Special 32K 800 System 800 w/32K, recorder star raiders, joystick.....	\$970
800 (16K)	\$770
400	Call
810 Disk Drive	Call
825 Printer	\$710
850 Interface	\$155
410 Recorder	\$70
830 Modern	\$140
Star Raiders	\$ 45
16K Memory	\$ 90
Software	From \$ 10

MODEMS

Lexicon LEX-II	\$115
Novation CAT	\$155
D-CAT	\$155

SOFTWARE

Centa Systems CBASIC	Call
CP/M	Call

VIDEO TERMINALS

Soroc IQ 120	Call
IQ135	Call
IQ 140	Call
Televideo 912 B	\$699
912 C	\$699
920 B	\$749
920 C	\$749
950	Call
Zenith - Z - 19	\$789

PRINTERS

Centronics 737 Serial	Call
737 Parallel	Call
Citoh	Call
Diablo	Call
Epson MX-80	Call
MX-70	Call
MPI-88G	Call
NEC 5510	\$2672
5520	\$2955
Okidata Microline 80	\$420
Microline 82	\$620
Microline 83	\$923
Qume 5/45 RO	\$2684
5/45 KSR	\$3081
5/55 RO	\$2863
5/55 KSR	\$3144
Texas Instruments 810 Basic	\$1516
810 Loaded	\$1739
820 KSR Basic	\$1732
820 KSR Package	\$1916



Prices & availability subject to change without notice

COMPUTERS

Altos	Call
Dynabyte	Call
Northstar HRZ II-32K D (Assm)	\$2300
HRZ II-32K Q (Assm)	\$2665
Zenith Z-89 48K	\$2210

DISKETTES

Memorex	Call
BASF	Call
Scotch 5 1/4"-0, 10, 16 Sector (Qty 100)	\$250
8"-0, 32 Sector (Qty 100)	\$260

MONITORS

APF - 9" Monitor	\$115
Sanyo - 9" Monitor	\$165

We Buy and Sell Used Equipment

Experienced Equipment

Centronics 779 .. \$450	Comprint 912 ... \$275
Teletype Model 40 (New)	\$2750
Hazeltine 1510 .. \$650	Atari 820 printer. \$400
Hazeltine 1420 .. \$600	Soroc
Centronics 730 .. \$375	TI 810 Basic ... \$1200
	Diablo, NEC, Qume from \$2100
	Axiom 801 HS... \$250



2222 E. Indian School Rd.
Phoenix, Arizona 85016
(602) 954-6109
1-800-528-1054



Personal checks will delay shipping two weeks. **Store Hours: Tues. - Friday 10-6 MST Saturday 10-5 MST**
Prices reflect 3% cash discount. Product shipped in factory cartons with manufactures warranty. Add 2%, a minimum of \$5, for shipping and handling.

A Reformatter for CP/M and IBM Floppy Disks

John A Lehman, 716 Hutchins #2, Ann Arbor MI 48013

In the "old" days of personal computing (ie: five years ago), the transfer of programs or data between large and small computers was not a major problem. You simply turned on the paper-tape punch in your Teletype ASR33 terminal and listed the program on the source computer. You then took the paper tape to the second computer, inserted it in the paper-tape reader, and read it in. This was slow, noisy, and did not encourage transfer of long programs, which microprocessor-based computers didn't have enough memory to run anyway.

The situation has changed quite a bit. Small computers are no longer mere experimenter's toys, but serious tools for science and business. Instead of being programmed only in machine language or BASIC, they are now programmed in FORTRAN, Pascal, PL/I, COBOL, and many other popular high-level languages. The fact that small machines can now run the same programs as the

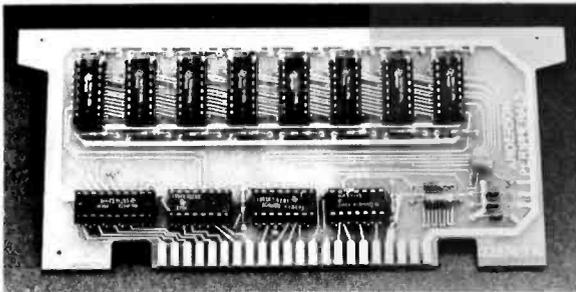
larger ones has increased the demand for program transfer between machines. For example, it is not uncommon for me to take a 1000-line FORTRAN program from a large timesharing system and run it (virtually unchanged) on my CP/M system. However, a program of that size is too large to dump to paper tape, even if any of the systems I use still had a Teletype terminal with a paper-tape reader.

This is where Microtech Exports' Reformatter for floppy disks comes in. IBM originally intended the floppy disk to be a replacement for punched-card data entry. The IBM 3740 Data-Entry System Basic Exchange Format (BEF) is a fixed-field, uncomplicated standard for data transfer between IBM equipment. Many machines that use floppy disks do not use BEF for normal use, because it is inefficient. However, almost all IBM equipment can use it to transfer files. Reformatter allows the transfer of data both ways between CP/M and BEF files.

Reformatter is a useful product for anyone who wants to take programs developed on one system and run them on another. For example, I have put a number of published FORTRAN packages onto my CP/M system. Going the other way, to avoid being charged for development time, I use my system to develop FORTRAN and PL/I programs to run on larger systems.

Another group who will find Reformatter useful are people with access to large computers that have peripherals they would like to use on a smaller system. For example, my CP/M system has neither 9-track magnetic tape nor a high-speed line printer, but I have access to an IBM Series/1 system that does.

So much for the motivation for using the Reformatter package. How does it work? Surprisingly well. It allows



Memory Boards for ATARI™ 800 & 400 Computers

Assembled and Tested
Completely Compatible
No Modifications necessary

Ready to plug in
One Year Warranty

16K \$ 99.95
16K with gold plated connector tabs 109.95
32K with gold plated connector tabs 199.95

Visa and Mastercard accepted Quality discounts available
Dealer inquiries invited

Anderson Peripherals, Inc.

P.O. Box 629
Richardson, Texas 75080
214-231-6866

™ATARI is trademark of Atari Corp.

At a Glance

Name
Reformatter

Format
8-inch floppy disk

Type
Translates between
CP/M and IBM Basic-
Exchange-Format floppy
disks.

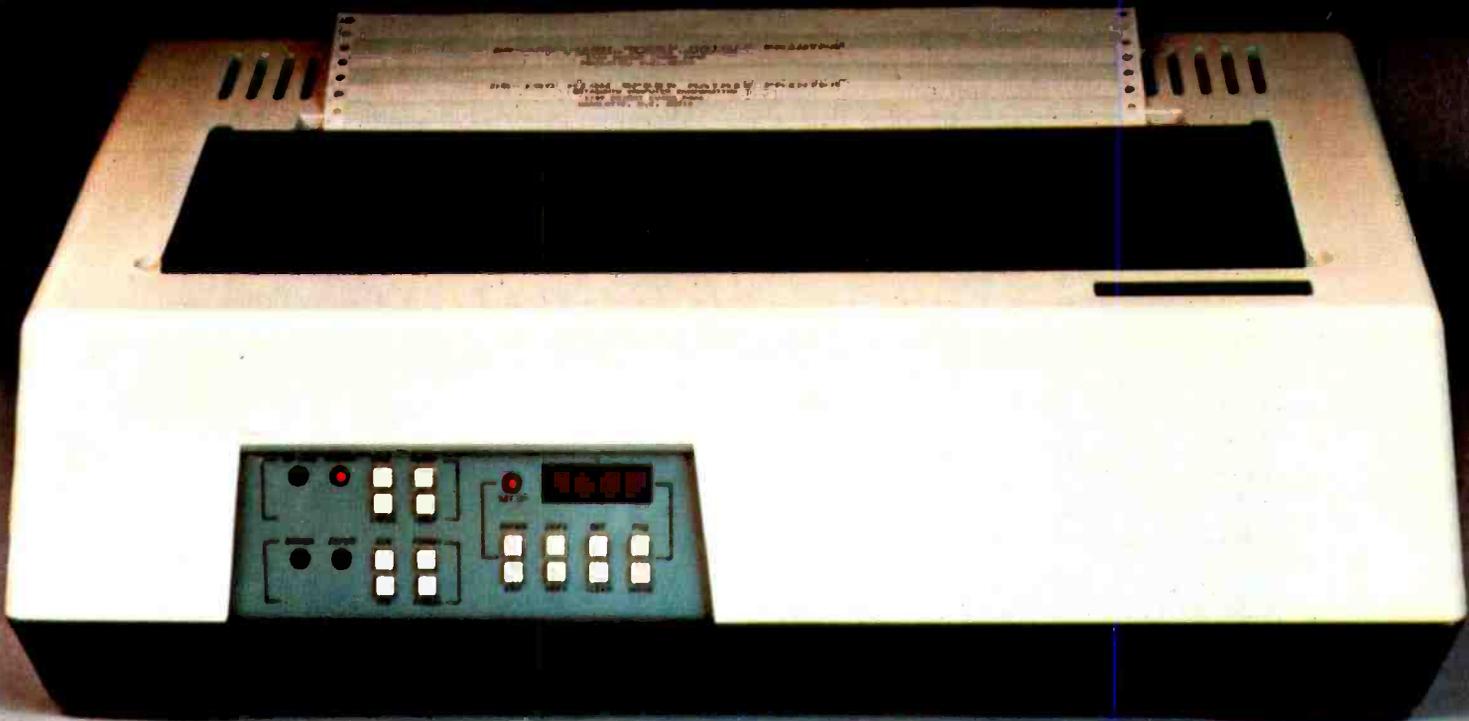
Computer
Any CP/M system and
any IBM system. Re-
quires two 8-inch disk
drives.

Manufacturer
Microtech Exports
912 Cowper St
Palo Alto CA 94301
(415) 324-9114

Audience
Anyone with access to
both CP/M and IBM
systems.

Price
\$195

datasouth announces... **THE TOTAL PRINTER PACKAGE!**



With so many matrix printers on the market today, it may seem tough to find exactly the right one for your application. Some models may offer the speed you need, others the communications flexibility and still others the forms handling capability. But no printer offers all the features you need... until now.

The DS180 matrix printer provides the total package of performance features and reliability required for applications such as CRT slave copy, remote terminal networks and small to mid-range systems. Not a "hobby-grade" printer, the DS180 is a real work-horse designed to handle your most demanding printer requirements. And pricing on the DS180 is hundreds of dollars below competitive units.

High Speed Printing—Bidirectional, logic-seeking printing at 180 cps offers throughput of over 200 lpm on average text. A 9-wire printhead life-tested at 650 million characters generates a 9x7 matrix with true lower case descenders and underlining.

Non-volatile Format Retention—a unique programming keypad featuring a non-volatile memory allows the user to configure the DS180 for virtually any application. Top of form, horizontal and vertical tabs, perforation skipover, communications parameters

and many other features may be programmed and stored from the keypad. When your system is powered down, the format is retained in memory. The DS180 even remembers the line where you stopped printing. There is no need to reset the top of form, margins, baud rate, etc... it's all stored in the memory. If you need to reconfigure for another application, simply load a new format into the memory.

Communications Versatility—The DS180 offers three interfaces including RS232, current loop and 8-bit parallel. Baud rates from 110-9600 may be selected. A 1K buffer and X-on, X-off handshaking ensure optimum throughput.

Forms Handling Flexibility—Adjustable tractors accommodate forms from 3"-15". The adjustable head can print 6-part forms crisply and clearly making the DS180 ideal for printing multipart invoices and shipping documents. Forms can be fed from the front or the bottom.

If you would like more information on how the DS180's low-cost total printer package can fill your application, give us a call at Datasouth. The DS180 is available for 30-day delivery from our sales/service distributors throughout the U.S.

datasouth
computer corporation

you to initialize Basic-Exchange-Format floppy disks, list their directories, change the file definitions, dump, display, edit, or delete the files, and to transfer data to and from CP/M files. Automatic character-set conversion and proper handling of conversion between fixed- and variable-record formats can be used or disabled. All of these functions work well and rapidly. Reformatter can transfer a file between CP/M and BEF twice as fast as an IBM Series/1 can transfer that same file to hard disk. Its file-manipulation facilities are also considerably more flexible than are the IBM-supplied versions.

Reformatter is also easy to use. It is menu driven, and entering a carriage return at any point backs you up one level in the menu. In terms of ease of use, it ranks in the top quarter of the CP/M software that I have used, and in the top 1% of IBM software.

In fact, any problems I had using this package stemmed from IBM's tendency to do things the hard way from the user's standpoint. With any IBM software that I have used, you are required to specify the size of a file at the

time you create it. On the other hand, CP/M can dynamically expand a file; moreover, it uses variable-length records, as opposed to IBM's fixed-length. The result is that you must specify the size of the IBM file without knowing the size of the CP/M file. There are a number of ways around this. You can set up your IBM disks with only one file per disk, which is not as wasteful as it sounds, since a BEF disk holds about 50 K bytes of text or programs (each line takes a full 128 bytes). The second solution is to purposely create overlapping files, copy them, check the directory for the resulting sizes, and repeat the process again. Finally, you can write a program that counts the lines in a CP/M file and tells you how many tracks and sectors the IBM disk will require.

In summary, if you have access to an IBM or an IBM-compatible computer system and you want your file- and data-transfer problems solved, Reformatter is probably what you've been looking for.

If you have a TRS-80 or access to DEC machines, Microtech Exports has another version for you. ■

When will the Personal Computer Explosion touch YOU?

Are you prepared for the explosive transformation? Right in your own home? Electronic mail. Personalized investment analysis. Foreign language tutorial. Home energy management. Robots. Computer music. Secretarial service. Diet and menu planning. And more, more, more.

onComputing™, the new McGraw-Hill quarterly, prepares you for the enormous changes coming during the 1980's (Some are already here). **onComputing™** explains in non-technical language what personal computers are, how they work, and how you can use them at home, for fun and profit. Don't let the personal computer explosion catch you off guard. Know what's happening and help make it happen! Prepare now for the exciting future with **onComputing™**!

Start your subscription today.
Call Toll Free 800-258-5485



A MCGRAW-HILL PUBLICATION
onComputing
GUIDE TO PERSONAL COMPUTING

GETTING STARTED
What You Need And What It Will Cost
EQUIPMENT REVIEWS
TRS-80, Apple, Sordac and PET
Best-Selling Author
JERRY POURNELL
"Writing With A Microcomputer"
THE BINARY WORLD
Also...
A PERSONAL
COMPUTER DIRECTORY
COMPUTER CLUBS
WHO NEEDS THEM?
If this doesn't match yours
Four of our newest computers in color

onComputing™ Subscription Dept. P.O. Box 307, Martinsville, NJ 08836

DOMESTIC subscription rate.

U.S. 1 yr (4 issues) @ \$8.50 Canada & Mexico, 1 yr. (4 issues) @ \$10.00

FOREIGN (to expedite service, please remit in U.S. funds drawn on a U.S. bank.)

Europe (and all other countries, except above), 1 yr. @ £12.00 — surface delivery.

Bill Visa Bill Master Charge Bill me (North America only)

Card Number

Expiration

Signature

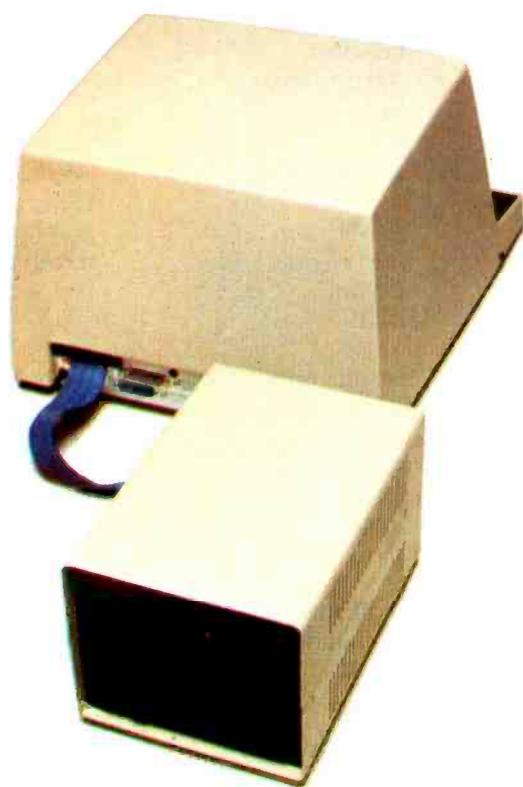
Name (please print)

Street/Apartment Number

City

State/Province/Country Code

Please allow 6-8 weeks for processing.



**"And in conclusion,
I'll only use
my exceptional powers
for the good of mankind."**

"That's a vow all we Vector 3005s make. And it's not one we make lightly.

"After all, being the only product on the market with a Vector 3 terminal, a 5¼" floppy, and a 5¼" Winchester rigid disk drive that provides 5 megabytes of storage is quite a responsibility. It used to take 20 floppies to give you that kind of capacity.

"Our powers don't stop there, however. Each 3005 also comes with a 32-bit error-correcting code — the first time sophisticated IBM-style technology has been available on a small business system. This lets us detect and correct errors, and almost completely eliminates data loss on disks due to dirt, wear, or damage.

"All this makes us pretty awesome, all right. But there's more. When coupled with Vector's MEMORITE III and EXECUPLAN software packages, we give you a 30,000 word dictionary, the ability to create your own phrase library, a teaching manual right on the screen, pass word security, plus a host of other word processing capabilities as well as financial planning, forecasting and basic accounting.

"And we're reliable. Our powers won't diminish, our abilities won't fade, and dedication to mankind won't weaken.

"For more information and your nearest dealer, call Vector at 800-423-5857. In California, call 800-382-3367. Or write to them at 31364 Via Colinas, Westlake Village, CA 91362.

"Thank you all for coming today. And I hope we'll have the chance to do business together in the future."

VECTOR
VECTOR GRAPHIC INC.

COMPUTERS FOR THE ADVANCEMENT OF SOCIETY.

MicroShakespeare Revisited or Kilobard

Andrew Kalnik, 3201 Wamath Dr, Charlotte NC 28210

William Shakespeare would have made a first-rate computer analyst. He had all the qualifications: superb powers of observation, capacity to deal with complex problems, imagination, and a fair ability to express himself.

Looking at his writings, you can easily recognize the vocabulary of a systems consultant making his pitch to land an installation contract. Presented in a conference room against a backdrop of easel charts, with gold-stamped proposal binders on the broad walnut table, some of his phrases would be right in place:

"...I'll teach you how to flow..."
(*The Tempest*, Act II, scene i)

"What is written shall be executed..."
(*Titus Andronicus*, Act V, scene ii)

"I will execute, and it shall go hard,
but I will better the instruction..."
(*Merchant of Venice*, Act III, scene i)

"...Our interpreter does it well..."
(*All's Well That Ends Well*, Act IV, scene iii)

From other lines, you can feel the sympathy the Programmer of Avon would give wretches like you and me sentenced to a debugging session:

"O hateful error, melancholy's child
Why dost thou show to the apt thoughts of man
The things that are not? O, error, soon conceived
Thou never comest into a happy birth..."
(*Julius Caesar*, Act V, scene iii)

Here's another short quiz to test how well you can match Master Will's golden words against the shiny silicon jargon of our art. (Try your hand at the other quiz in the April 1980 BYTE, page 104.) What we've done is to make free translations from Shakespearean phrases into terms familiar in computing.

Simply match the letter of the most pertinent modern phrase against the quotations. No prizes, just the satisfaction of puzzling out the answers. The answers and ratings are on page 184. [Editor's note: Each of the items 1 thru 20 will match to one of the answers "a" thru "t," so read through all the answers before you try to make a match. ...GW]

- | | | |
|--|----|--|
| 1. () We'll evaluate your purpose, and put on a form... | a. | "And <i>that</i> crashed the whole program!" |
| <i>Troilus and Cressida</i> , Act III, scene iii | | |
| 2. () ...an adder did it... | b. | "We'll have the function graphed on screen in a few seconds." |
| <i>A Midsummer Night's Dream</i> , III/ii | | |
| 3. () That one error fills him with faults. | c. | "I wish I could check the register flags." |
| <i>Two Gentlemen of Verona</i> , V/iv | | |
| 4. () ...shall run in a new channel fair and evenly... | d. | "There isn't much time to convert the analog readings between interrupts." |
| <i>I Henry IV</i> , I/i | | |
| 5. () ...unpleasantest words that ever blotted paper... | e. | "Put a scope on it to check those big input spikes." |
| <i>The Merchant of Venice</i> , III/ii | | |
| 6. () ...inferreth arguments of mighty strength... | f. | "With the new I/O board, it should just perk right along." |
| <i>III Henry VI</i> , V/ii | | |
| 7. () ...the minute of their plot is almost come... | g. | "That frosts me—we're not getting any output from those ANDs." |
| <i>The Tempest</i> , IV/i | | |

C ~~AND~~ Pascal

Efficiency ~~AND~~ Portability

Flexibility ~~AND~~ Strong Typing

Now you don't have to compromise!

Whitesmiths Ltd. now offers portable language development systems for four families of computers. Approximately one thousand installations use our software.

We support complete versions of both C and Pascal, as compilers and cross-compilers. You get C automatically when you license Pascal, and you get native support with each cross-compiler. Test the software on your VAX before burning PROMs for your 68000 or 8080.

Whitesmiths Ltd. offers a variety of licensing arrangements, the simplest being a binary license for use on a single CPU. The full source code is available with internal documentation. Maintenance, training and sublicensing rights may also be obtained.

Call or write for more information.

Source Operating Systems	Target Machines			
	8080/Z80	LSI-11/PDP-11	VAX-11	M68000
8080/Z80 CP/M	C: \$630 Pascal: \$880	*	*	*
LSI-11/PDP-11: Idris, Unix, RT11, RSX-11/M, RSTS/E, IAS	C: \$1130 Pascal: \$1380	C: \$630 Pascal: \$880	*	C: \$1130 Pascal: \$1380
VAX-11 Unix/V32 VMS	C: \$1130 Pascal: \$1380	*	C: \$630 Pascal: \$880	C: \$1130 Pascal: \$1380
M68000 VERSA [®] dos	*	*	*	C: \$630 Pascal: \$880

Idris is a trademark of Whitesmiths, Ltd. ■ Unix is a trademark of Bell Laboratories ■ CP/M is a trademark of Digital Research Company ■ VMS, RSX-11/M, RSTS/E, LSI-11, VAX, are trademarks of Digital Equipment Corporation ■ VERSA[®]dos is a trademark of Motorola Corporation

*Special Order

Protect your software investment.

Whitesmiths, Ltd.

P.O. Box 1132 Ansonia Station New York, N.Y. 10023
(212) 799-1200

8. () This fierce abridgement hath to it circumstantial branches.
Cymbeline, V/v
9. () Look, what thy memory cannot contain/ Commit to these waste blanks.
Sonnet lxxvii
10. () ...full characterized, lasting memory...
Sonnet cxxii
11. () ...the very cipher of a function...
Measure for Measure, II/ii
- h. "We regret to inform you that we can no longer supply replacement parts for your system."
- i. NOP
- j. "It was in accumulator A."
- k. "Looks like you're getting a hard-copy memory dump."
12. () ...Would I were assured of my condition...
King Lear, IV/vii
13. () ...Is it ended then...?
Coriolanus, IV/iii
14. () ...The gates made fast! Brother, I like not this.
III Henry VI, IV/vii
15. () O'erbearing interruption...
King John, III/iv
16. () ...mark the high noises...
King Lear, III/vi
- l. "If you have no more memory left, you store everything on a scratch disk."
- m. "Let's work up a high-level flowchart."
- n. "We can't be any worse off."
- o. "It seems you can call a macro that inverts a 99 by 99 matrix."
- p. "It's unmaskable."

17. () What should that alphabetical position portend?
Twelfth Night, II/v
18. () Thou hast caused printing to be used...
III Henry VI, IV/ii
19. () What I can do can do no hurt to try...
All's Well That Ends Well, II/i
20. () If it were done when 'tis done, then 'twere well/ It were done quickly...
Macbeth, I/vii
- q. "That IF-THEN-ELSE decision sequence cut the program down by at least 40%."
- r. "Are we at step 9999?"
- s. "ROM with complete ASCII set."
- t. "Can you tell me what this string is doing in position FFCA?"

Save on Calculators

Model	Retail	Your Cost
New Hp-41CV 22K bytes, 4 mem. modules built-in, slanted keyboard	\$375.00	\$239.95
System One, HP41CV & Card Reader	495.00	394.95
System Two, HP41CV-Card Reader & Printer	840.00	669.95
Card reader for 41C/41CV	215.00	169.95
Printer for 41C/41CV	385.00	289.95
HP 41C new price	250.00	189.95
Quad Ram to upgrade the HP41C to 22K bytes leaving 3 ports. Plugs into the 41C	95.00	84.95
Optical Wand for 41C/41CV	125.00	109.95
Memory Modules for 41C/41CV	39.50	27.95
HP-34C Scientific	150.00	119.95
HP-38C Bus./R.E	150.00	119.95
HP-33C Scientific	90.00	78.95
HP-32E Adv. Scientific	55.00	49.95
HP-37E Bus. Calc.	75.00	63.95
HP-67 Programmable Sci.	375.00	299.95
HP-97 Prog. Printer Sci.	750.00	579.95
HP-85 Computer	3250.00	2495.00
New HP-83 Computer, similar to HP-85 without printer & cassette	2250.00	1795.00

**HEWLETT
PACKARD**
Olympic Sales is an HP franchised dealer.
Call us for the best deal.
"C" stands for continuous memory.
One year guarantee by HP on all calcs. 90 days on computers. All units complete.

Texas Instruments

Ask about special rebate on some TI calculators and free software on TI-59

TI-99/4 Computer Console	\$469.95	Speak and Read	74.95
TI-59	199.95	Speak and Math	67.95
TI-58C	89.95	Language Tutor (Speaks)	129.95
TI-57	49.95	Language Teacher	72.95
PC 100C	159.95	Invest Analyst	42.95
TI-5230 printer (was \$495.)	189.95	Bus Analyst II	43.95
TI-55	35.95	TI Programmer	48.95
TI-50	35.95	TI-5040 Printer	74.95
Speak and Spell	58.95		

Ask about the new line of TI plain paper printers at new low costs

SPECIALS Computers at unbeatable prices

<p>APPLE II and APPLE III</p> <p>Huge inventory of Apple II computers. 16K-32K-48K. Disk drives, monitors, 80 column card. Dow Jones & Quote Reporter.</p> <p>Pascal-Fortran-DOS 3.3, etc. You name it...we've got it at super low prices.</p> <p>Immediate delivery on Apple III computers 96K and 128K systems. Call us!</p>	<p>Apple II personal computer</p>	<p>Texas Instruments</p> <p>99/4 console computer \$469.95</p> <p>Atari 800 16K computer console 759.95</p> <p>Atari TV Game 139.95</p> <p>Mattel Intellivision TV Game 229.95</p> <p>Mattel Race Horse Analyzer 99.95</p> <p>Sony Walkman TPS L2 169.95</p> <p>Centronics printer P1 for Apple and Radio Shack computers 189.95</p> <p>Was \$495.00</p> <p>Craig Translator M 100 99.95</p>
---	--	---

SCM Typewriters • 320 models Seiko watches • Royal • Victor • Canon • Sharp • Casio and more.

Prices f.o.b. L.A. Minimum freight & handling charge \$4.95. In CA, add 6% sales tax. Goods subject to availability. We'll beat any advertised price if competitor has goods on hand. Call Mon-Sat 7AM-6PM. Outside CA, toll free 800-421-8045. Inside CA, toll free 800-252-2153.

OLYMPIC SALES COMPANY, INC.
216 South Oxford Ave. • P.O. Box 74545 • Los Angeles, CA 90004 • (213) 381-3011
Order Desk (213) 739-1138 • Customer Service (213) 739-1100 • Telex 67-3477

See answers on page 184. ■

100 April 1981 © BYTE Publications Inc

Circle 68 on inquiry card.

At General Electric we're using computers in ways no one thought of before.

If you are looking for exciting technical challenges coupled with excellent growth opportunities join General Electric's Space Systems Division. Help us develop large scale, distributed, information processing systems requiring innovative design approaches. You

will be working in the following Data Processing Environments:

- 3033
- 3081
- VAX 11/780
- MVS
- JES 2
- ACF/NCP
- ADA BAS

Entry level and Sr. positions available for:

MVS Systems Programmers

Perform SYSGENs, maintain and tune MVS. Select and install program products. Develop MVS enhancements, H/W-S/W interfaces, and 3705 telecommunications applications.

Math Analysts

Perform modeling for simulation of complex command and control systems. Solve operational research problems and develop algorithms in systems and vehicle flight dynamics and orbit mechanics. Develop computer programs to generate study data to aid analysis and trade-offs.

Computer Systems Architects

Responsible for requirements analysis in the design of large scale Computer Systems to support on-line information management applications. Duties include selection and specifications of:

- Computer Hardware
- Operating Systems
- Data Management Systems
- Telecommunications Systems

Data Base Designers/ Administrators

Perform data base design-administration and implementation tasks for large scale data systems using state-of-the-art data base management tools. Analyze data base requirements. Design and select file structures, access methods, and data management techniques. Install, maintain and tune vendor supplied Data Base Management packages. Provide Data Base support and technical interface for Data Base definition, design, query and update utilities.

Data Base Analysts

Responsible for data requirements analysis and subsequent selection of appropriate data management approaches including Data Base Management Systems evaluations.

Programmer/Analysts

Develop design approaches and implement state-of-the-art, high technology programs. Knowledge of structured implementation environment with related documentations and design reviews a plus.

For immediate consideration, please forward your resume indicating position of interest to: Mr. William E. Sarno, Dept. VF 31-D, General Electric Space Systems Division, Valley Forge Space Center, Goddard Blvd., King of Prussia, PA 19406.

Applying computers to make our most important product: Progress

GENERAL  ELECTRIC

GE takes pride in being an equal opportunity employer, m/f

Programming the Game of Go

Jonathan K Millen
661 Main St
Concord MA 01742

Go is a board game. Like chess, it is a game of pure skill; moreover, a considerable body of literature has been devoted to it. Go was invented in China around 2000 BC. Since its introduction into Japan around 700 AD, it has flourished there to the extent that the most accomplished masters of the game are now Japanese. However, the game has spread world-wide. In the United States, one can find Go clubs in the vicinity of large cities and universities, and most large bookstores have at least one substantial book on the game.

Go is played on a 19 by 19 square grid having black spots on nine intersections, as illustrated in figure 1. The traditional board, called a *Go Ban*, is a wooden block about 17 inches square and several inches thick, with four short feet. It stands alone as a table at just the correct height for players sitting on floor cushions.

One player has a supply of black stones; the other, white stones. The stones are disks about the same size as the grid spacing; they are approximately three-eighths of an inch thick in the middle and almost sharp around the edge. The black stones traditionally are made of slate, and the white stones of clam shell.

Players move alternately, each

placing a stone on the point of intersection of a pair of grid lines. The object of the game is to enclose the most area, measured by the number of unoccupied points enclosed by stones of a given color. A point is enclosed by, say, black, if no path along the grid from the point runs into a white stone. Figure 2 shows some enclosed areas. Note that the edge of the board can form one boundary of an area.

A player can increase his area by capturing the opponent's stones. Stones are captured a connected group at a time. A set of stones forms a connected group if there are paths along the grid from any stone to any other stone in the set, such that all points on the path are occupied by stones in the set. This criterion is easy to visualize because the stones, being as large as the grid spacing, actually touch along paths of connection. The phrase "connected group" also implies that the stones in the group are all of the same color, and that the group is not merely a part of some larger connected group.

A group of stones is captured when it has no *liberties*. A liberty of a connected group is an unoccupied point adjacent (vertically or horizontally) to a stone in the group. If a group has just one liberty, the opponent may capture it by placing one of his stones

on the liberty. The opponent then picks up the captured stones and keeps them as prisoners. At the end of the game, a player's point count of area is augmented by the number of prisoners he has captured. Figure 3 shows a group having one liberty.

The game ends when both players pass consecutively, because they both see no further advantage in playing more stones. Usually, when this happens, there are white stones within areas enclosed by black, and vice versa. These stones have been given up because the owner can predict that they will be captured. They are removed as prisoners at the end of the game before counting the score.

The remaining rules are technicalities. Two that have a significant effect on the game, concerning "ko" and "suicide," will be mentioned later on. The rest involve details of ending the game and scoring, and are rarely invoked.

A Go-Playing Program

A Go opponent, called Wally, was programmed on a KIM-1 within its approximately 1 K bytes of memory. Wally's algorithm is based on essentially two capabilities: finding the liberties of a connected group, and matching a few common patterns. Moves take less than a second.

A 15 by 15 board was used because

Verbatim Comments:

“Compared to the brands I’ve used before, Verbatim Datalife™ is the best yet!”
*Sandy Tiedeman
Las Vegas, NV*

“New Verbatim helped eliminate I/O errors on my Apple.”
*Richard Adams
Ft. Walton Beach, FL*

“I would prefer Verbatim Datalife over any brand I’ve ever used.”
*Skip Piltz
Overland Park, KS*

“My experience with Verbatim diskettes has been excellent. I’ve used several boxes over the past few months and they’ve all been error-free.”
*Robert Roeder
Las Vegas, NV*

“Much stronger, better centering. A definite improvement.”
*Leroy LaBalle
Marrero, LA*

“It has worked perfectly everytime!”
*Richard Ruth
Shippensburg, PA*

“I like the thicker protective cover.”
*David Hendel
Lititz, PA*

“Great! I have had no problems!”
*Timothy Roscoe
Mechanicsburg, PA*

“So far my Verbatim disks have been performing flawlessly. Not always so with other disks.”
*Chris Otis
Hoffman Estates, IL*

“Runs quieter in the disk drive.”
*Richard Cannova
Los Angeles, CA*

“Verbatim disks are super. They’re our standard for quality.”
*Bob Mills
Mission, KS*

“Anything that prolongs the life of a diskette is a plus. Thank you Verbatim for an excellent improvement.”
*Steve Toth
Piscataway, NJ*

“Of the 130-plus Verbatim disks I have, I’m not aware of any problems. I’m sure the improvements will give your disks an even longer life.”
*Gerald Janas
Warren, MI*

“FANTASTIC. Not a single registration problem. Much more reliable than what I had been using.”
*Gary Sandler
Playa Del Rey, CA*

“Verbatim is much more reliable. I wouldn’t trust anything else.”
*Howard Chin
Pomona, CA*

“Thank you for the improvements. Just another reason why I’ll always use Verbatim.”
*James Hassler
Cheyenne, WY*

We introduced Verbatim Datalife mere months ago. And it’s already playing to rave reviews like these.

But don’t take anybody else’s word for it. Try it yourself, and see if you don’t agree it’s the best media you’ve ever tried. For the name of your nearest Verbatim dealer, call (800) 538-1793, in California call (408) 737-7771 collect.



We play it back, Verbatim!

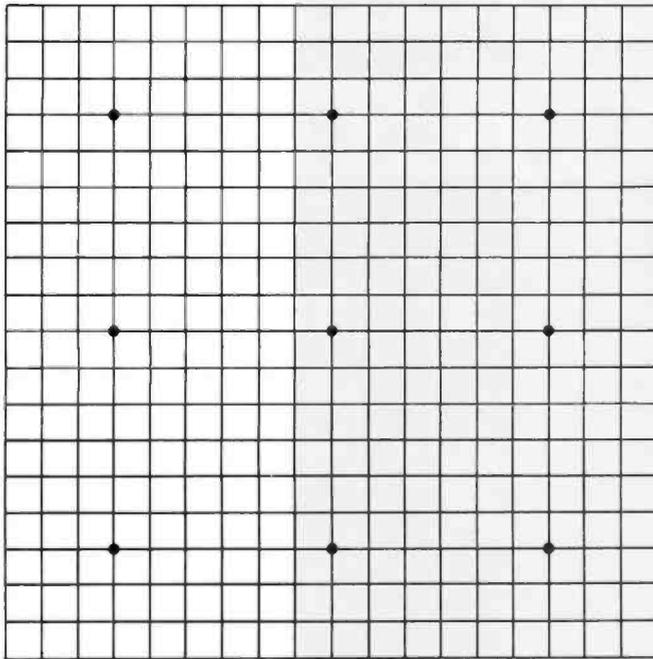


Figure 1: The Go board. Players move alternately, placing stones on the points of intersection of the lines, rather than in the spaces. The nine dots are handicap-stone locations. The line spacing is about 2.2 cm (seven-eighths of an inch).

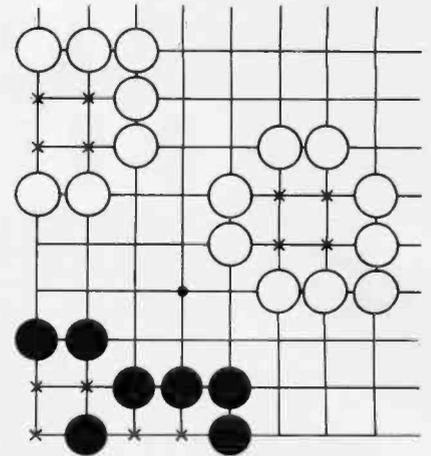


Figure 2: Enclosed areas. Points marked x are in areas enclosed by one player or the other. The figure shows five black points and eight white points.

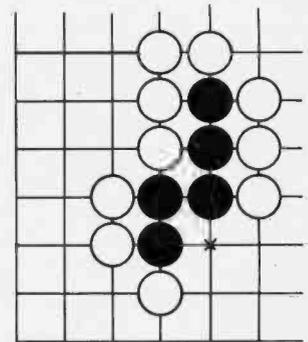


Figure 3: A black group with exactly one liberty, marked x. If it is white's turn, he can capture the black group by placing a stone at x and removing the black group as his prisoners.

it was convenient for addressing reasons to represent it internally within a single 256-byte page, using one byte per point. Although there would be room for a 16 by 16 board, a Go board ought to have a center point. Rows and columns were numbered from 1 to F (in hexadecimal) so that the coordinates of a move could be entered on the KIM keyboard.

When a move is entered, Wally responds with the coordinates of his move on the KIM display, and the complete board is also output on a video terminal. The display of a game in progress is shown in photo 1.

Once the board representation and the input and output routines were set up, the first major component of the

MARK GORDON COMPUTERS

DIVISION OF MARK GORDON ASSOCIATES, INC.
P.O. Box 77, Charlestown, MA 02129 (617) 491-7505

COMPUTERS

Atari 800 W 16K	799.00
4K Model III	599.00
Model-II 64K System	3499.00
16K Model III	879.00

DISK DRIVES

40 Track 5 1/4 inch drive	314.00
80 Track 5 1/4	544.00
4 Disk Drive Cable	39.00

PRINTERS

Centronics 730	599.00
Epson MX80B	Call for price
Epson MX70	Call for price
Centronics 737	849.00
Okidata Microline 83	999.00
Okidata Microline 82	729.00
Integral Data 440G	999.00
NEC 5510 w-tractor	2679.00
Okidata Microline 80	499.00
Diablo 630	2495.00

MISC HARDWARE

Expansion int TRS-80(Ok)	269.00
Novation D-Cat Modem	166.00
16K Memory Kit	41.99
Leedex Monitor	119.00
Leedex 100G	139.00
Printer Cable for above	49.00
ISO-2 Isolator	54.00
AC LINE FILTER	24.00

STORAGE MEDIA

Scotch-box 10.5 1/4	27.00
Memorex-box 10.5 1/4	22.00
Plastic Storage Box	5.00

OPERATING SYSTEMS

NEWDOS by APPARAT INC	49.00
NEWDOS+ by APPARAT INC	99.00
MMS FORTH DISKETTE-PRIMER	79.95
NEWDOS 80	149.00

DISKETTE TRS-80* BUSINESS SOFTWARE FOR TRS-80 BY SBSG
Free enhancements and upgrades to registered owners for the cost of media and mailing. 30 day free telephone support. User reference on request.
Fully Interactive Accounting Package. General Ledger, Accounts Payable, Accounts Receivable and Payroll Report Generating Complete Package (requires 3 or 4 drives) \$475.00
Individual Modules (requires 2 or 3 drives) \$125.00
Inventory II (requires 2 or 3 drives) \$99.00
Mailing List Name & Address II (requires 2 drives) \$129.00
Intelligent Terminal System ST-80 III \$150.00
The Electric Pencil from Michael Shrayser \$150.00
File Management System \$ 49.00

FINE PRINT

TRS-80 is a Tandy Corporation trademark. Use of above operating systems may require the use of Radio Shack TRS-DOS. Radio Shack equipment subject to the will and whim of Radio Shack.

ORDERING INFORMATION

We accept Visa and Mastercharge. We will ship C.O.D., certified check, or money order only. There will be a 40 percent deposit on orders over \$300.00. Massachusetts residents add 5 percent sales tax.

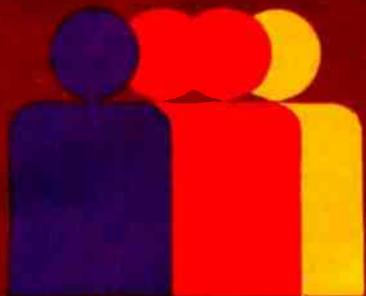
To order call toll-free 1-800-343-5206

For information call 617-491-7505

The Company cannot be liable for pictorial or typographical inaccuracies.

The above prices do not include shipping.

UniFLEX™



Multi-User

UniFLEX is the first full capability multi-user operating system available for microprocessors. Designed for the 6809 and 68000, it offers its users a very friendly computing environment. After a user 'logs-in' with his user name and password, any of the system programs may be run at will. One user may run the text editor while another runs BASIC and still another runs the C compiler. Each user operates in his own system environment, unaware of other user activity. The total number of users is only restricted by the resources and efficiency of the hardware in use.



Multi-Tasking

UniFLEX is a true multi-tasking operating system. Not only may several users run different programs, but one user may run several programs at a time. For example, a compilation of one file could be initiated while simultaneously making changes to another file using the text editor. New tasks are generated in the system by the 'fork' operation. Tasks may be run in the background or 'locked' in main memory to assist critical response times. Inter-task communication is also supported through the 'pipe' mechanism.



Support

The design of UniFLEX, with its hierarchical file system and device independent I/O, allows the creation of a variety of complex support programs. There is currently a wide variety of software available and under development. Included in this list is a Text Processing System for word processing functions, BASIC interpreter and precompiler for general programming and educational use, native C and Pascal compilers for more advanced programming, sort/merge for business applications, and a variety of debug packages. The standard system includes a text editor, assembler, and about forty utility programs. UniFLEX for 6809 is sold with a single CPU license and one years maintenance for \$450.00. Additional yearly maintenance is available for \$100.00. OEM licenses are also available.

FLEX™

UniFLEX is offered for the advanced microprocessor systems. FLEX, the industry standard for 6800 and 6809 systems, is offered for smaller, single user systems. A full line of FLEX support software and OEM licenses are also available.



Box 2570, West Lafayette, IN 47906
(317) 463-2502 Telex 276143

™UniFLEX and FLEX are trademarks of Technical Systems Consultants, Inc.

program to be written was the routine that walks through a connected group of stones, marking the members of the group, and both marking and counting its liberties. Called COUNT, this routine is a variety of the maze-search algorithm. It was programmed recursively in machine language.

What COUNT does for each board location it looks at is based on the "invariant assertion" that any point it looks at is one of the following:

- a stone in the connected group
- a liberty of the connected group
- a stone of the other color adjacent to the connected group

If it is looking at a stone in the group, it checks to see whether that stone has previously been marked. If not, it marks the stone and calls itself to repeat the same process, starting with each of the four locations north, east, south, and west of the present stone.

Marking a stone or point, of course, means to set a particular bit in the byte corresponding to that point in the board representation. Other bits encode whether the point is

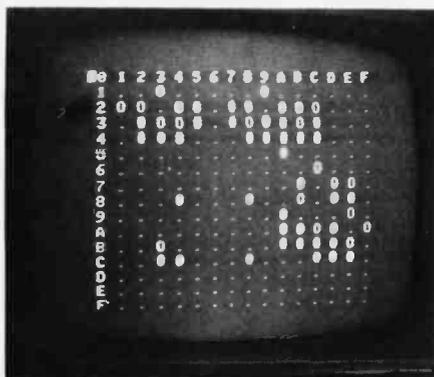


Photo 1: A game in progress. Wally (the computer) is playing black, represented by the solid-looking crosshatches (#). The author is playing white, represented by Os. The computer uses a 15 by 15 board; the points of play are indicated by periods. In this game, black was given a nine-stone handicap.

occupied and, if so, by what color stone.

If COUNT is looking at an unoccupied point, it marks the point as a liberty and increments the count of liberties, unless the point has already been marked and counted.

If COUNT is looking at a stone of the other color, it does nothing, and

just returns.

If a stone is on the edge, or first line, of the board, then one (or, in a corner, two) of its neighbors will be off the board. If COUNT is called for an off-board location, it returns immediately.

Note that, if COUNT starts on a stone and operates as described above, the recursive calls to COUNT will carry the center of attention all over the group and onto all neighboring points. The invariant assertion is satisfied because COUNT progresses one step each time only from stones in the group, as sketched in figure 4.

The algorithm for COUNT is specified concisely in listing 1 using a kind of "structured English." The rest of the Go-playing program will be specified similarly, as a collection of modules like COUNT.

Recursion is not difficult to implement; COUNT just calls itself with the usual jump-to-subroutine instruction for each of the neighboring points. The current board location is in a register; it is saved on the KIM stack before it is replaced by the location of each neighboring point, and then restored upon return from each call. The size of the connected group

THUNDERCLOCK PLUS™

PUT TIME AND REMOTE CONTROL IN YOUR APPLE II

The THUNDERCLOCK PLUS is two peripheral systems on one card for your APPLE II OR II PLUS. An accurate, reliable, real-time clock/calendar and an interface for the popular BSR X-10 Home Control System.

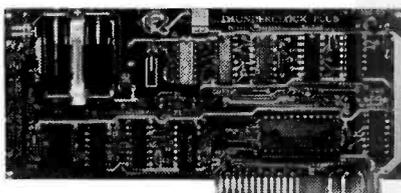
The THUNDERCLOCK clock/calendar makes accurate time and date available to your programs: month, date, day-of-week, hour, minute, and second, in any of four software selectable formats. On-board batteries keep your THUNDERCLOCK running when your APPLE II is turned off - for up to four years before battery replacement. On-card 1K firmware makes reading or setting the time easy from APPLESOFT or INTEGER BASIC, PASCAL, or assembly language programs. And it provides software selectable interrupts at any of three rates: 64, 256, or 2048 interrupts/second.

THE PLUS

Add THUNDERWARE'S X-10 ULTRASONIC INTERFACE OPTION to your THUNDERCLOCK and your programs can send all 22 BSR X-10 commands so you can remotely control lights and appliances. A full 128 dim/bright levels. And a powerful disk software package! The THUNDERWARE SCHEDULER software lets you create schedules to control lights, appliances, security systems, or almost any other electrical device. The software includes: SCUTIL- the SCHEDULER utility that lets you make or change a schedule, and SCHED- executes your schedules in real-time using the THUNDERCLOCK. SCHED runs in the 'background' so you can run other programs in the 'foreground'.

The THUNDERCLOCK PLUS is a SYSTEM for your APPLE II. Supported by intelligent, easy to use firmware, a powerful software package, and good documentation!

Available through your dealer.



BSR X-10 is a trademark of BSR (USA) LTD.
APPLE II is a trademark of APPLE COMPUTER, INC

Suggested retail prices:

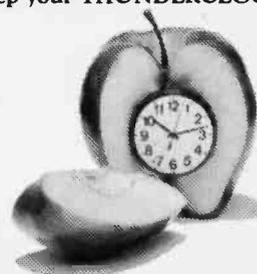
THUNDERCLOCK PLUS.....	\$139
Clock/calendar card with batteries and user's manual	
X-10 INTERFACE OPTION	\$49
BSR X-10 Ultrasonic interface, disk with SCHEDULER SOFTWARE & demos, and user's manual	
PASCAL SOFTWARE.....	\$29
Disk with PASCAL interface for clock and X-10 interface, and user's guide	
MANUALS ONLY, each.....	\$5
California residents add 6% sales tax	

If your dealer doesn't carry the THUNDERCLOCK PLUS:

ORDER TOLL FREE (VISA/MC) CALL:
800-227-6204 EXT 307 (Outside California)
800-632-2131 EXT 307 (California Only)

OR WRITE TO:

THUNDERWARE INCORPORATED
P.O. Box 13322, Oakland, CA 94661



**“If your database system
is so terrific,
why doesn't the world
beat a path to your door?”**

It is.

And the way is paved by the MDBS product line: database management systems second to none.

None.

The reasons are as plentiful as our product features. Such as the most important of all: increased productivity — thanks to the successful management of peopleware, hardware and software.

With MDBS database systems, you tailor the software to fit the organization easily: because our system is the most flexible around, offering speed; low cost

going in; fast startup; less programmer time... plus you can use it on a variety of hardware configurations using an even more extensive variety of languages.

(One example: with MDBS you can transform a programming language from an ordinary file management system into a full fledged database system without missing a beat.)

So, please take our invitation and give us a call, write or TWX.

Instead of beating the *bushes*, beat the *path*... to success.

MDBS: We manage success.

Micro Data Base Systems, Inc./Box 248/Lafayette, IN 47902
(317) 448-1616/TWX 810 342 1881

is limited by the size of the stack; one byte of board location plus two bytes of return address are pushed for each call, and the calls are nested as the algorithm "walks" around the group. A 100-byte stack can handle a 33-stone group. A group of that size would occur, if at all, only near the end of the game, when Wally's play deteriorates for other reasons anyway.

Main Loop

After COUNT was coded, a reasonable overall structure for a program to use it followed quickly. The main loop is specified in listing 2. The "consequences" of counting a group of stones include removing it from the board (zero out the board locations) if it has no liberties; other consequences have to do with suggesting tentative moves for Wally. Wally always plays black, in accordance with the Go tradition of giving the black stones to the weaker player.

The pattern-matching facility was not implemented immediately. In fact, the first version of the program chose black moves randomly, trying again if it hit upon an occupied point.

At least the capturing of black groups could be tested, and, for the most part, it was playing legal Go.

Tactics and Priorities

The next step in the design of the program was the decision that Wally would make contact moves, adjacent to white stones. In this way, the program would appear to be attempting to capture white groups, and would eventually fill up the liberties of each white group and capture it, if no defensive action were taken.

At the same time, it was clear that Wally also should take some defensive moves to avoid capture. This brought up the question of priorities: when is a black group threatened enough so that Wally should stop attacking white and make a defensive move instead? The answer had to be based on the number of liberties remaining in the black and white groups. It was decided that threats would be ignored until a black group had been reduced down to one or two liberties. Otherwise, Wally attacks whichever white group has the least number of liberties, because that group promises the best chance of be-

ing captured.

This strategy was implemented by associating a number of liberties with each suggested black move—namely, the number of liberties remaining for the group contacted by the stone. When a move is suggested, such as some liberty of a white group being

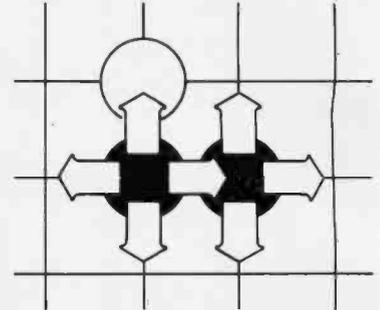


Figure 4: How the procedure COUNT works. When tracing a black group, COUNT begins on a stone in the group and calls itself recursively to look at the four neighboring locations. If a neighbor is a black stone, the process is repeated until all stones in the connected group have been found. All unoccupied points adjacent to stones in the groups (ie: liberties) are also found and counted.



ROOTS IRISH FAMILY HERITAGE



Search for your Irish Family Roots through a unique Micro-Program from Ireland.

Eiron Computers are proud to offer you an original computerized Irish Family Heritage Program, containing a summary of every Irish Family and areas from which they originated.

Also a background summary and emigration dates.

Included are Map with Crest names and Family locations

Price: \$100.

Send To:

**Eiron Computers Ltd.,
Eiron House, Park Road,
Dun Laoghaire,
Co. Dublin.
IRELAND
Tel: 808575/805045
Cables: Eiron, Dublin. Telex: 31502**

Allow 28 days for delivery
Mastercharge, American Express
Diners Club, Visa,
or Personal Cheque accepted.

Add \$5 for Post & Packaging.

**When ordering state your Name, Address and Disk Type and Format e.g. North Star Horizon 5¼" Single Density, and whether you are using North Star, TRS-80, Apple or PET, etc.

EIRON COMPUTERS are distributors of North Star, NEC and Epson Products.

WHY CIS COBOL LETS YOUR MICROCOMPUTER PERFORM LIKE A MAINFRAME.



Now, you can use a microcomputer for sophisticated business applications ... because now there's CIS COBOL. Micro Focus developed this COBOL so your microcomputer can run the same programs as a minicomputer or a mainframe.

CIS COBOL is Micro Focus' Compact, Interactive, Standard COBOL which offers the advantages of COBOL... powerful data structure features, English-like language, existing programmer expertise... to provide you with a full commercial language. You won't be restricted by size either: a 64K byte microcomputer will compile up to 8000 lines of COBOL, more if the program's split into dynamically loaded modules.

Choose a Compact Compiler.

The Compact compiler runs on 32K byte microcomputer systems. Its powerful subset includes full support for random, indexed and sequential files.

Or choose the Standard Compiler.

The Standard CIS COBOL compiler requires a minimum 48K of user RAM. A super-set of the Compact compiler, implementing ANSI '74 COBOL to Federal Low-intermediate Level.

The same CIS COBOL extensions for conversational working, screen control, interactive debugging, and special peripheral support are in both compilers. And there are more reasons to consider CIS COBOL:

- It conforms fully to the ANSI '74 standard, so programs are portable upwards and downwards to minis or mainframes.
- Its interactive features enable mainframe programmers to get results fast... working on inexpensive microcomputers.

Forms

The FORMS utility lets you build a screen layout online at the CRT. Then it automatically generates COBOL record descriptions for inclusion in your program.

Forms-2

A superset of FORMS, it eliminates the need to write simple data entry and inquiry programs, because the programs can be automatically generated from screen definitions.

Environment

CIS COBOL products run on the 8080 or Z80 microprocessors under the CP/M* operating system, and on the LSI-11 or PDP-11 processors under RT-11. They are distributed in a variety of disk formats and come with a utility that enables you to use any make of CRT.

OEMs

Intel has adopted CIS COBOL and offers it (as iCIS-COBOL) for their Intellec and

Intellec II systems. Ideal for OEM's or private label, CIS COBOL was developed entirely by Micro Focus. Send inquiries for CIS COBOL object packs and application vendor terms to MICRO FOCUS or its licensed distributors. Distributor terms also available from MICRO FOCUS.

Send me more information for: B4

Single Copy Users
 Reseller and Distributor Licensing

Name _____

Title _____

Company _____

Address _____

City/State _____

Zip/Phone _____

Computer Model _____

Version of DOS _____



MICRO FOCUS™

Micro Focus Inc. • 1601 Civic Center Drive •
Santa Clara • CA 95050 • Tel: (408) 984-6961 •
Telex: 171-135 MISSION SNTA

U.K. Office • 58 Acacia Road • St. Johns Wood •
London NW8 6AG • Tel: 01 722 8843 • Telex:
228536 MICROF G

Listing 1: Structured English specification of COUNT module to find and count the liberties of a connected group containing a stone at point "x" of color "color." COUNT calls itself recursively, saving x on the push-down stack during each call.

```

COUNT(x, color):
  IF x is not off the edge
  THEN
    IF there is a stone at x AND
      it is the given color AND
      it is not marked
    THEN
      mark it
      CALL COUNT(NORTH(x), color)
      CALL COUNT(EAST(x), color)
      CALL COUNT(SOUTH(x), color)
      CALL COUNT(WEST(x), color)
    ELSE IF there is no stone at x
    THEN
      mark the point as a liberty
      increment the liberty count
    END
  END
END

```

counted, a best (move, liberties) pair is updated if the new move is adjacent to a group of a smaller or equal number of liberties. Since black groups are counted after the phase in which white groups are counted, a move by black in contact with a black group with one or two liberties is automatically preferred to a move adjacent to a white group with the same number of liberties. An exception was put in later: when Wally finds a chance to capture a white group on the next move, he always takes it, even if some black group also has only one liberty. There is some doubt whether this exception was wise, however.

Ko and Illegal Moves

There are two situations in which a

move on an unoccupied point is illegal. A move that leaves one's own group with no liberties is illegal. Figure 5a shows a move by black that would be illegal because the resulting black group would have no liberties. A move resulting in the capture of an opponent's group, as in figure 5b, is permissible because removing the captured group creates at least one liberty.

The second type of illegal move arises from a *ko*, illustrated in figure 6a. If white captures the central black stone on his next move, the position will look as in figure 6b. Now black can capture the white stone and reproduce the original position in figure 6a. This could go on forever. To prevent such infinite repetition, the *Rule of Ko* was introduced: no

Listing 2: Module specification for the main loop of the Go-playing program and two of its called modules.

```

MAIN:
  place black handicap stones
  LOOP
    display the board
    get white's move from keyboard
    CALL WEFFECT for the effect of white's move
    CALL BEFFECT to obtain a tentative black move
    CALL PATS to check for a pattern match
    place black stone
  END

WEFFECT:
  FOR each point x with a black stone DO
    CALL COUNT(x,black)
    IF the group has no liberties
    THEN remove its stones
    ELSE IF the group has at least one liberty

```

```

    THEN
      choose a liberty not on edge line
      IF the group has 1 or 2 liberties
      THEN CALL EVAL for the chosen liberty
    END
  END

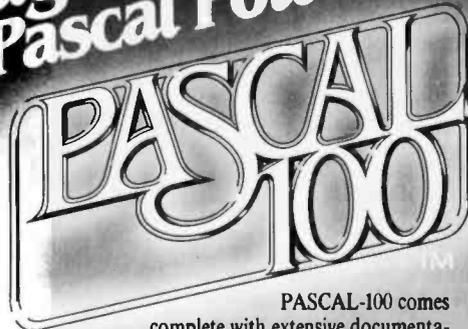
```

```

BEFFECT:
  FOR each point x with a white stone DO
    CALL COUNT(x,white)
    IF the group has exactly 1 liberty
    THEN
      designate it as the black move
      remove the white stones
      EXIT
    ELSE IF the group has 2 or more liberties
    THEN
      choose a liberty
      CALL EVAL for the chosen liberty
    END
  END
END

```

Plug in Pascal Power...



...new CPU boards for 8086 computers. Go to the heart of the Pascal Micro-engine. Run UCSD Pascal² up to 10 times faster than typical implementations—with twice the memory capacity. You've got the best hardware for the best software around.

On-board Z80

PASCAL-100 includes a Z80¹ processor, so you can run your current software—including CP/M³—without modification. Ready to convert an application to Pascal? Do it anytime, with no disruptive hardware changes.

PASCAL-100 comes complete with extensive documentation—our users say it's the best around!

New Generation S-100

PASCAL-100 is designed for the versatile, flexible S-100 bus. Fully compatible with the new IEEE-696 standard, yet works with

- most pre-standard hardware
- 16 bit operation
- 128K byte memory—expandable to 1 Mega byte with Extended Memory Map
- Works with 8 or 16 bit memory

Want to know more? Just circle our number on the reader service card. For fast action, call or write us directly.

OEM'S/DEALERS

Be sure to specify our PASCAL-100 OEM/Dealer Information Package

Digicomp Research
Terrace Hill Ithaca, NY 14850
(607) 273-5900



¹Trademark of Western Digital ²Trademark of University of California
³Registered Trademark of Zilog, Inc. ⁴Registered Trademark of Digital Research

NOW CLEANING YOUR OWN DISKETTE HEADS COULD SAVE YOU A \$40 SERVICE CALL. AND A LOT MORE.

The recording heads on your diskette drives may be dirty—and that can cause you a lot of grief. There's the serviceman you have to call when the machine doesn't perform. (You know how much service calls cost these days!) There's machine down-time. Idle data entry clerks. All the other delays a cranky machine can cause.

And that service call might not even be necessary.

3M solves the problem in seconds—and leaves your heads "Computer Room Clean".

The Scotch® head-cleaning diskette kit lets you clean the read-write heads on your 8" or 5¼" diskette drives. In just 30 seconds, without any disassembly, mess or bother, the heads can be completely cleansed of dirt, dust, magnetic oxides—all the things that can get into your machines every day. And foul them up.

Just saturate the special white cleaning pad in its jacket with the cleaning solution. Then insert the jacket into the diskette drive and turn it on. Your machine does the rest. The



heads are microscopically cleaned without wear, without abrasion.

This 3M head-cleaning diskette kit has been evaluated and approved by major diskette drive manufacturers. It's the best possible way to clean your heads without service calls or machine teardowns.

**At only \$1 per cleaning—
it's the best insurance you
can get.**

This fast-cleaning new Scotch kit comes with everything you need (including special fluid, applicator tip, cleaning diskettes) to handle up to 30 cleanings. That's only about a dollar a cleaning.

With the Scotch head-cleaning diskette kit, you could save yourself a lot more than just a service call. So try this remarkable kit today. For the name of



A Scotch cleaning diskette shown before use, and after 15 cleanings of recording heads.

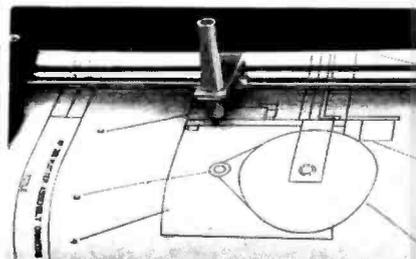


the dealer nearest you, call toll free: 800-328-1300. (In Minnesota, call collect; 612-736-9625.) Ask for the Data Recording Products Division.

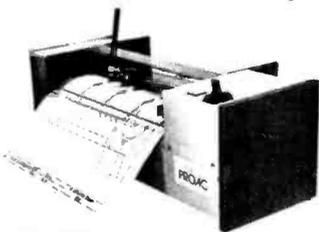
(Not yet available for Burroughs Mini-Disk II, Vydec or 96 TPI Drives.)
Circle 76 on Inquiry card.



3M



Price/Performance Breakthrough!



Mauro MP-250B Proac

The \$695 pen plotter that gives professional accuracy with superb line quality!

Mauro's design innovations make it possible to produce a high quality, low cost plotter that out-performs every other plotter of comparable price on the market today. In fact, its line quality matches that of plotters costing \$2,000 or more.

Proac draws with .005"/step resolution and $\pm 0.5\%$ @ 17" degree of accuracy at speeds of 2.5" per second or higher. A unique multi-point paper drive helps achieve this level of accuracy, making Proac suitable for a wide variety of applications for which Mauro is developing supportive software. Programs currently available include: [1] Complete 2D and perspective plotting, including ASCII and curve generation which are available as relative linking libraries (L80) for Microsoft compatible software products, Fortran-80, Cobol-80, Compiler Basic, and Macro-80 in CP/M compatible files on 8" IBM-3740 or 5 1/4" Northstar formatted disks. [2] Apple II UCSD Pascal implementation of Turtle Graphics including full 128 ASCII character set; Pascal subroutines are Fortran compatible. [3] Complete scientific and business data graphing package for Apple II. Includes data editor, Hi Res screen preview, Axis tic marks, labeling and scaling, data overlays, names and comments, point, line, bar, and pie graphs, 128 ASCII character set, data file handling. [4] Schematic drawing system for TRS-80. Has two font system: .15" grid for B size, and .1" for A size drawings. Comes complete with predefined symbols for standard logic, linear devices, passive and active components, connectors, and 128 ASCII character set. System is menu driven with placement of symbols and interconnectors done under cursor control on the screen before plotting. Other software is in development and will be available upon completion.

Proac comes with full vector driving software for 8080, 6502, and 6800 based computers. Interfaces are available for Apple, TRS-80 and PET. With the addition of the SIA 250 intelligent interface, Proac becomes compatible with any computer.

Contact Mauro Engineering about complete information and specifications for MP-250B Proac and available software.

MAURO ENGINEERING

2220 Pack Trail, Mount Shasta, CA 96067
Telephone 916 926-4406

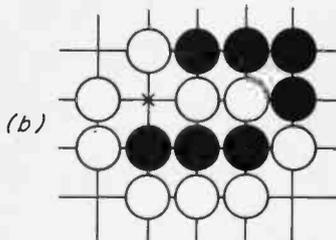
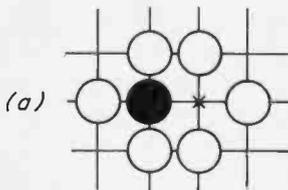


Figure 5: Illegal moves. The point marked *x* in 5a is illegal for black because it would result in a black group with no liberties. The point marked *x* in 5b is permissible, however, because it captures the two white stones, leaving the inner black group with two liberties.

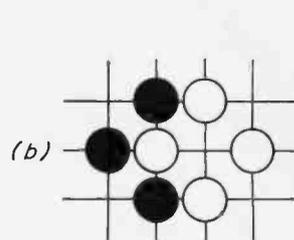
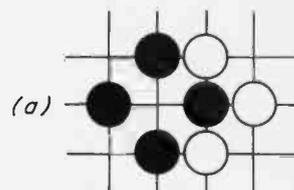


Figure 6: Ko. In 6a, white can capture the black stone, resulting in 6b. It is illegal for black to restore 6a immediately by recapturing the white stone; he must wait a turn.

player may move so as to reproduce the board position existing just prior to his opponent's last move. A move must be made elsewhere to change the board position before the ko capture is allowed.

Lookahead

Kos are common and often critical in master games, but at Wally's level it was simpler to leave out the Rule of Ko. However, it is essential to avoid suicidal or totally wasted moves which fill in the last liberty of a group, or leave it only one liberty, so that the group will be captured anyway. Hence a limited lookahead capability was adopted. The last step in evaluating a suggested black move is to put the stone down tentatively and count the liberties of the resulting black group. This is done by calling COUNT. The move is rejected if the resulting group does not have at least two liberties.

The complete move evaluation module, EVAL, is shown in listing 3. The module LOOKAHEAD saves the current (move, liberties) pair before COUNT is called with the tentative black stone in place.

Pattern Matching

Wally's most intelligent-looking moves are pattern matches. There are common configurations of stones which suggest an obvious next move to a good player. Wally has a table of

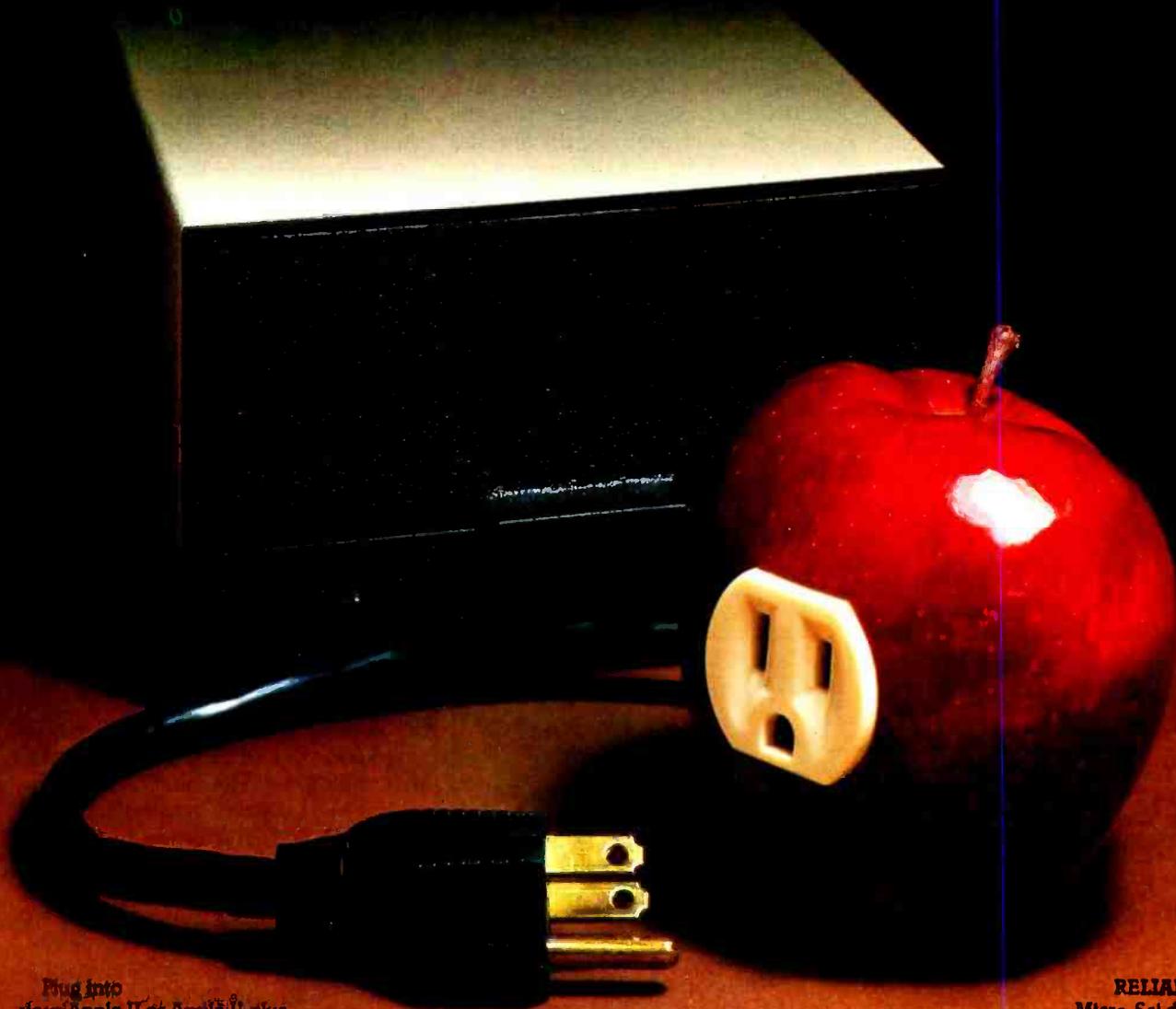
patterns of this sort; these patterns are illustrated in figure 7. Each pattern includes one white stone and two black stones, with a third black move indicated. Patterns 7a thru 7e represent responses to threatened connections. Patterns 7f and 7g create good "shape."

In Go, as in other spheres, there is truth to the motto, "In unity there is strength." The first step in capturing a group of stones is to cut it off from any other large groups nearby. Two weak groups, when connected into a single large group, often have a much better chance of survival. That is why defensive moves like figures 7a thru 7e are important.

Good *shape* in Go is a local positional strength. It is characterized by diamond-shaped configurations, or box-like shapes with at least two solid walls. These patterns enclose an area in an easily defended way, and serve as a basis for expansion. Moves like those in figures 7f and 7g are aggressive moves that take area while expanding against the opponent's outposts.

The program looks at each white stone, trying to find two black stones near it in the same relative positions as in one of the patterns. The table entry for a pattern contains the vertical and horizontal displacements of the two black stones relative to the white stone, and that of the suggested black move. If the two black stones

NEW DISK SYSTEM POLISHES APPLE™



Plug into your Apple II or Apple II plus with a Micro-Sci disk system, and you get Apple software compatibility, PLUS: Increased capacity, improved performance and higher reliability. And you save money, too!

COMPATIBILITY:

With thousands of programs currently available in Apple format—and many more being released every day—the ability to read and write diskettes interchangeable with the Apple disk II system is a MUST. The Micro-Sci disk subsystems offer this compatibility and more. Our disk system has a jumper-selectable boot PROM to move from DOS 3.2 to DOS 3.3, or to the language system at your fingertips.

CAPACITY:

The Micro-Sci A-40 system provides 40 tracks of storage (versus the Apple disk II system which offers only 35 tracks). The A-40's 5 extra tracks give you an additional 20,000 bytes of storage. And for even greater capacity, check out our A-70 system which offers a full 70 tracks of storage—exactly DOUBLE the storage capacity of the Apple disk II system!

PERFORMANCE:

Micro-Sci's disk systems' abbreviated track-to-track access time of 5msec (versus 15msec for the Apple disk II) means improved random disk access performance.

RELIABILITY:

Micro-Sci disk systems incorporate band-actuated head positioners for faster access and more accurate head positioning. Each disk system features Micro-Sci's improved media centering system which provides uncommonly accurate diskette registration, and virtually eliminates damage to the media centering hole.

PRICE:

The Micro-Sci A-40 drive, with controller is priced at only \$549; the second A-40 drive is only \$499. The large-capacity A-70 disk drive with controller is only \$699, with the second drive priced at only \$599.

Call or write us today to order your new Micro-Sci disk system.

μ-SCI

are found and the point for the black move is unoccupied, the black move is returned for evaluation.

Each pattern must be considered in all possible orientations around the

Listing 3: Module specifications for move evaluation, lookahead, and pattern matching.

```

EVAL(move, liberties):
  GLOBAL (best-move, best-liberties)
  IF liberties ≤ best-liberties AND
    LOOKAHEAD(move) ≥ 2
  THEN
    best-move = move
    best-liberties = liberties
  END
  
```

```

LOOKAHEAD(move):
  place black stone at move
  CALL COUNT(move, black)
  remove black stone
  RETURN count of liberties
  
```

```

PATS:
  FOR each white stone DO
    IF there is a pattern in the table
      centered on that white stone
    THEN
      get suggested black move y
      CALL EVAL(y, 2)
      EXIT
    END
  END
  
```

white stone. Three-stone patterns have either four or eight orientations, depending on their lateral symmetry. The program trades table space against program space by performing 180° rotations automatically. Thus, two or four table entries representing different orientations of each pattern are needed to account for all possibilities.

Pattern matches are checked last, because they almost always take priority over moves arising from the earlier phase of counting the liberties of groups. Pattern-match moves are associated with an artificial figure of two liberties to set their priority. Thus, if Wally can capture a white group, or avoid the capture of a black group having one liberty, he will do so despite any pattern matches. The priorities of the patterns are determined by the order in which they are checked, since the first match found is returned.

Ghost Stones

The edge of the Go board is strategically important because it helps to wall off areas. An attempt by white, for example, to invade be-

tween a black stone and the edge of the board should be defended against. The first five patterns in figure 7 already defend against threatened connections; why not use them to protect the connection between a stone and the edge of the board? Imagine that there is an additional row of black "ghost" stones all around the board. As figure 8 shows, a white move near the edge can then invoke a pattern. This idea was implemented in the pattern match by allowing off-board positions to count as black stones tested for in each pattern.

Edge Moves

One of the most startling improvements in Wally's performance resulted from a simple observation in the first few games. Groups on the edge of the board, when attacked, often extended fruitlessly along the edge, as in figure 9. A prohibition against edge moves, except to capture or on a pattern match, was added. Wally's play began at that moment to take on the character of an opponent to be reckoned with.

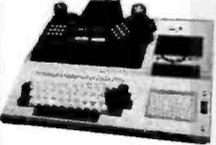
Handicaps

Go has a handicap system that allows an expert to play an even and interesting game with a novice. Black is given a head start of two to nine stones on designated points—the ones marked with black spots on the board (see figure 1). The handicap stones are placed symmetrically like die spots, except that a handicap of three stones is placed on three corners. Additional handicap points, for a total of up to seventeen stones, were added for Wally's benefit, since it was not expected that he would be a strong player. Each additional handicap stone accounts for roughly 10 points difference in score.

The handicap stones help to make up for Wally's lack of overall strategy. The handicap points are good points to occupy early in the game, so a large handicap solves much of the strategy problem.

Eyes and Life

Wally has a blind spot that costs him dearly against experienced players: he does not understand that any group, no matter how large, will be captured unless it has two "eyes," or sufficient space to make them. An eye is an unoccupied point or connected group of points. A group enclosing two eyes is immune from

<p>(212) 986-7690</p> <h2 style="text-align: center;">MAIL ORDER ONLY</h2> <p style="text-align: center;">Micro Computer Your One Stop For... Quality and Huge Savings</p> <h1 style="text-align: center;">DISCOUNT</h1> <p style="text-align: center;">Company</p> <p style="text-align: center;">QUALITY • DELIVERY • SERVICE</p> <p style="text-align: center;">60 E. 42nd St. Suite 411 New York, NY 10017</p>				<p>SALE!</p> <p>EPSON MX-80 EPSON MX-70</p> <p>PAPER TIGER 445 & 460</p> <p>CALL FOR PRICE</p>
 CENTRONICS CALL FOR PRICES	 APF IM1 - \$495 IM2 - \$988	 COMMODORE 16K - \$888 32K - \$1088 2022 - \$695 2040 - \$1088 8050 - \$1535 8032 - \$1495	 SUPERBRAIN* 32K - \$2445 64K - \$2749 64KQD - \$3395	
 ATARI 800—\$795	 XYMEC HQ 1000 - \$2395	 NEC SPINWRITER 5510 - \$2795 5520 - \$2990	 DIABLO 630 \$ 2195 1730 - \$2195	
<p>MAIL ORDER ONLY</p> <p>Send Certified Check (Personal or Company Checks require 2 weeks to clear.) We pay all shipping and insurance charges except items marked with asterisk. VISA, MasterCard add 5%. N.Y.S. Residents add appropriate sales tax.</p> <p style="text-align: right;">* (DENOTES ITEMS SHIPPED F.O.B. NYC)</p> <p style="text-align: right;">PHONE (212) 986-7690</p>				

HOW'S YOUR MEMORY?

Our MEMORIES Have Made US Famous!

WHY?

Reliability!

That's the secret of our success. We are dedicated to producing the most reliable memories possible for the S-100 bus and the new IEEE S-100 bus.

Flexibility!

No matter what CPU you use, we have the memory for you.

SUPERAM™ 2—We've delivered over 5,000 of these 64K dynamic RAM boards to OEMs worldwide. This board sets the standard for reliable operation.

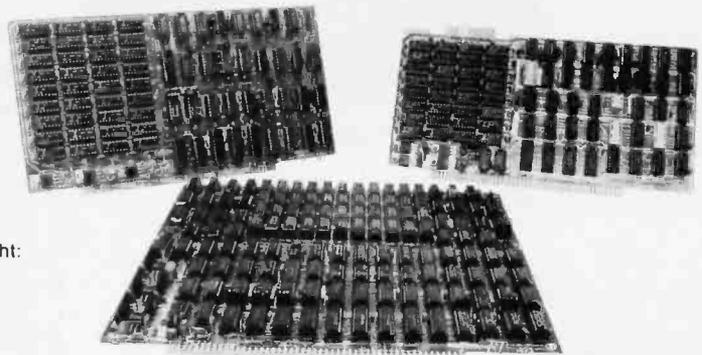
SUPERAM™ 4—Now available for Z80A and 8085A users, with bank select and optional parity bit.

SUPERAM™ 5—Our forthcoming IEEE-696 (S-100) compatible RAM will provide 64 Kbytes of dynamic RAM as either 32Kx16 or 64Kx8.

With ECC, too!

Announcing the **SUPERMEM™ ECC!** This is the ultimate in memory

Circle 79 on inquiry card.



Shown Left to Right:
SUPERAM 4
SUPERMEM-ECC
SUPERAM 2

data protection: built-in automatic error correction. The **SUPERMEM** transparently corrects single bit errors and detects double bit errors.

We'll Design One for You!

If you have a special situation that calls for a custom design involving memory, processors, controllers, or even complete systems, give **PIICEON** a call. We might have the answer to your product need.

And That's Not All!

We also supply the following Microcomputer Boards:

- C-86 — 16-bit 8086 processor

board with multi-processor arbitration logic, on-board PROM and RS-232 port.

- V-100 — 80x24 high-speed video output board.
- D-100 — Coming soon, the answer to 5¼ and 8-inch Winchester control.

WRITE FOR OUR NEW BROCHURE

PIICEON™

OEM Computer Products

2350 Bering Drive
San Jose, CA 95131
(408) 946-8030

©PIICEON, INC. 1980

We've lowered the

No, the low CompuServe \$5.00 per hour charge hasn't changed, but the world of information we offer is growing steadily.



Of CompuServe's 22 large computer systems, 10 are housed here in our Dublin, Ohio Computer Center.

More Computer Power

The number of CompuServe customers keeps growing — now more than 8,000 strong. The more customers we have, the more computer power and access lines we dedicate to our Information Service. Our 22 mainframe computer systems provide sufficient power and capacity to serve thousands more.

More News

In addition to the Associated Press, we've added more news. Read The New York Times and all the news that's fit to print, including Broadway show and movie reviews, stories from Pulitzer Prize-winning

writers and more. We are continually adding new features to the information service, so check our "What's New" section regularly to see what other information is available.

TRS-80™ Color Computer and Videotex™

The CompuServe Information Service is sold in Radio Shack® Stores and, in addition to all the major brands of computers and terminals, can be used with the new TRS-80 Color Computer and Videotex terminal. Our special software formats the information in easy-to-read pages. Go forward, backward, anywhere in the CompuServe Information Service databases — even directly to a page of information.

Big System Reliability

When we say we're reliable, we mean it. In fact CompuServe computers were up and running for a 99.6 percent reliability factor last year. We've also built in many "invisible" features like data error detection and retransmission — all those technical enhancements which add up to the CompuServe Information Service being ready to use when you're ready to use it.

Radio Shack, TRS-80 and Videotex are trademarks of Tandy Corporation. ATARI is a trademark of ATARI, Inc.

cost of the world.



Access to all the CompuServe services, including electronic mail; bulletin board; CB simulation; newsletters from Radio Shack®, Atari®, and others; up to 128K storage free plus all the services listed here are yours. Access time is only 8½ cents per minute between 6 PM and 5 AM weekdays and all day weekends, billed to your charge card. It's a local phone hook-up in more than 260 U.S. cities.

There's an energy management system, home repair tips, discount information, personal health information and more. Better Homes & Gardens provides household information such as recipes, nutritional analyses and meal plans.



All kinds of games (including some for the kids), book and movie reviews, astrology and the latest sporting event news — even point spreads and injury lists. There's the CompuServe line printer art gallery and even a national user opinion poll for instant feedback on current events.

A complete program. The AP financial wire, newspaper financial pages, Raylux Financial Advisory Service, the Commodity News Service and personal financial programs. At a slight additional charge, you can retrieve fundamental financial data on more than 1,700 companies from Value Line, and MicroQuote offers current and historical data and special market reports on more than 40,000 stocks, bonds and options, updated daily.



While the CompuServe Information Service is designed for everyone, MicroNET Personal Computing is for the knowledgeable computer hobbyist or business



person. You can buy software and have it downloaded directly to your person computer. Use programming languages such as *APL-SF*, *EXTENDED BASIC*, *MACRO-10*, *SNOBOL*, *EXTENDED FORTRAN* and *PASCAL*, use word processing and text editing programs.

Not 1985, NOW!

See for yourself what a state-of-the-art electronic information service can do. Get a demonstration at a Radio Shack® computer center or store — or write to us for further information.

CompuServe

Information Service Division
5000 Arlington Centre Blvd.
Columbus, Ohio 43220
(614) 457-8600

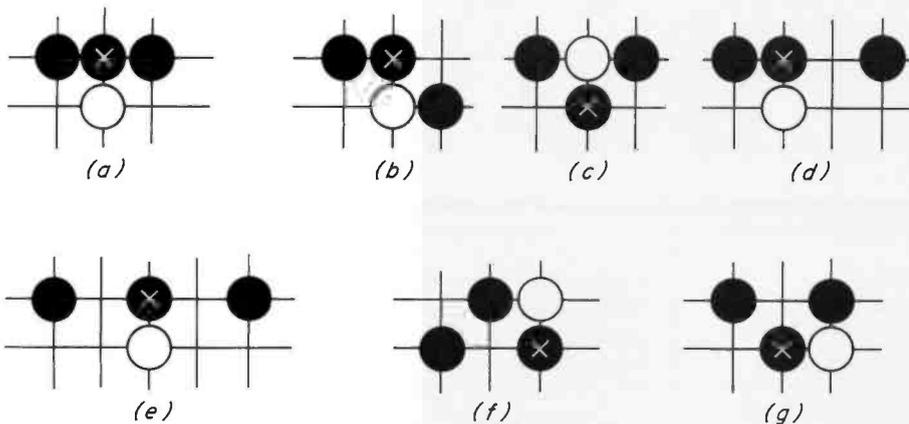


Figure 7: Patterns. In each of these seven configurations, the black move marked x is suggested when the white stone and the two other black stones are already present. These patterns are applied in all orientations.

capture, because a group cannot be captured unless it can be brought down to only one liberty. A group with two eyes will always have at least two liberties. The opponent cannot fill either eye because such a move would fill all the liberties of his invading stone, and hence is illegal. Figure 10 illustrates this.

Wally does surprisingly well despite a fundamental ignorance of the facts of life. Captures and pattern-

matching moves tend to create eyes more or less automatically.

Play Experience and Improvements

Wally plays like a beginner; however, he does play better than people just introduced to the game. Experienced players are surprised by the reasonableness and apparent skill of some of Wally's moves but are quick to discover that he does not

know about forming two eyes. Along the present lines, there is no room for significantly improving Wally within the 1 K-byte memory that my KIM-1 has. With a memory extension, the first improvement that springs to mind for the future is a full-sized board. The Rule of Ko is not hard to implement and should be included. Many more patterns ought to be added, and the pattern-matching mechanism could be more general.

Wally should be taught something about ladders, if only to avoid them. A ladder, illustrated in figure 11, is a sequence of moves that ends in disaster for one side or the other, depending on conditions several moves ahead.

The most challenging problem for a Go-playing program is how to recognize when a group does or does not have the potential to form two eyes.

Looking ahead down the move tree as a general approach, as is done in chess-playing programs, has two obstacles: the sheer number of possible moves at each turn, and the need to first develop a way to evaluate the board configuration. The best candidate for an evaluation function is

RACET SORTS — RACET UTILITIES — RACET computes — RACET SORTS — RACET UTILITIES — RACET computes — RACET SORTS — RACET UTILITIES — RACET computes —

HARD DISK MULTIPLEXOR WITH 10 MEG HARD DISK FOR THE TRS-80* Mod II

NOW YOU CAN HAVE THAT LARGE COMMON DATA BASE!!

- Allows up to 4 Mod II's to connect to a single controller — up to 4 hard disk drives per controller. Users may access the same file simultaneously (first-come first-served).
- Uses Cameo controller and standard 10-megabyte cartridge (hard) disk drives along with RACET Hard/Soft Disk System (HSD) software.
- Access times 3 to 8 times faster than floppy. Mixed floppy/hard disk operation supported.
- Compatible with your existing TRSDOS programs! All BASIC statements are identical.
- A single file may be as large as one disk. Alternate mode allows 24-million byte record range. Directory expandable to handle thousands of files.
- Includes special utilities — backup and copies, HPURGE for multiple deletions, HOCs directory catalog system, and Hard Disk Superzap. FORMAT utility includes options for specifying sectors/gran, platters/drive, logical disk size, etc.

HARD DISK DRIVE & CONTROLLER \$5995 RACET HSD Software \$400
Call for multiuser pricing. Dealers call for DEM pricing.

INFINITE BASIC (Mod I & III Tape or Disk) Mod I \$50.00, Mod III \$60.00
Extends Level II BASIC with complete MATRIX functions and 50 more string functions. Includes RACET machine language sorts! Sort 1000 elements in 9 seconds!! Select only functions you want to optimize memory usage.

INFINITE BUSINESS (Requires Infinite BASIC) Mod I & III \$30.00
Complete printer pagination controls — auto headers, footers, page numbers. Packed decimal arithmetic — 127 digit accuracy +, -, *, /. Binary search of sorted and unsorted arrays. Hash codes.

BASIC CROSS REFERENCE UTILITY (Mod II 64K) \$50.00
SEEK and FIND functions for Variables, Line Numbers, Strings, Keywords. *All options available for line numbers and variables. Load from BASIC — Call with 'CTRL'R. Output to screen or printer!

OSM Mod I \$75.00, Mod II \$150.00, Mod III \$90.00
Disk Sort/Merge for RANDOM files. All machine language stand-alone package for sorting speed. Establish sort specification in simple BASIC command File. Execute from DOS. Only operator action to sort is to change diskettes when requested! Handles multiple diskette files! Super fast sort times — improved disk I/O times make this the fastest Disk Sort/Merge available on your TRS.
(Mod I Min 32K 2-drive system. Mod II 64K 1-drive. Mod III 32K 1-drive)

*****NEW*** DISCAT (32K 1-drive Min) Mod I, III \$50.00**
This comprehensive Diskette Cataloging/Indexing utility allows the user to keep track of thousands of programs in a categorized library. Machine language program works with all TRSDOS and NEWDOS versions. Files include program names and extensions, program length, diskette numbers, front and back, and diskette free space.

*****NEW*** KFS-80 (1-drive 32K Min — Mod II 64K) Mod I, III \$100.00; Mod II \$175.00**
The keyed file system provides keyed and sequential access to multiple files. Provides the programmer with a powerful disk handling facility for development of data base applications. Binary tree index system provides rapid access to file records.

*****NEW*** MAILLIST (1-drive 32K Min - Mod II 64K) Mod I, III \$75.00; Mod II \$150.00**
This ISAM-based maillist minimizes disk access times. Four keys — no separate sorting. Supports 9-digit zip code and 3-digit state code. Up to 30 attributes. Mask and query selection. Record access times under 4 seconds!!

*****NEW*** LPSPPOOL (32K 1-drive Min) Mod I \$75.00**
LPSPPOOL — Add multi-tasking to permit concurrent printing while running your application program. The spooler and despooler obtain print jobs from queues maintained by the system as print files are generated. LPSPPOOL supports both parallel and serial printers.

UTILITY PACKAGE (Mod II 64K) \$150.00
Important enhancements to the Mod II. The file recovery capabilities alone will pay for the package in even one application! Fully documented in 124 page manual! XHIT, XGAT, XCOPY and SUPERZAP are used to reconstruct or recover data from bad diskettes! XCOPY provides multi-file copies, 'Wild-card' mask select, absolute sector mode and other features. SUPERZAP allows examine/change any sector on diskette include track-0, and absolute disk backup/copy with I/O recovery. DCS builds consolidated directories from multiple diskettes into a single display or listing sorted by disk name or file name plus more. Change Disk ID with DISKID. XCREATE preallocates files and sets 'LOF' to end to speed disk accesses. DEBUGII adds single step, trace, subroutine calling, program looping, dynamic disassembly and more!!

DEVELOPMENT PACKAGE (Mod II 64K) \$125.00
Includes RACET machine language SUPERZAP, Apparal Disassembler, and Model II interface to the Microsoft 'Editor Assembler Plus' software package including uploading services and patches for Disk I/O.
CHECK, VISA, M/C, C.O.D., PURCHASE ORDER
TELEPHONE ORDERS ACCEPTED (714) 637-5016
*TRS-80 IS A REGISTERED TRADEMARK OF TANDY CORPORATION

RACET COMPUTES
1330 N. Glassel, Suite 'M'
Orange, CA 92665

RACET SORTS — RACET UTILITIES — RACET computes — RACET SORTS — RACET UTILITIES — RACET computes —

BMC's best seller newly available with superb functional versatility

VIDEO DISPLAY

12 Inch
80 ch x 25 line
80 ch x 20 line
40 ch x 25 line Selectable by Programming
40 ch x 20 line
Color (8 colors)/Green
Smooth Scrolling

• FUNCTION KEY

Programmable
10 Keys

• FLOPPY DISC

5 Inch x 2 deck, 280 KB/deck
Dual sided — Double density

• SUPER FUNCTION KEY

Programmable
10 Keys

• PRINTER

Dot Impact
80 ch/sec.
80 ch/line, 40 ch/line
Graphic Mode
Alphabets (capital/small), Numerics,
Katakana
Various Symbols, Hiragana, Kanji
Roll Paper/Sprocket Paper
3 Copies

Dimensions: 510W x 683D x 505H mm (Color)
510W x 606D x 505H mm (Green)

Input Voltage: AC 117V-220V $\pm 10\%$ 50/60Hz

Option: Light pen Rom Cartridge



BMC USA INC.

Suite 600, Union Bank Bldg.
11222 La Cienega Blvd., Inglewood CA 90304 USA
Tel: 213-641-4586. Telex: 182379 bmcinc

MORE FOR YOUR RADIO SHACK TRS-80 MODEL I! THE DATAHANDLER

DATABASE MANAGEMENT SYSTEM IN MMSFORTH

Now the power, speed and compactness of MMSFORTH drive a major applications program for many of YOUR home, school and business tasks! Imagine a sophisticated database management system with flexibility to create, maintain and print mailing lists with multiple address lines, Canadian or the new 9-digit U.S. ZIP codes, and multiple phone numbers, plus the speed to load hundreds of records or sort them on several fields in 5 seconds! Manage inventories with selection by any character or combination. Balance checkbook records and do CONDITIONAL reporting of expenses or other calculations. File any records and recall selected ones with optional upper/lower case match, in standard or custom formats. Personnel, membership lists, bibliographies, catalogs of record, stamp and coin collections—you name it! ALL INSTANTLY, without wasted bytes, and with cueing from screen so good that non-programmers quickly master its use! With manual, sample data files and custom words for mail list and checkbook use.

Technical: Handles data as compressed indexed sequential subfiles of up to 25K characters (9K in 32K RAM). Access 1.4 data diskettes. Modified Quicksort. Optionally precompiles for 5-second program load. Self-adjusts for many routine mods. Structured and modular MMSFORTH source code ideal for custom modifications.

THE DATAHANDLER V1.1, a very sophisticated database management system operable by non-programmers (requires Disk MMSFORTH, 1 drive & 32K RAM); with manuals, \$59.95*

mmsFORTH

THE PROFESSIONAL FORTH FOR TRS-80 MODEL I

(Over 1,000 systems in use)

MMSFORTH Disk System V1.9 (requires 1 disk drive & 16K RAM) just \$79.95*
MMSFORTH Cassette System V1.8 (requires Level II BASIC & 16K RAM) \$59.95*

AND MMS GIVES IT PROFESSIONAL SUPPORT

Source code provided
MMSFORTH Newsletter
Many demo programs aboard
MMSFORTH User Groups
Programming staff can adapt
THE DATAHANDLER to YOUR needs.

MMSFORTH UTILITIES DISKETTE: Includes FLOATING POINT MATH (L2 BASIC ROM routines plus Complex numbers, Rectangular-Polar coordinate conversions, Degrees mode, more), plus a full Forth-style Z80 ASSEMBLER; plus a powerful CROSS-REFERENCER to list Forth words by block and line. All on one diskette (requires MMSFORTH, 1 drive & 16K RAM), .. \$39.95*

FORTH BOOKS AVAILABLE

MICROFORTH PRIMER (comes with MMSFORTH) separately \$15.00*
USING FORTH — more detailed and advanced than above \$25.00*
THREADED INTERPRETIVE LANGUAGES—advanced, excellent analysis of MMSFORTH-like language \$18.95*
CALTECH FORTH MANUAL — good on Forth internal structure, etc \$10.00*

* — Software prices include manuals and require signing of a single-system user license. Add \$2.00 S/H plus \$1.00 per additional book; Mass. orders add 5% tax. Foreign orders add 20%. UPS COD, VISA & M/C accepted; no unpaid purchase orders, please.

Send SASE for free MMSFORTH information.
Good dealers sought.

Get MMSFORTH products from your
computer dealer or

**MILLER MICROCOMPUTER
SERVICES (B4)**

61 Lake Shore Road, Natick, MA 01760
(617) 653-6136

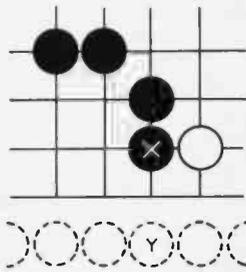


Figure 8: Ghost stones. The black move at *x* is suggested by the pattern in figure 7d because there is an imaginary black stone at point *Y*, off the edge of the board, for purposes of pattern matching.

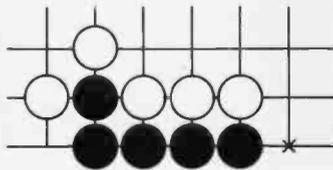


Figure 9: Running along the edge. Before the program was modified, black would move at *x*, white could respond just above *x*, and the process would be repeated until the black "worm" reached the edge of the board and was captured. Edge moves are now prohibited except for captures and pattern matches.

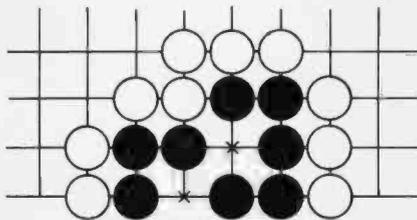


Figure 10: A safe group with two eyes. White cannot capture black because both eyes, marked *x*, would have to be filled. But white can make only one move at a time, and a move in either point is illegal.

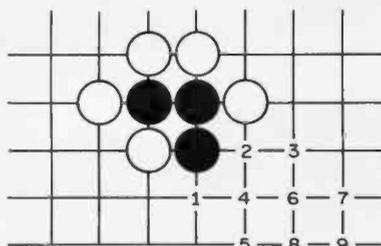


Figure 11: A ladder. White threatens to capture black by moving at 1. When black attempts to escape at 2, white moves at 3, and so on. The black stones form a staircase that eventually reaches the edge of the board and is captured by white 9. If there were a black stone at 6, however, black would escape, and white would be left in a vulnerable position.

an estimate of the area controlled by each player. When an area is only loosely surrounded, however, or an invasion is in progress, it is very difficult to determine the ownership of many points. A possible approach is the perceptual-grouping heuristic method developed by Zobrist (reference 3). Move tree searching is probably the only way to find the best move in confined tactical situations, like those that appear in Go problem books.

Another improvement suggested by chess programs is to include some of the countless known corner openings, or "joseki." Joseki are useful anywhere in the board, and should be implemented as an extension of the pattern matching.

After a move that leaves an opponent's group with only one liberty, one is supposed to say "atari" to warn him that his group is about to be captured. Wally says nothing, and I have lost large groups by failing to notice an impending capture. "Atari" goes in next. ■

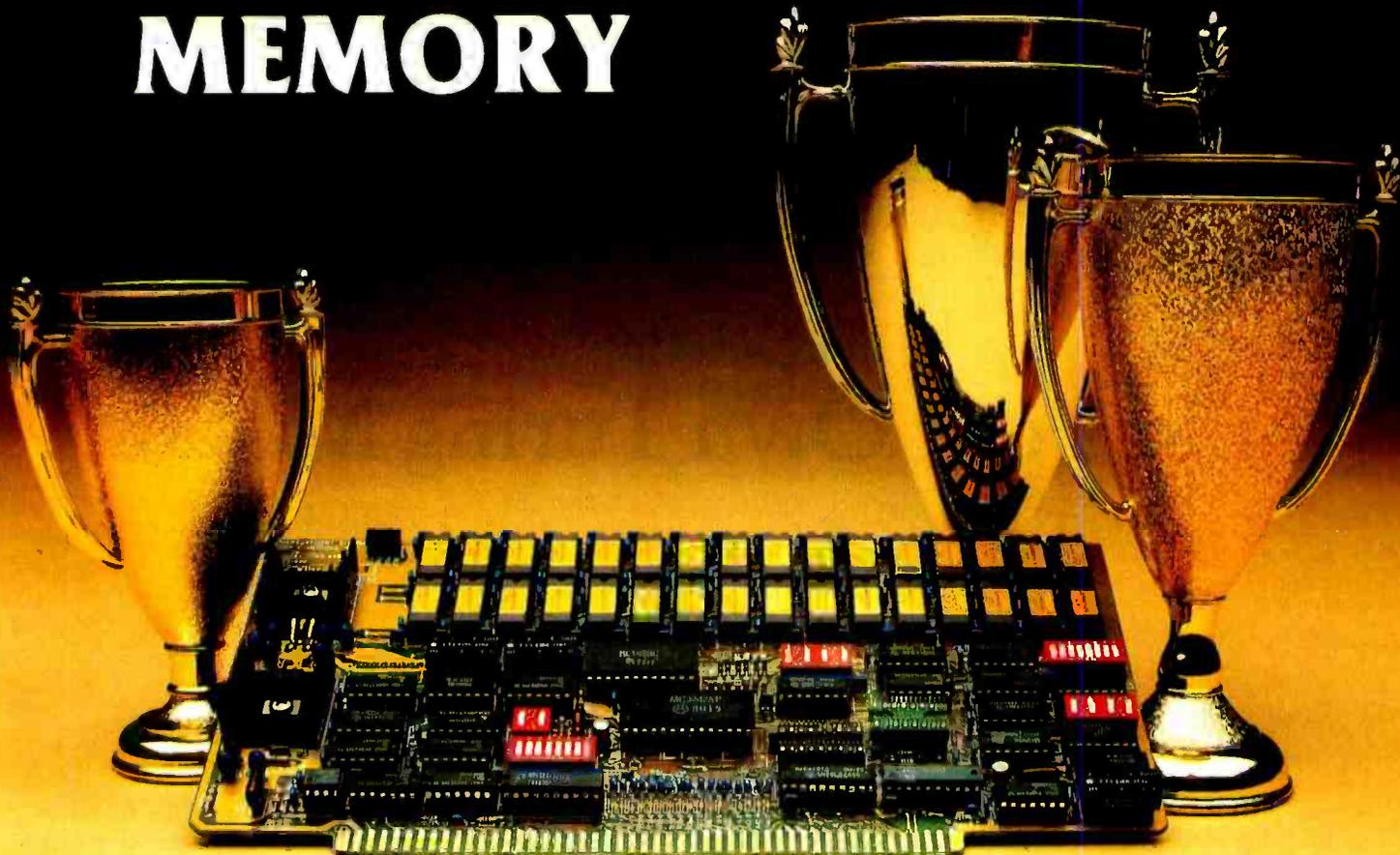
References

1. Ryder, J. "Heuristic Analysis of Large Trees as Generated in the Game of Go." Stanford University: Ph D Thesis, 1971.
2. Wilcox, B. "Computer Go." *American Go Journal*, 1979.
3. Zobrist, A. "A Model of Visual Organization for the Game of Go." AFIPS Spring Joint Computer Conference, 1969, pages 103 thru 112.

Make America smarter.

Give to the college of your choice.

THE UNBEATABLE S-100 MEMORY



That's the MEASUREMENT systems & controls DMB Series of S-100 bus memory modules, fully compatible with **ALPHA MICRO, CROMEMCO, DYNABYTE, NORTH STAR, MP/M,** and most other S-100 systems.

Definitely a winner, the DMB Series is available with Bank Select (DMB6400) or without (DM6400) and utilizes industrial quality construction, provides outstanding reliability, and is backed by dedicated customer service and a one year guarantee.

The DMB6400 uses I/O port addressing for the bank select feature. A switch provides the ability to select any one of the 256 I/O ports for addressing the memory banks. The memory is configured as four totally independent 16K software selectable banks, with each bank addressable on any 16K boundary.

Outstanding features such as those listed below make the DMB series the UNBEATABLE S-100 Memory:

- Four independent 16K software selectable banks.
- Each bank is independently addressable on any 16K boundary.
- Switch selectable bank sizes — from 16K to 64K in 16K increments.
- Eight banks (512K) per I/O port for each of the 256 ports.
- Z-80 4MHz operation with no wait states using transparent refresh.
- On-board diagnostic LED's.
- Low power — 8 watts maximum.
- Reliable, tested and burned-in memory.
- IEEE S-100 compatible timing.
- One year guarantee.
- Attractive Dealer & OEM Prices.

See your nearest computer dealer, or contact us for the complete story on the UNBEATABLE S-100 Memory.

See us at the sixth Computer Faire, booth 1526, San Francisco April 3-5

Systems Group

A Division of MEASUREMENT systems & controls
Incorporated

867 North Main St. / Orange, Calif. 92668 / (714) 633-4460
TWX/TELEX: 678 401 TAB IRIN

Build Your Own Turing Machine

James E Willis
Lawrence Berkeley Lab
1 Cyclotron Rd
Building 4
Berkeley CA 94720

In 1936, Alan M Turing gave the following description of a computing machine:

The machine is supplied with a "tape" (the analog of paper) running through it, and divided into sections (called "squares"), each capable of bearing a "symbol." At any one moment there is only one square, say the r th, bearing the symbol $G(r)$ which is "in the machine." We may call this square the "scanned square." The "scanned symbol" is the only one of which the machine is, so to speak, "directly aware." However, by altering its m -configuration, the machine can effectively remember some of the symbols which it has "seen" (scanned) previously. The possible behavior of the machine at any moment is determined by the m -configuration $g(n)$ and the scanned symbol $G(r)$. This pair $g(n), G(r)$ will be called the "configuration." Thus, the configuration determines the possible behavior of the machine. In some configurations in which the scanned square is blank (ie: bears no symbol) the machine writes

down a new symbol on the square; in other configurations, it erases the scanned symbol. The machine may also change the square which is being scanned, but only by shifting it one space to right or left.

A Turing Machine consists of three parts: a tape, a program, and a device.

Turing's description has become the definition of computability. That is, if a Turing Machine can work the problem, then the problem is said to be *computable*. If no Turing Machine can eventually find an answer to the problem, then the problem is not computable. John von Neumann and others have tried to establish a relationship between a Turing Machine and human neural networks. (See Michael Arbib's book, listed in the references at the end of this article.) An overview of these concepts along with some history of the problem is given in an article by Jeremy Bernstein (reference 2). An example of a

hardwired version may be found in Jonathan K Millen's article (reference 3).

As with other problems involving computing machines, the first step is to carefully define the problem or task. Once a careful definition has been given that defines and limits the scope of the project, we may then attempt a solution. The solution may take on many forms depending on the intended use of the project.

In this article, I will describe a finite (theoretical) Turing Machine (TM) and the implementation of a Practical Turing Machine (PTM) in hardware, in a program for the 6800 micro-processor, and in a FORTRAN program. These implementations are equivalent in that they accept the same input and, for that input, produce the same output.

Turing Machines—a Definition

A Turing Machine consists of three parts: a *tape*, a *program*, and a *device*. The tape consists of an infinite array of 1s and 0s. The device writes on the tape and moves the tape according to the program. (See figure 1a.)

Text continued on page 128

Configurability...

64K MINI



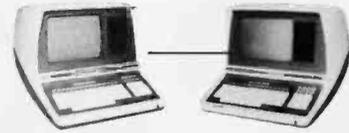
(8 SLOT S-100)
SINGLE USER

64K TWIN MINI + 10M 5 1/4 HD



(8 SLOT S-100)
DRIVE EXPANSION

DUAL PROCESSOR



LINKED USERS

64K - 1 & 2MB FLOP



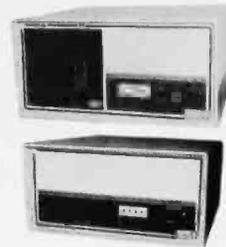
CONVENTIONAL SINGLE USER

64K - 10MB - 1MB FLOP



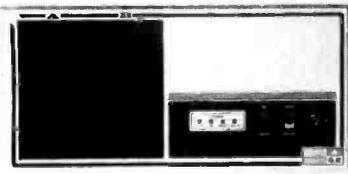
SINGLE USER - HARD DISK

35MEG - 17MEG TAPE



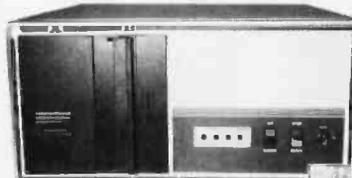
SINGLE USER-LARGE DATA BASE

128K - 2MB - FLOP



TWO USER MP/M®

256K - 10MB - FLOP



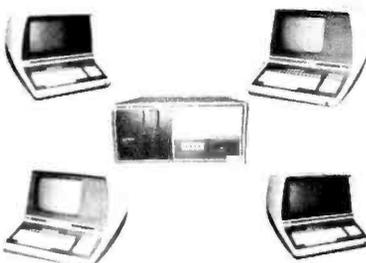
2 - 4 USER MP/M®

35-70MEG - 17MEG TAPE



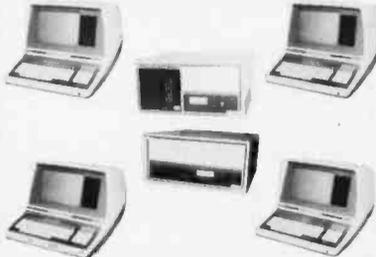
2 - 8 USER MP/M®

5X 64K - 10MB - 1MB FLOP



DRIVELESS SLAVE NETWORK

5X 64K - 35MEG - 17MEG TAPE



MINI DRIVE SLAVE NETWORK

35-150MEG - 17-75 MEG TAPE



16 USER NETWORK CP/NET®
with 8 Levels of Host Background Tasking

...Means;

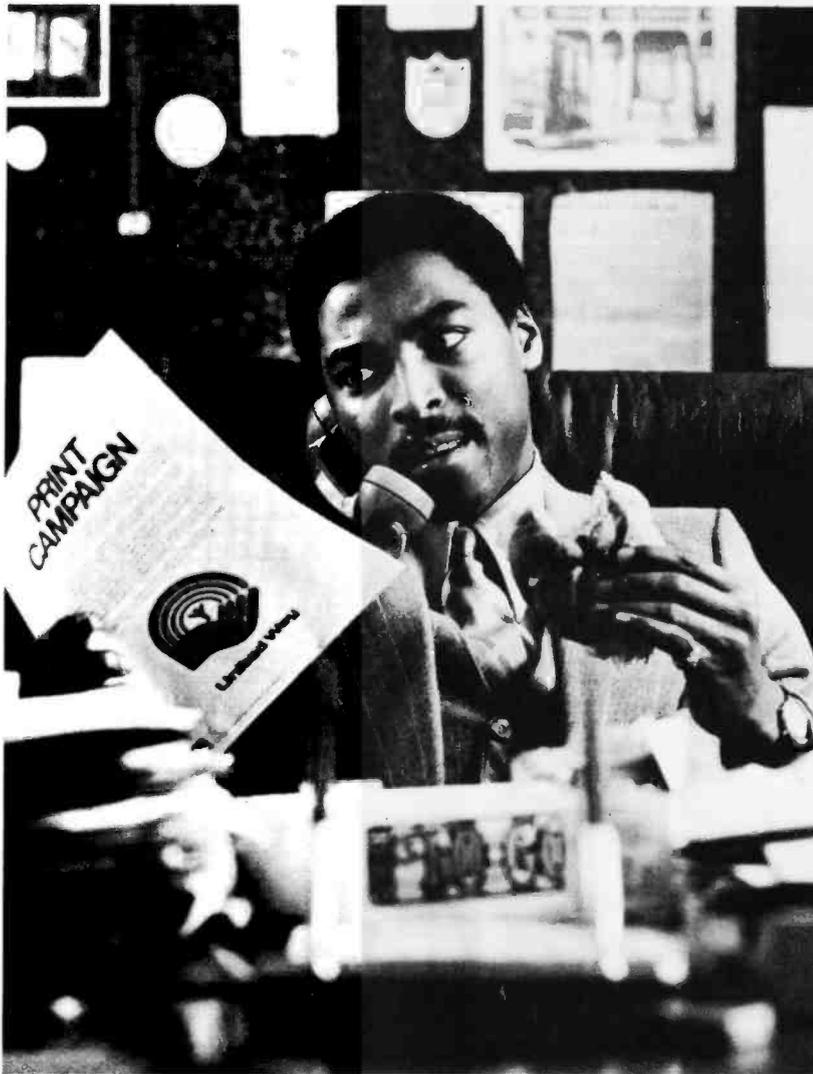
- ★ More Add-On Sales,
- ★ Less Duplicate Inventory.
- ★ Less Hassle from the Competition,
- ★ More "Yes" Answers to your Customers.

Emulation Available on ALL Systems:
IBM3780, 2780, 3741, 2770 and
IBM3270, 3271 and 3276,
PDP-11, RSTS-E, TOPS
on Deck 10 & 20
and VAX

SOLD ONLY
THRU DEALERSHIPS
MP/M, & CP/NET ARE REG. TM OF DIGITAL RESEARCH INC.



THANKS FOR HELPING TO KEEP UNITED WAY IN BUSINESS.



Every year, United Way successfully continues to support local human service agencies in communities all across the United States.

A lot of the credit for this success goes to the dedicated efforts of people in business — to top corporate leaders who volunteer their organizational skills and financial expertise, to middle-management people who work lunch-hours and evenings to help organize local campaigns and collect money, to the newest mailroom clerk who swallows his shyness and asks his fellow workers for a last-minute contribution.

And by operating like any other modern, well-run business enterprise, United Way succeeds in delivering the maximum in human services for the dollars that are collected.

Thanks again for *your* help.



Thanks to you, it works. For all of us. **United Way**



A Public Service of This Magazine & The Advertising Council

Apple World

3-D ANIMATED COLOR GRAPHICS
Written in machine code.
The program made famous on national T.V.I.
by Paul Lutus

APPLE WORLD turns your Apple into a sophisticated graphics system capable of creating animated three-dimensional color images, projecting them in true perspective on the screen, rotate them, move them closer, further away, and many other exciting and imaginative things.

Draws objects with 65,000 points per slide.

A powerful screen-oriented text editor is included to facilitate image formation. This program was recently featured on Tom Snyder's *Prime Time Saturday TV Show* and is now available for sale.

APPLE WORLD'S powerful editor is so easy to use that children will love it. You can now "sketch" your dream house, boat, car, or fantasy empire. Then view it as it would be seen from 10,000 feet, or you can ZOOM in until the screen is filled with a doorknob. You could then go inside and move from room to room examining furniture placement as your screen rotates within the room. Images or specific parts of images can easily be saved to disk or printer.

Does all this sound like science fiction?
You won't think so after you have visited Apple World.

INTRODUCTORY PRICE \$59.95
36 page manual included
For 48K Apple II or Plus with Disk

3-D Supergraphics

& 3-D GAME DEVELOPMENT SYSTEM IN COLOR
by Paul Lutus

Watch colorful butterflies, birds, fly across your Apple or Atari screen with true 3 dimensional perspective. Have rocket ships fly out at you in this incredible high speed graphics package. 3-D SUPERGRAPHICS™ is a 6502 machine language program that will interface to your Basic or machine language programs or games using simple "DOS-like" commands.

Features include:

- Simple image entry through editor
- Objects up to 256 points per side
- Uses all hi-res colors
- Allows mixed colored text & graphics for prompts and captions
- Translates on 3 axes
- Individual axis scales
- 21 different commands
- Rotate object 1.4° to 360° increments at machine speeds

FOR 48K APPLE II OR PLUS WITH DISK II \$39.95 FOR DISK

FOR ATARI 800 WITH 40K MEMORY (DISK OPTIONAL) \$39.95 FOR TAPE

OTHER SOFTWARE

APPLE COMPUTERS

Super Space Wars	\$ 9.95
States & Capitals	9.95
Moving Point	
Average	19.95
Stock Options	24.95
Finance	12.95
Bonds	12.95

COMMODORE PET

Stock Options	24.95
Finance	12.95
Bonds	12.95
Stock Analyzer	22.95
Mortgage	14.95
Space Invaders ("Best Game of 1979")	19.95
Jury/Hostage	9.95
Kentucky Derby/ Roulette	9.95
Alien I.Q./Tank	9.95
Submarine Attack	9.95
Battle of Midway	7.95
Laser Tank Battle	9.95
Swarm	14.95
Baseball	9.95
Super Star Trek	14.95
PET Music Box	29.95
Music Composition System	19.95
Pearl Harbor Adventure	14.95
Super Gomoku	9.95

Relational Query System For Management

REQUEST™

By Ken German & Toby Zweifach

DATABASES: You've Heard The Hype Before... The Truth IS... REQUEST DELIVERS!

DATABASE MAINTENANCE—

- Uses sophisticated screen formatting & data entry, like on IBM 3270's!
- Generates it's own screens automatically!
- Handles records up to 4K in length, using multiple screen "Pages"!
- Automatic data compression for increased disk capacity
- Uses Superkram (See below) access method for incredibly fast access, **LESS THAN .2 SECOND FOR A RECORD!**
- Automatic index creation/maintenance
- Automatic maintenance capabilities
- "Goof-Proof" error handling
- Input can come from VISICALC™ or SOURCE™

DATABASE SELECTION—

- Uses screen masks to form query
- Provides extensive search capabilities
- Search arguments can include arithmetic/boolean functions, multi-field comparisons
- Queries can generate input for automatic database maintenance
- Queries can be stored in "Query Library" and executed from menu on demand
- Any number of fields can be queried concurrently
- Query output can be routed to disk, CRT report formatter, VISICALC™ or SOURCE™

ONLY \$225

DATABASE REPORTING—

- Automatic headlines
- Automatic field editing
- Report fields can be calculated, sub-totaled & cross-footed in any manner desired.
- Optional counter breaks may be set
- Automatic grand totals
- Automatic statistics

REQUIREMENTS

Superkram (see below) and: Commodore Pet 32K (40 or 80 col.) and 2040/4040/8050 disk OR Apple II 48K with Applesoft or language system and 2 disk drives or CORVUS.

SUPER KRAM™

Now With Multi-Key Capabilities For Apple & Pet

by Ken German

Since KRAM™ was introduced in 1979 it has fast become known as the quickest and most powerful access method for serious Apple and Pet users. Now, after hundreds of requests we have added MULTI-KEY, MULTI-INDEX, functions, as well as increasing processing speed.

IBM/370 users have VSAM (Virtual Storage Access Method) to provide fast, flexible keyed-access to their data. Now SUPER KRAM (Keyed Random Access Method), from United Software of America, gives Apple and Pet users the same flexibility, substantially increasing the processing power of the Apple and Pet.

Until SUPER KRAM the only "random access" capability in the Apple and Pet consisted of a crude form of "relative record" processing. While this is usable for very simple applications, it falls far short of the needs of today's business and analytical applications. Using SUPER KRAM records may be processed by any one of multiple "Key" values, which may consist of any kind of data: numbers, letters, special characters, etc. Even Apples's long-awaited OOS 3.3 doesn't have anything like this!

KRAM™ 2.0 Regular Features

- Written in 6502 machine code
- Basic compatible
- Create/Open a dataset
- Put record by key
- Add & delete records by key
- Get any record by Full/Partial key
- Access by any key in as little as 2 sec (1 sec. with Corvus disk)
- Supports multiple disks
- Read next or previous record
- Dynamic space allocation
- Dynamic space reclamation
- Dynamic index compression
- Files never need reorganization
- Compatible with language systems

NEW IMPROVED
KRAM™ 2.05

SUPER KRAM'S™ Added Features

- MULTIKEY SUPPORT — Allowing simultaneous access to a KRAM file by more than one key field.
- HI-SPEED READ — This feature allows increased I/O speed up to 60% faster during processing of SUPER KRAM read next, read previous, put and delete requests.
- IMPROVED INDEX ARCHITECTURE — Allowing faster index searches and more efficient disk space utilization.
- INTEGRATED BASIC COMMANDS — Allowing SUPER KRAM™ commands to be coded in-line with Basic, providing easier usage of KRAM than ever before.
- USER-SPECIFIABLE BUFFER POOL — Allowing the user to specify how many KRAM files are allowed open at one time; will support any number of KRAM files.
- LOGICAL RECORDS (KEYS MAY BE NON-UNIQUE) — Records added to the KRAM files are immediately accessible by any of the defined keys for the file (Automatic Upgrade).
- KRAM 2.0 files are totally compatible with SUPER KRAM

KRAM™ 2.0 Only \$99.95

ATTENTION-EXISTING KRAM USERS:

Send \$15 with original disk and ROM to United Software for improved version of Kram.

SUPER KRAM™ Only \$175

USA UNITED SOFTWARE OF AMERICA

750 3RD Avenue,
New York NY 10017
(212) 682-0347

Telex 640055

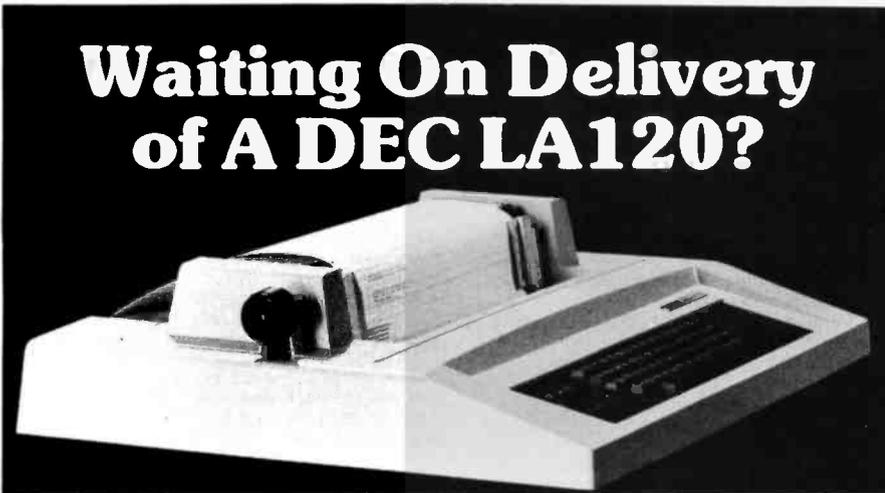
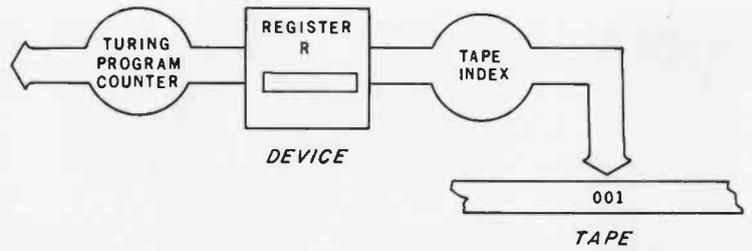
Look for the RED-WHITE-BLUE
United Software Display at your local
computer dealer, or send check or
moneyorder, plus \$3.00 shipping to:
DEALER INQUIRIES INVITED

REQUEST & KRAM are trade marks of United Software of America

(1a)

STM. NUMBER	R=0			R=1			COMMENTS
	W	D	ADR	W	D	ADR	
0	0	1	1	1	1	2	CHECK FIRST BIT
1	0	1	3	1	1	4	CHECK SECOND BIT
2	0	1	4	1	1	3	WRITE A 1
3	1	1	5	1	1	5	WRITE A 0
4	0	1	5	0	1	5	LOOP TO 6
5	0	0	6	1	0	6	LOOP TO 5
6	0	1	5	1	1	5	(HALT)

PROGRAM



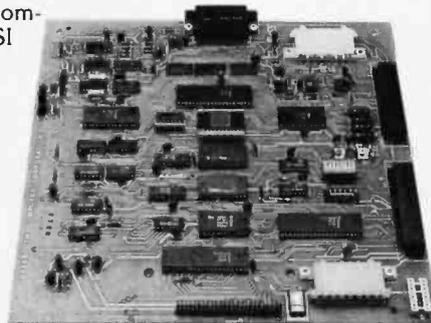
Waiting On Delivery of A DEC LA120?

Avoid the hassle by upgrading your LA36 for 1200 baud operation with a DS120 Terminal Controller.

The Datasouth DS120 gives your DECwriter® II the high speed printing and versatile performance features of the DECwriter® III at only a fraction of the cost. The DS120 is a plug compatible replacement for your LA36 logic board which can be installed in minutes. Standard features include:

- 165 cps bidirectional printing
- Horizontal & Vertical Tabs
- Page Length Selection
- 110-4800 baud operation
- 1000 character print buffer
- X-on, X-off protocol
- Self Test
- RS232 interface
- 20 mA Current Loop interface
- Top of Form
- Adjustable Margins
- Double wide characters
- Parity selection
- Optional APL character set

Over 4000 DS120 units are now being used by customers ranging from the Fortune 500 to personal computing enthusiasts. In numerous installations, entire networks of terminals have been upgraded to take advantage of today's higher speed data communications services. LSI microprocessor electronics and strict quality control ensure dependable performance for years to come. When service is required, we will respond promptly and effectively. Best of all, we can deliver immediately through our nationwide network of distributors. Just give us a call for all the details.



DATASOUTH COMPUTER CORPORATION

4740 Dwight Evans Road • Charlotte, North Carolina 28210 • 704/523-8500

(1b)

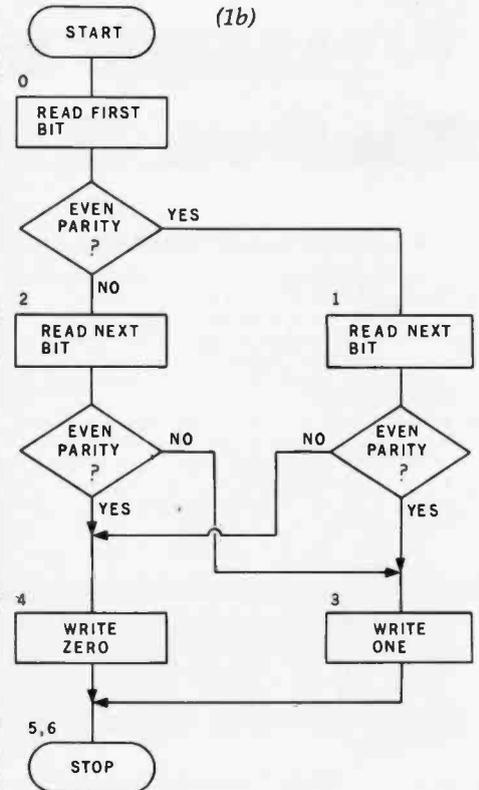


Figure 1: Model of a Turing Machine and an example. Figure 1a presents a symbolic representation of a Turing Machine divided into three principal components: a program, a tape, and a mechanism or device for executing the program. The current instruction being executed is pointed to by the Turing program counter (TPC), the register R holds the contents of current tape position. The index I points to the character that is currently under the tape head. The program given in figure 1a reads 2 bits from the tape and writes a third bit to give the three characters odd parity (an odd number of 1s among them). The program has an initial state given by statement 0 and a final or halting state given by the infinite loop of statements 5 and 6. The flowchart in figure 1b shows the logic of this program, with the numbers beside each box being the statement number associated with that position within the flowchart.



Turn your Apple into the world's most versatile personal computer.

The SoftCard™ Solution. SoftCard turns your Apple into two computers. A Z-80 and a 6502. By adding a Z-80 microprocessor and CP/M to your Apple, SoftCard turns your Apple into a CP/M based machine. That means you can access the single largest body of microcomputer software in existence. Two computers in one. And, the advantages of both.

Plug and go. The SoftCard system starts with a Z-80 based circuit card. Just plug it into any slot (except 0) of your Apple. No modifications required. SoftCard supports most of your Apple peripherals, and, in 6502-mode, your Apple is still your Apple.

CP/M for your Apple. You get CP/M on disk with the SoftCard package. It's a powerful and simple-to-use operating system. It supports more software than any other microcomputer operating system. And that's the key to the versatility of the SoftCard/Apple.

BASIC included. A powerful tool, BASIC-80 is included in the SoftCard package. Running under CP/M, ANSI Standard BASIC-80 is the most powerful microcomputer BASIC available. It includes extensive disk I/O statements, error trapping, integer variables, 16-digit precision, extensive EDIT commands and string functions, high and low-res Apple graphics, PRINT USING, CHAIN and COMMON, plus many additional commands. And, it's a BASIC you can compile with Microsoft's BASIC Compiler.

More languages. With SoftCard and CP/M, you can add Microsoft's ANSI Standard COBOL, and FORTRAN, or

Basic Compiler and Assembly Language Development System. All, more powerful tools for your Apple.

Seeing is believing. See the SoftCard in operation at your Microsoft or Apple dealer. We think you'll agree that the SoftCard turns your Apple into the world's most versatile personal computer.

Complete information? It's at your dealer's now. Or, we'll send it to you and include a dealer list. Write us. Call us. Or, circle the reader service card number below.

SoftCard is a trademark of Microsoft. Apple II and Apple II Plus are registered trademarks of Apple Computer. Z-80 is a registered trademark of Zilog, Inc. CP/M is a registered trademark of Digital Research, Inc.

MICROSOFT

CONSUMER PRODUCTS

Microsoft Consumer Products, 400 108th Ave. N.E.,
Bellevue, WA 98004. (206) 454-1315

Circle 86 on inquiry card.

The device first reads position I of the tape through the tape head, then places the value it finds into its register, R . If R contains a zero, the device executes the left side of program statement number Turing Program Counter (TPC). If R contains a 1, the device executes the right side of program statement number Turing Program Counter.

Each side of each program statement contains a value for the variables W , D , and ADR . The symbol W indicates what is to be written on the tape. The symbol D indicates the direction to move the tape head: if $D=0$, the tape head is moved one space to the left; if $D=1$, the tape head is moved one space to the right. The symbol ADR is the address of the next program statement to be executed. Briefly, the device reads the tape, writes on the tape, moves the tape head, and transfers control to another program statement. The program presented in figure 1b is a parity checker—that is, the machine reads two binary digits and writes a third to

give the total 3 bits an odd number of 1s—that is, odd parity.

[It should be noted that the previously mentioned notation for a Turning Machine is not the one usually encountered in classrooms and textbooks. A more formal definition defines a Turning Machine with the program expressed as a set of 5-tuples of the following form;

(current state, character being read, character to write over current character, next state, direction to move tape)

where the particular 5-tuple to be applied is the one that is given by the current state and the character being read. It can be seen that each line of the notation used in this article can be rewritten as two 5-tuples of the above form; therefore, the two notations are equivalent GW]

The operation of a Turing Machine may be represented by a flowchart, as in figure 2. Suppose that the variables W , D , and ADR are contained in

three arrays, each two-dimensional: $W(R,TPC)$, $D(R,TPC)$ and $ADR(R,TPC)$. The first subscript corresponds to the value contained in register R , while the second subscript refers to the program statement number. (In the example of figure 1, $W(1,3)=0$, $D(1,3)=1$, and $ADR(1,3)=3$.) The variable I refers to the position of the tape. Hence, the tape is represented by a one-dimensional array, $TAPE(I)$. The variable TPC represents the Turing program counter—that is, the line of the Turing program being referenced. These variables, along with the description of the operation of a Turing Machine, are utilized in the flowchart of figure 2.

So far, no restrictions have been placed on the values of TPC or the tape index I . Turing assumed that the program and tape were indefinitely large. In a practical Turing machine, the variable TPC takes on values up to and including the maximum number of program statements. The tape index I may take on values up to and including the number of spaces on the tape. It is usual to assume that when the value of I exceeds the length of the tape, it returns to the first position on the tape, so that the tape then becomes finite and connected to form a loop. We call such a restricted machine a *practical Turing Machine* (PTM). With these restrictions it is possible to construct a PTM from discrete digital components.

A Hardware Version

A hardwired version of a PTM utilizing integrated circuits can be readily constructed as described in the Millen article (see reference 3). In the present implementation, the program is stored in a 128 by 8-bit programmable memory circuit. (See figure 3.) The variables are the same as those used in the flowchart. The temporary register holds the value of $ADR(R,TPC)$. Register TPC points to a program statement. Register R selects the left or right side of the program statement. The value of I is held in a 12-bit binary up-down counter. The tape is represented by 4096 bits of programmable memory. The boxes labeled "address selector" operate like double-throw switches and facilitate loading and execution of programs. A maximum of sixty-four program statements may be

Text continued on page 136

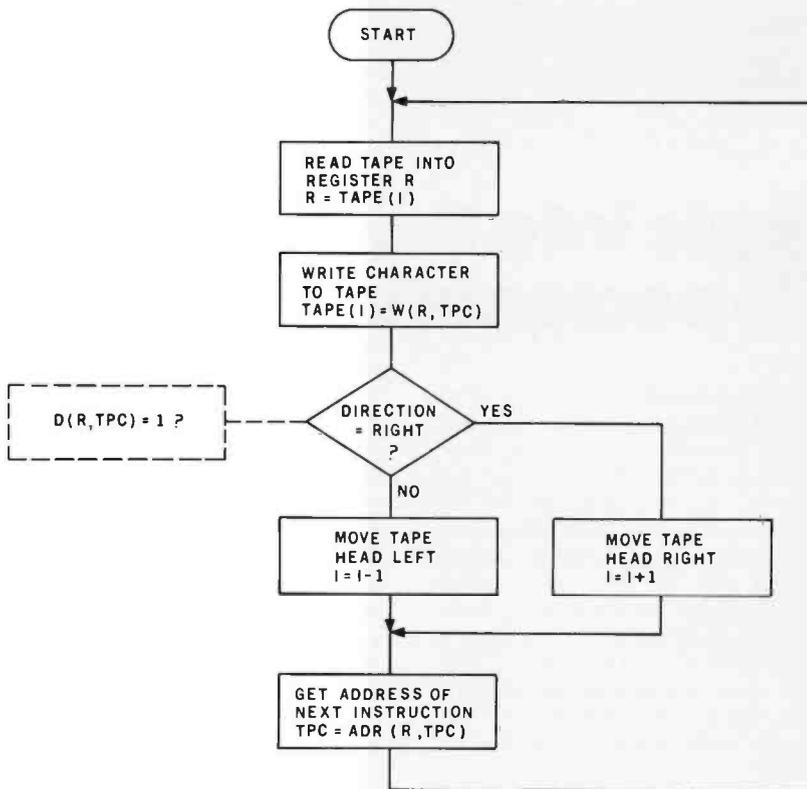


Figure 2: Flowchart for the Turing Machine algorithm. In this algorithm, written primarily for a hardwired or assembly-language implementation, the only allowable characters that can be written are 0 and 1. The only allowable movements for the tape head are left and right. The algorithm does not end as such, but a final or halting state can be implemented by the addition of two program lines that unconditionally loop to each other, denoting the end of the algorithm. This is done in the example of figure 1a.



Unretouched CAT-400 display, 242x256x16 bits per pixel, 128K byte image buffer. Partial picture shown here to highlight detail quality. Image processing courtesy of Earth Resources Data Analysis Systems, Inc. 999 McMillan St. N.W. Atlanta, Ga.

And You Thought You Couldn't Afford Color Like This?

Check our pricing. A system price for everyone's budget. We manufacture a full line of color graphic imaging systems, subsystems, and boards to fit your needs. Our CAT-100 FAMILY including the new CBX Series boasts high performance at reasonable costs.

Features available: Real time video frame grabber input in monochrome or color, Resolutions to 640 pixels per line, 65,536 Simultaneous colors out of a palette of 16 million colors, Standard RS-170 NTSC and RGB

video output, and Image memory from 32K to 256K bytes. In addition we carry accessories and a steadily growing line of software support packages.

For more information call or write DIGITAL GRAPHIC SYSTEMS, INC., 407 California Avenue, Palo Alto, Calif. 94306. Telephone 415/321-8871.



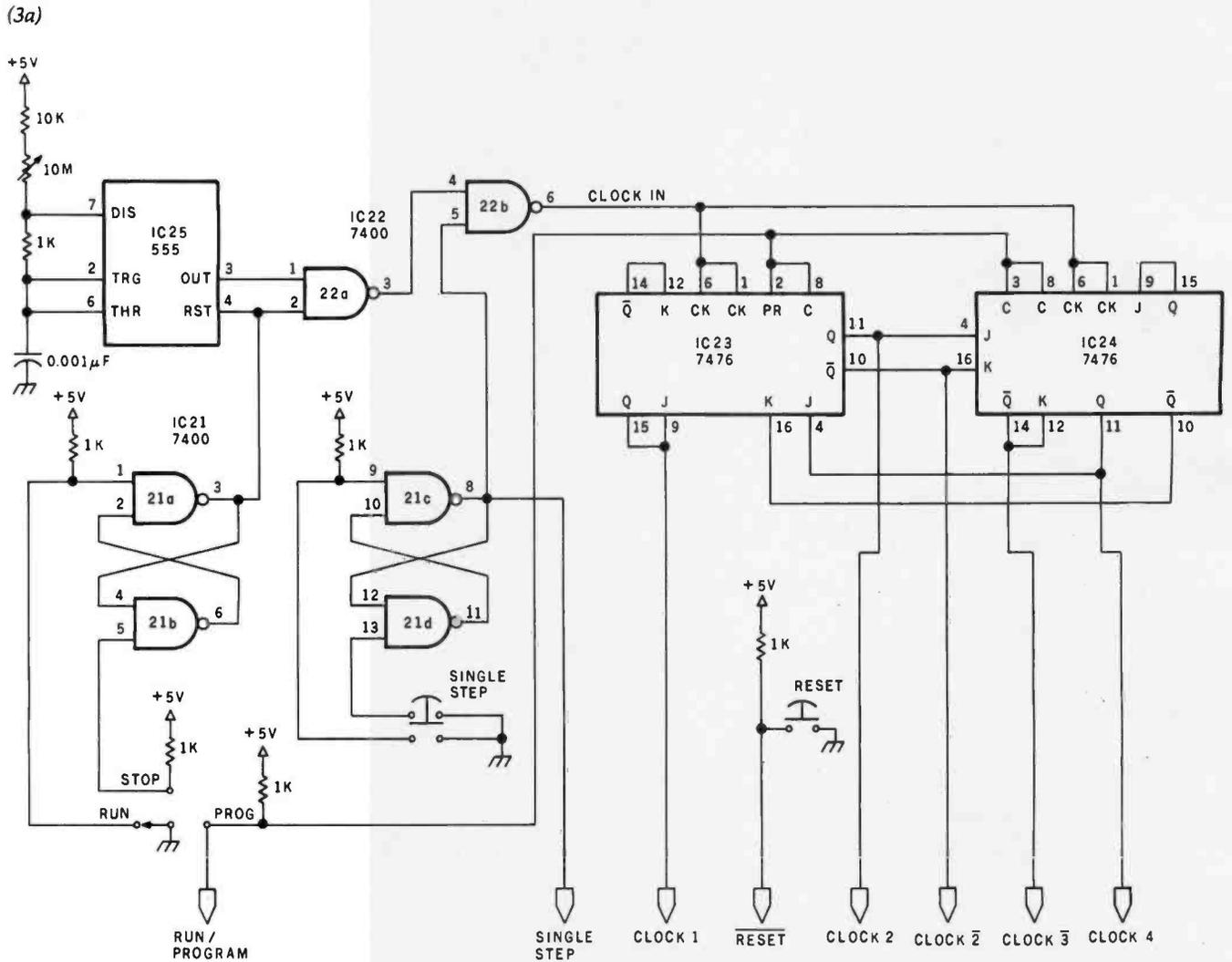


Figure 3: Schematic diagram for the hardwired Practical Turing Machine. The device is designed to be built on three small circuit cards, figures 3a thru 3c. In figure 3a, the clock board, IC23 and IC24 produce a four-phase clock used by the other boards.

LEO ELECTRONICS
 8921 S. Sepulveda #208
 Los Angeles, Ca 90045
 213-641-3101

"WANT LOW PRICES AND QUALITY"
LEO CAN FILL YOUR NEEDS
 Call for 50+ piece pricing

SHIPPING & POSTAGE
 UPS (Ground) or
 Parcel Post Add \$2.00
 UPS Blue (Air) .. Add \$4.00
 Please specify method

MEMORY PRODUCTS				LS PRODUCT				S PRODUCT		TTL	
1702A	1-10 4.85	11-49 4.65	TMS 4060	1-10 3.00	11-49 2.70	LS00 .25	LS42 .75	LS109 .45	LS163 .90	LS244 1.20	7489 1.65
2708	6.00	5.00	4116	4.00	3.50	LS02 .25	LS51 .30	LS123 .75	LS164 .85	LS245 1.20	
TMS 2716	7.50	6.50	8080A	4.00	3.00	LS04 .25	LS54 .30	LS138 .75	LS174 1.10	LS283 .95	
2716 5v	7.50	6.50	8085A	11.00	9.50	LS08 .25	LS73 .40	LS139 .75	LS175 1.00	LS367 .65	
2532	22.00	20.00	8216	2.60	2.40	LS10 .25	LS74 .40	LS151 .75	LS191 1.00	LS368 .65	
2732	22.00	20.00	8748	35.00	52.00	LS20 .25	LS85 1.15	LS153 .75	LS193 .85	LS373 1.40	
2758	8.00	7.50	TMS 9900	27.00	25.00	LS30 .25	LS86 .40	LS157 .75	LS195 .70	LS374 1.40	
						LS32 .35	LS93 .65	LS158 .80	LS221 1.15	LS377 1.45	
						LS38 .35	LS95 .75	LS161 .90	LS240 1.20		

VOLT REGS

S188 3.50	340T5 .85
S189 3.50	340T12 .85
S287 3.50	320T5 .95
S288 3.00	320T12 .95
S471 7.50	

TERMS: WE ACCEPT CASH, CHECK, OR MONEY ORDERS. CALIFORNIA RESIDENTS ADD 6% SALES TAX

A \$175 Program That Makes Your Microcomputer Worth Its Weight In Gold.



The Denver Software Company has developed, with the assistance of a Big Eight accounting firm, a financial package for microcomputers which accommodates the needs of both the very small-businessman and the household budget manager, and costs far less than you would imagine.

The FINANCIAL PARTNER™ contains all essential accounting functions, and yet is easy to use. It also has built-in flexibility: Programming expertise and valuable time are not needed to get the FINANCIAL PARTNER™ ready to use. And most important, this is a complete package, containing the programs, language, operating system, and supplies.

The beauty of the FINANCIAL PARTNER™ is that you don't have to be a professional bookkeeper or accountant to use it. Controller Jim Vogt says, "It is one

of the simplest accounting systems I have ever worked with, and it has a great ability to produce timely and accurate financial statements for small business or home use." All the necessary "how-to" is detailed in a well-written, step-by-step reference manual.

The FINANCIAL PARTNER™, which operates from menu selections, collects and organizes information for all of the standard categories: Assets, liabilities (including accounts payable), normal living expenses, deductible expenses (including all six deductions for personal Federal Income Tax returns), earned income (for both the wage earner and the

self-employed), and other income and expenses.

The provided chart of accounts is tailored for most users, but it can easily be modified by adding new accounts or changing descriptions. The FINANCIAL PARTNER™ generates standard financial reports—including a detail trial balance, income statement, and balance sheet—as well as batch proof listings, check register, vendor payable reports, and chart of accounts reports.

The FINANCIAL PARTNER™ is available for Apple, Atari, Commodore, Ohio Scientific, Texas Instruments, Radio Shack, Zenith, and most other microcomputers.

Minimum hardware requirements are: 48 K RAM, 140 K on-line storage, 40 x 24 or 80 x 24 display device, and almost any 80-column printer (optional).

The FINANCIAL PARTNER™ is available from your local dealer or you can direct inquiries to:

THE DENVER SOFTWARE COMPANY

MANUFACTURERS OF MICROCOMPUTER SOFTWARE



36 Steele Street, Suite 19 • Denver, Colorado 80206
Dealer inquiries welcome. 303 321-4551.

THE NATIONAL COMPUTER SHOWS

HAVE WE GOT A PROGRAM FOR YOU IN '81



Attend the biggest public computer shows in the country. Each show has 100,000 square feet of display space featuring over 50 Million Dollars worth of software and hardware for business, industry, government, education, home and personal use.

You'll see computers costing \$150 to \$250,000 including mini and micro computers, software, graphics, data and word processing equipment, telecommunications, office machines, electronic typewriters, peripheral equipment, supplies and computer services.

All the major names are there including; IBM, Wang, DEC, Xerox, Burroughs, Data General, Qantel, Nixdorf, NEC, Radio Shack, Heathkit, Apple, RCA, Vector Graphic, and Commodore Pet. Plus, computerized video games, robots, computer art, electronic gadgetry, and computer music to entertain, enthrall and educate kids, spouses and people who don't know a program from a memory disk.

Don't miss the Coming Of The New Computers—Show Up For The Show that mixes business with pleasure. Admission is \$5 for adults and \$2 for children under 12 when accompanied by an adult.

Ticket Information

Send \$5 per person with the name of the show you will attend to National Computer Shows, 824 Boylston Street, Chestnut Hill, Mass. 02167. Tel. 617 739 2000. Tickets can also be purchased at the show.

THE SOUTHWEST COMPUTER SHOW

DALLAS
Dallas Market Hall
2200 STEMMONS FRWY
AT INDUSTRIAL BLVD

THURS-SUN
APRIL 9-12
10 AM TO 7 PM

THE MID-WEST COMPUTER SHOW

CHICAGO
McCormick Place
SCHOESSLING HALL
23RD & THE LAKE

THURS-SUN
SEPTEMBER 10-13
10 AM TO 7 PM

THE MID-ATLANTIC COMPUTER SHOW

WASHINGTON, DC
DC Armory/Starplex
2001 E. CAPITOL ST. SE
(E CAP ST EXIT OFF I295
- KENILWORTH FRWY)
ACROSS FROM RFK STADIUM

THURS-SUN
SEPTEMBER 24-27
10 AM TO 7 PM

THE NORTHEAST COMPUTER SHOW

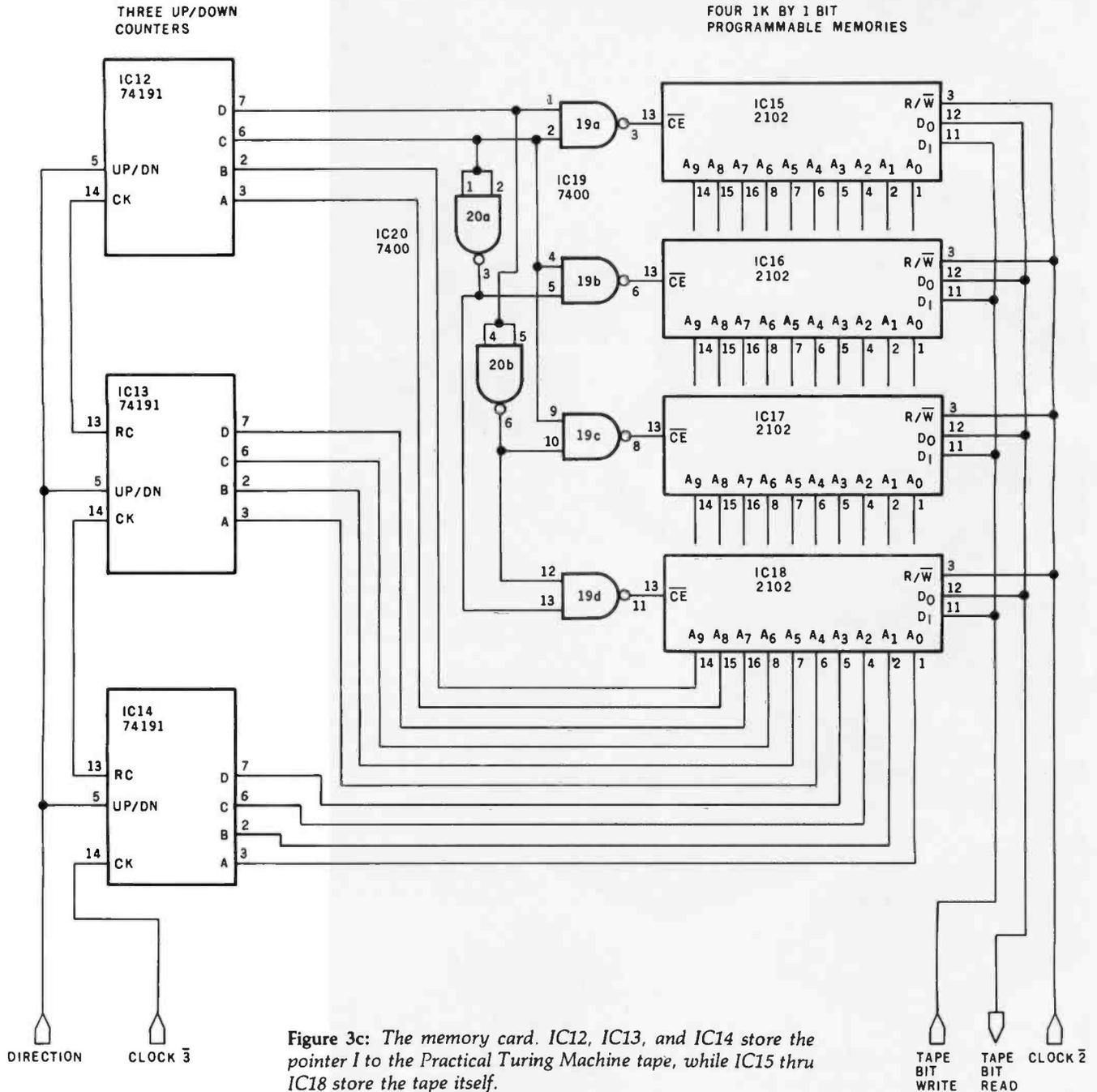
BOSTON
Hynes Auditorium
PRUDENTIAL CENTER

THURS-SUN
OCTOBER 15-18
10 AM TO 7 PM

THE SOUTHEAST COMPUTER SHOW

ATLANTA
Atlanta Civic Center
395 PIEDMONT AVE NE AT
RALPH MCGILL BLVD

THURS-SUN
OCTOBER 29-NOVEMBER 1
10 AM TO 7 PM



Bring the computer to your senses

The Soundchaser* computer music system transforms the Apple II** into an expandable, professional quality, polyphonic keyboard synthesizer and sequencer. Soundchaser's music modules include a 4 octave keyboard housed in an attractively finished wood cabinet complete with polyphonic interface card, connector and control software. The synthesizer voice card provides

3 analog/digital hybrid, studio quality programmable synthesizers. Each synthesizer consists of a wide range, waveform select oscillator, digitally controlled 24 dB/octave, low pass resonant filter, user definable LFO, fully programmable envelope generators, and a digitally controlled amplifier. System software includes a 4 channel sequencer which supports up to 12 synthesizers!

Explore Soundchaser's musical horizons. Play the sounds at your fingertips.
 Keyboard: \$650.00,
 3 Synthesizer voice card: \$350.00,
 Write or call for details.
 Dealer Inquiries invited.
 (415) 747-0614

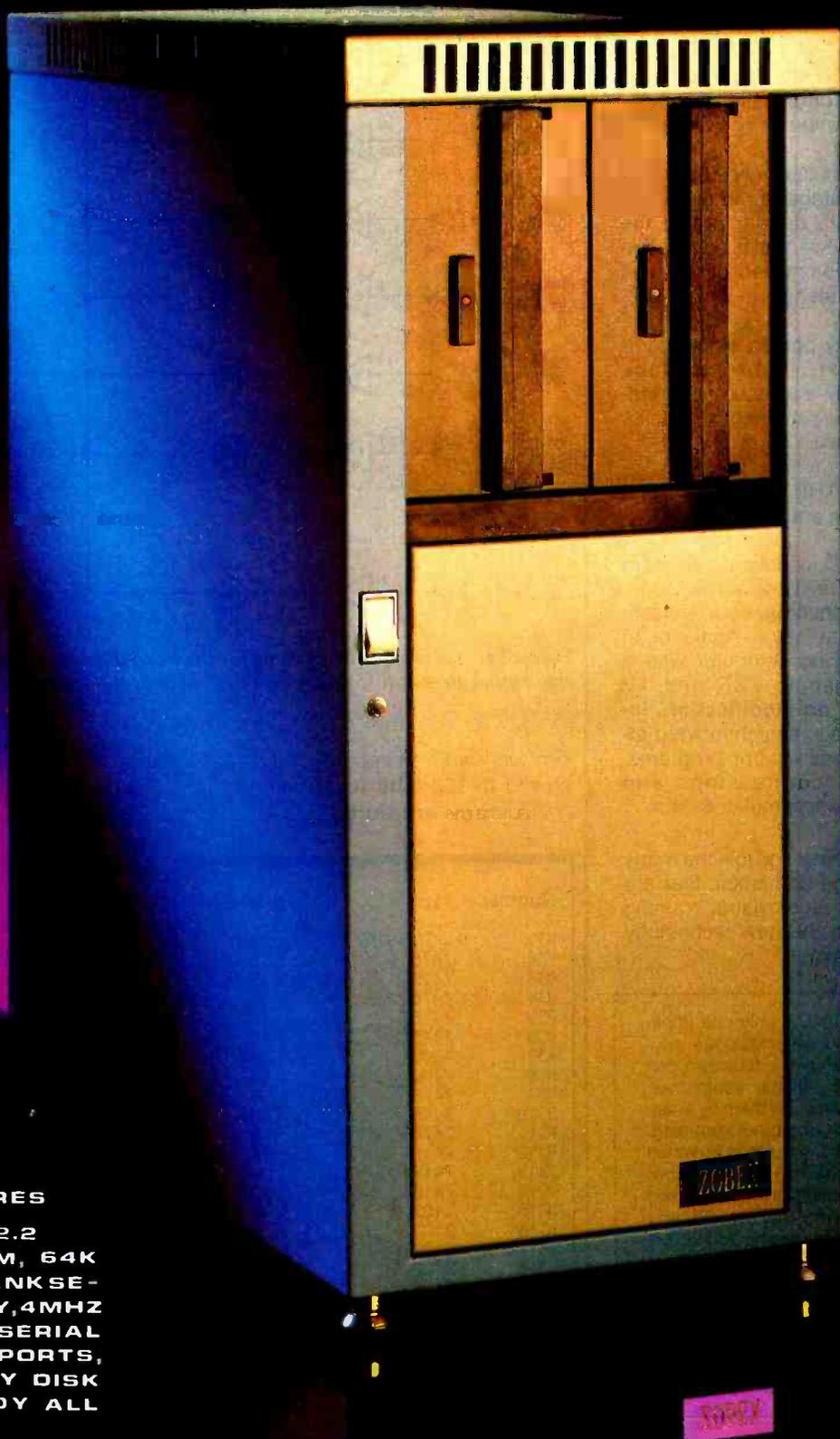
**PASSPORT
DESIGNS**

Marketing:
Box 21061,
Minneapolis, MN 55421

Headquarters:
Box 4/8,
La Honda, CA 94020

*Soundchaser is a trademark of Passport Designs, Inc.
 **Apple is a registered trademark of Apple Computer, Inc.

MULTIUSER



COMPUTER
ON S-100 BUS
DESIGNED TO
SATISFY A WIDE
VARIETY OF
APPLICATIONS.

STANDARD FEATURES

INCLUDE: CP/M 2.2
OPERATING SYSTEM, 64K
EXPANDABLE, BANKSE-
LECTABLE MEMORY, 4MHZ
Z80A CPU WITH 4 SERIAL
AND 3 PARALLEL PORTS,
RELIABLE 8" FLOPPY DISK
DRIVES IN A STURDY ALL
METAL CABINET.

\$ 4900

MP/M OPTIONAL.

CP/M AND MP/M REGISTERED TRADE MARKS OF DIGITAL RESEARCH

ZOBEX™

P.O. BOX 1847 SAN DIEGO, CA. 92112
7343-J RONSON RD, SAN DIEGO, CA. 92111
(714) 571-6971

What do you want your computer and video player to do that they can't do now?

- A. Display videotape segments then automatically switch to computer text.
- B. Display multiple-choice options at each stage of the presentation, then, depending on the choice made, replay any portion of text and/or video, or move on to new material.
- C. Show any portion of the computer text and/or videotape (randomly accessed) depending on the pace and/or choices of the user.
- D. ALL OF THE ABOVE . . . and do it all on one screen.

If you checked D, contact us for more information on Cavri Interactive Video. We offer a reasonably priced, sophisticated system that links an Apple* or an RS-232 interfacing computer with a Sony or Panasonic VCR and TV screen — **with no modification**. Included are simple, straightforward instructions for writing your programs. Plus frame-accurate stops and switches with no accumulated error.

Write or call today and join the many companies, large and small, that are improving their audiovisual training and testing with the new technology pioneered by Cavri.

Training, of course, is only one application. Now you can catalogue anything — for example, a museum can videotape its paintings, sculptures, and artifacts, then show them by artist, subject, date, or any other grouping, regardless of the sequence in which they were recorded on the videotape. Tell us your application, and we can help by supplying the system and guidance on programming and videotape or videodisc production.



26 Trumbull Street, New Haven, CT 06511
(203) 562-4979

*TM — Apple Computer Co.

(3d)

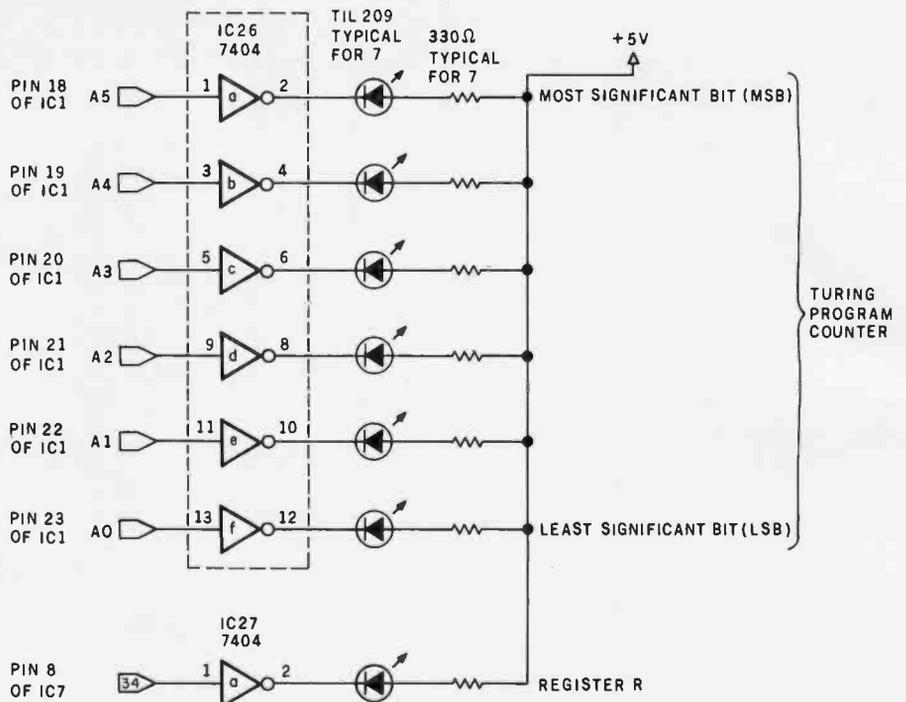


Figure 3d: This simple front panel for the PTM displays the address being pointed to by the Turing Program Counter and the value in the R register.

Text continued from page 128:
stored in 128 8-bit locations.
Programs are stored by:

Number	Type	+5 V	GND
IC1	MCM6810	24	1
IC2	7475	5	12
IC3	7475	5	12
IC4	7475	5	12
IC5	74157	16	8
IC6	74157	16	8
IC7	7400	14	7
IC8	7400	14	7
IC9	7476	5	13
IC10	7476	5	13
IC11	7476	5	13
IC12	74191	16	8
IC13	74191	16	8
IC14	74191	16	8
IC15	2102	9	10
IC16	2102	9	10
IC17	2102	9	10
IC18	2102	9	10
IC19	7400	14	7
IC20	7400	14	7
IC21	7400	14	7
IC22	7400	14	7
IC23	7476	5	13
IC24	7476	5	13
IC25	555	8	1
IC26	7404	14	7
IC27	7404	14	7

Table 1: Power-wiring table for figures 3a, 3b, and 3c.

- single-stepping the programming counter to the desired statement number,
- selecting the proper side of the statement with the L/R switch,
- loading the values for W, D, and ADR via the programming switches, and
- depressing the "write" button.

This sequence is repeated until all of the program has been entered.

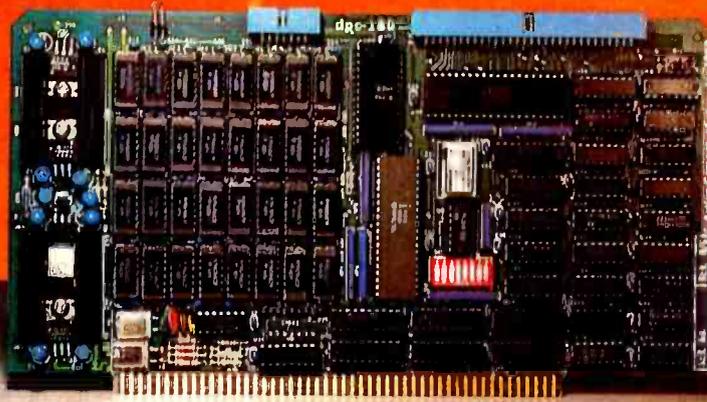
Execution is initiated by:

- single-stepping the starting location of the Turing program into register TPC, and
- switching to RUN mode.

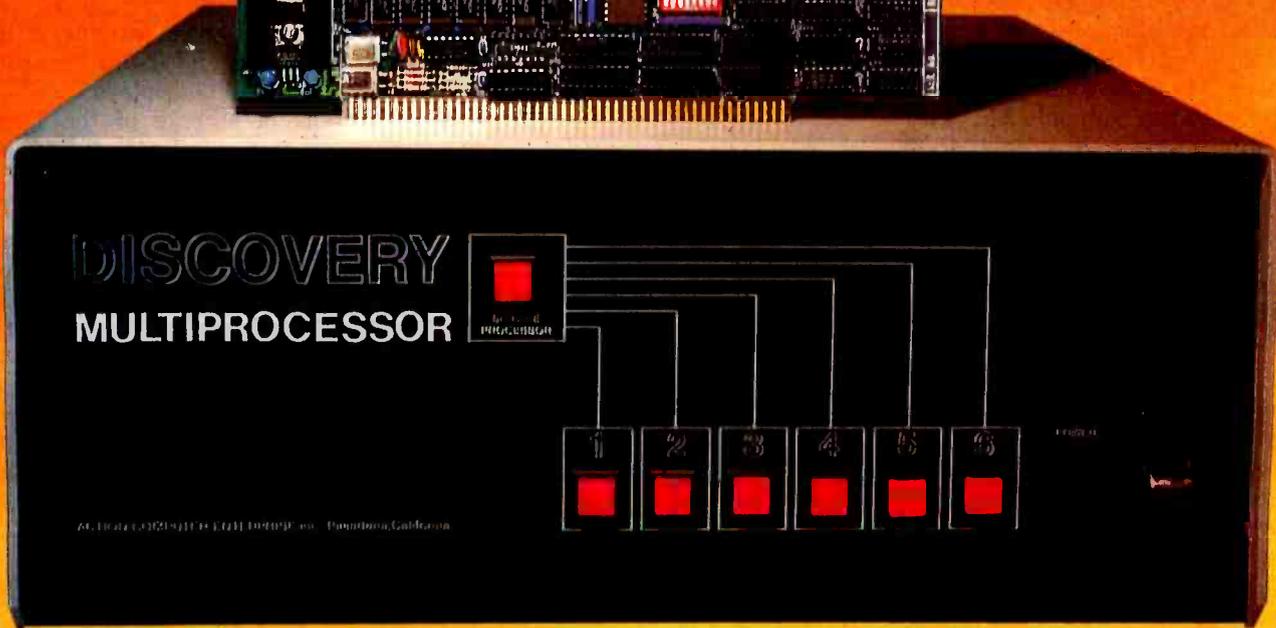
Timing signals are provided by a 4-phase clock through the inputs labeled clock 1 thru clock 4.

This representation offers a relatively fast execution time of about 2 μs per cycle. Changes in the length of the tape or in the maximum number of program statements are extremely difficult to make. Output is limited only by the imagination and

**This
Single
Board...**



**...is the Heart
of the
Microprocessor
World's
Best Multi-User
System ...**



THE DISCOVERY MULTIPROCESSOR

The dedicated power of this complete single board computer is provided to each user, making the DISCOVERY MULTIPROCESSOR unique among multi-user systems. With the power and expandability of distributed processing • With the economy of shared peripherals • With the flexibility of shared and public files • And all of this with full CP/M* and S-100 compatibility.

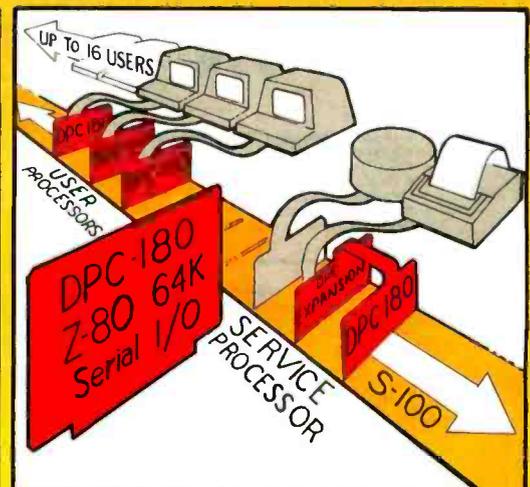
Multiprocessing Software Multiprocessing Hardware

Our Distributed Processing Operating System, **dpc/os**[®], resides in the Service Processor, establishing a CP/M environment for each user and managing access to the shared system resources. Multiuser facilities are provided for print spooling, for interprocessor communication and for private, public and shared-update files. Several processors can be employed concurrently by a single user via the enhanced batch submit facilities. And with **DISCOVERY** all CP/M compatible programs will execute without modification, thus protecting your software investment.

The ACE 64K Distributed Processing Single Board Computer, the **dpc-180**[™] gives the **DISCOVERY MULTIPROCESSOR** its own unique architecture. One DPC is dedicated to each user providing exclusive use of the onboard Z-80, 64K ram and serial I/O. Access to the shared resources is provided by an expanded DPC used as a Service Processor. Additional users can be added at any time by simply inserting additional DPC's into the standard S-100 bus — up to a total of sixteen user processors in a single chassis!

*CP/M is a registered TM of Digital Research, Inc.

DISCOVERY has been proven in installations throughout the World. If you need the Power of Multiprocessing... it's time you discovered us!



The ACE **DISCOVERY MULTIPROCESSOR** dedicates a complete 64K Z-80 Distributed Processing single board Computer, the **dpc-180**[™] to each user. An expanded DPC coordinates all of the system activities.

Multiuser mainframes with 192K ram start at under \$6000. The 64K **dpc-180**[™] is priced at \$1395. Immediate delivery. A complete line of standard peripherals including a 26M byte hard disk subsystem can be supplied on request. Dealer and OEM inquiries are invited.

Action Computer Enterprise, Inc.
The Multiprocessing Company

Visit our Booth at the NCC

55 West Del Mar Boulevard. Pasadena, California 91105 USA • Cable ACEPAS Pasadena • (213) 793-2440

means of the user. In my prototype, a row of light-emitting diodes (LEDs) displays the contents of register R and register TPC (see figure 5). Components for this hardwired representation of a PTM cost about \$80.

An Assembly-Language Version

Another implementation of a Practical Turing Machine is with a microprocessor. The code given in listing 1 is designed to run with only 512 bytes of memory and a Motorola 6800 microprocessor. The main program, as written, uses monitor routines available on the Heathkit ET-3400 Trainer. The tape index *I* is represented by the contents of locations *I2* and *I1*. The variable *I1* points to an 8-bit word in the tape array. The 3 least significant bits of the contents of the location *I2* point to a bit within that word. A maximum of thirty-two program statements may be stored in 64 bytes of memory.

Subroutine RUN is divided into five parts:

- statements 0000 thru 0016 (hexadecimal) load R with the value of TAPE (*I*)

STM #	R = 0	R = 1
0	0080	00A0
1	0081	00A1
2	0082	00A2
3	0083	00A3
•	•	•
•	•	•
•	•	•
31	009F	00BF

W	D	—	A	D	R	—
7	6	5	4	3	2	1 0
Bit locations						

Figure 4: Memory map of assembly-language implementation of a Practical Turing Machine. Memory locations hexadecimal 0080 thru 00BF are used to store a program of up to thirty-two steps, with 2 bytes being used to store each statement line. The character to be written, *W*, is in bit 7 of a given byte. The direction of tape head movement, *D*, is in bit 6. The statement number of the next statement to be executed is stored in bits 4 thru 0 of the byte. Bit 5 is unused.

- statements 0017 thru 001C (hexadecimal) establish an offset for finding the proper half of a Turing program statement
- statements 001D thru 002F (hexadecimal) print *W(R,TPC)* on the TAPE
- statements 0030 thru 0044 (hexadecimal) increment or decrement *I*
- statements 0045 thru 0049 (hexadecimal) restore TPC to the next program statement number

decimal) print *W(R,TPC)* on the TAPE

- statements 0030 thru 0044 (hexadecimal) increment or decrement *I*
- statements 0045 thru 0049 (hexadecimal) restore TPC to the next program statement number

The main program provides output through the ET-3400 monitor routines and LED displays.

Details of storage of the Turing program appear in figure 4. Each side of each program statement is stored in a separate memory location. The value of *W* occupies the most significant bit and the value of *D* occupies the next most significant bit. The value of *ADR* is stored in the 5 least significant bits of a Turing program statement location.

Program statements are entered directly into memory locations using monitor routines available on the trainer.

Execution is initiated by:

- entering the starting location of the Turing program into the location TPC,

Text continued on page 146

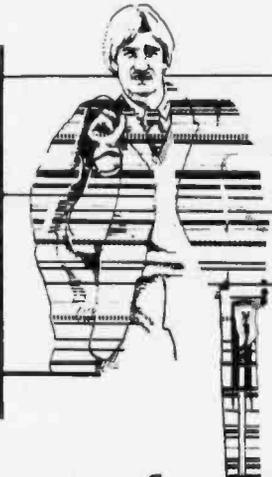
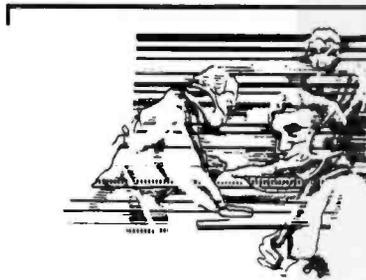
Why Do Professionals Prefer

BECAUSE

- Unique software • Technical support • Quick delivery • Established company • Release 2 CP/M[®] (some packages under UNIX[®] and TRSDOS[®])
- Quality software • In-house expertise • Fast response • User orientation • Competitive prices
- Customer service • Verbatim[®] media • Onyx hardware (CP/M and UNIX versions).

BECAUSE

Unique swift routing cybernetics response system gives you no-nonsense technical answers that save you time. Call: (714) 848-1922.



- NEW RM/COBOL[®] applications:
 - Order Entry/Inventory • Receivables • Payables • General Ledger • Financial Modeling • Client Accounting—and more on the way!
- NEW CBASIC[®] applications:
 - REAP (Real Estate Acquisition Package).

Business
Medical
Real Estate
Computer Systems

Software from Cybernetics?

RM/COBOL—The new standard for microcomputer COBOL!! The only COBOL for CP/M (also on TRSDOS & UNIX) with alternate keys (multi-key ISAM), CRT screen handling, interactive debug, and the most useful Level 2 features. Compatible with RSCOBOL[®]—but runs faster.

Plus existing CBASIC[®] packages:
APH (Automated Patient History)
Osborne & Assoc.—Payroll • Payables/Receivables • General Ledger
NAD[®] (Name and Address)
PMS (Property Management System)

Inquire for details
Trademarks of: Ryan-McFarland Corp., Compiler Systems, Inc., Digital Research, Bell Telephone Laboratories, Inc., Tandy Corp., Verbatim, Inc., Cybernetics, Inc., Structured Systems Group, Inc., Small Business Applications, Inc.

TRS-80[®], Model II CP/M—The fastest Mod II CP/M with the most features. Outstanding teaching documentation for newcomers to CP/M, multiple CRT emulation, down loading package, support for CORVUS 10 Mb hard disk. Many additional user-oriented features.

And system software packages
MAGIC WAND[®] Editing/Word Processing
CBASIC[®] Compiler BASIC
QSORT[®] Sort Merge Package



8041 Newman Ave., Suite 208
Huntington Beach, CA 92647
(714) 848-1922

4 ALL NEW GUIDES

from OSBORNE/McGraw-Hill

The Apple II User's Guide by Lon Poole, Martin McNiff, and Steven Cook #46-2, \$15. □

This Guide is the key to unlocking the full power of your Apple II or Apple II plus computer. The Apple II User's Guide brings together in one place a wealth of information for Apple computer users. It will tell you more about your Apple than any other single source. This book will save you both time and effort. No longer will you have to search endlessly for useful information. It's all here, in the Apple II User's Guide, thoughtfully organized and easy to use. Topics include:

* Applesoft and Integer BASIC programming - especially how to make the best use of Apple's sound, color and graphics capabilities. The book presents a thorough description of every BASIC statement, command and function.

* Advanced programming - special sections describe High Resolution graphics techniques and other advanced applications.

* Hardware features - the disk drive and printer are covered in separate chapters.

* Machine level programming - although not a machine language programming guide, this book covers the Machine Language Monitor in detail.

*Apple is a trademark of the Apple Computer Corporation.

PET/CBM Personal Computer Guide Second Edition by Adam Osborne and Carroll Donahue #55-1, \$15. □

The *PET/CBM Personal Computer Guide* is a step-by-step guide that assumes no prior knowledge of computers. If you can read English, you can use this book. This revised second edition provides even more useful material than the popular first edition. It covers the most recent CBM products: the CBM 8000 and 4000 series computers, the 2040 and 8050 disk drives, and programmable printers. Adam Osborne co-authored this new edition. He has re-written it to be a step-by-step BASIC tutorial. So if you don't know BASIC, don't worry. This book will teach you both BASIC and CBM BASIC. If you're thinking about buying any personal computer, this book will show you what the PET can do for you. If you've just bought a PET or CBM, this is the book you must have to really understand your computer. By using the examples found in this book you'll quickly get your PET/CBM up and running. These examples are thoroughly documented so you can learn how and why the programs work. It's the "how" and "why" that are important in learning to make the PET work efficiently for you. The PET Personal Computer Guide covers everything you'll need to be master of your PET.

*PET and CBM are both trademarks of Commodore Business Machines.

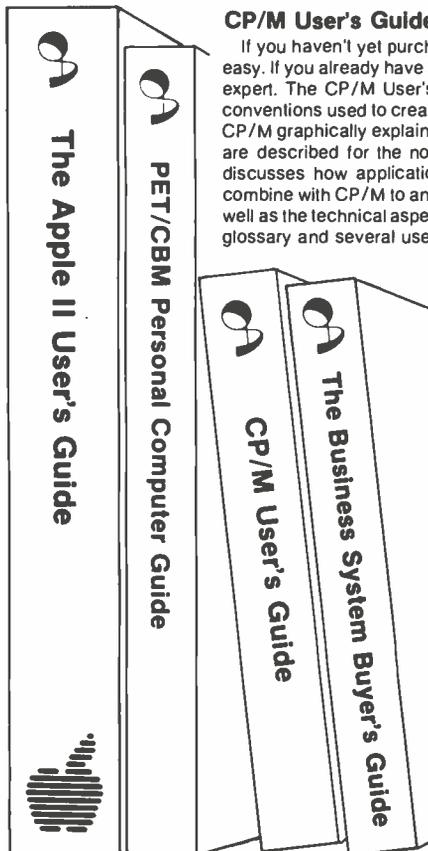
CP/M User's Guide by Thom Hogan #44-6 \$12.99 □

If you haven't yet purchased CP/M for your system, the CP/M User's Guide will make your first use of CP/M easy. If you already have CP/M, this book will help you modify your system and let you "jockey your disks" like an expert. The CP/M User's Guide describes types of CP/M and their compatibility. It includes a discussion of conventions used to create file names and command lines. Numerous sample screen displays for each version of CP/M graphically explain each operator command and computer response. CP/M's Assembly Language Utilities are described for the non-technical reader who wants maximum use of CP/M's capabilities. The book also discusses how application packages, high level languages, solution programs, and other support programs combine with CP/M to answer a user's individual needs. You'll also find an explanation of MP/M and CP/NET as well as the technical aspects of CP/M's internal structure which will permit you to make simple modifications. A full glossary and several useful appendices are included.

*CP/M is a trademark of Digital Research Corporation.

The Business System Buyer's Guide by Adam Osborne #47-0 \$7.95 □

When you enter the marketplace of small business computers you face a bewildering array of products, prices, features, and fables. This guide cuts through the jargon and unravels the task of buying the right computer system. Dr. Osborne is the foremost authority on the use of computers in small businesses. Here, he helps you to analyze your computer needs by applying the same know-how that made your business a success. This book provides solid information on how to determine your needs, how to choose software and hardware for all business applications, what to expect from vendors, what to avoid, and what questions you must ask. It also provides a wealth of detailed information on products, manufacturers, retailers, and the whole micro-computer marketplace. Purchasing a computer system for any business is a complex process, but it need not be a frustrating one. This book will help. Before you buy any computer, read this book. You'll never make a better investment.



Make check payable to:  OSBORNE/McGraw-Hill
630 Bancroft Way, Berkeley, CA 94710 Dept. B14 Phone Orders:(415) 548-2805



Name _____

Address _____

City/State/Zip _____

Plus .75/item 4th class \$1.25/item UPS \$2.50/item Air Mail \$4.00/item Overseas
(California residents add applicable tax.) Please send me your free catalog.

Total amount enclosed \$ _____ or charge my Visa Mastercharge

Card # _____ Expiration Date _____

Signature _____

Listing 1: Listing for implementation of the Practical Turing Machine in 6800 machine code. The program uses routines from the Heathkit ET-3400 microprocessor trainer at hexadecimal locations 0058 and 005B.

```

"                MICRO-TURING
" PRACTICAL TURING MACHINE SIMULATOR FOR USE WITH A 6800 MPU
" AND AT LEAST 512 BYTES OF RAM.THE MAIN PROGRAM USES MONITOR
" ROUTINES AVAILABLE ON HEATHKIT'S MODEL ET-3400 MICROPROCESSOR
" TRAINER.WRITTEN BY JIM WILLIS PHYSICS DEPT. UNC CHAPEL HILL.
" CHAPEL HILL , NC. 27514.
"                MICRO-TURING
MEM.
LOC. OP. CODE LABEL MNEMOMIC          COMMENTS
" READ TAPE
" SET UP TAPE MASK FROM (I2)
0000 86 01    RUN    LDA A # $01          A=00000001
0002 D6 4A          LDA B I2            B=I2
0004 C4 07          AND B # $07          B=00000111 .AND. B
0006 27 04    FIRST BEQ NEXT          IF (B=0) GO TO NEXT
0008 48          ASL A                A=2*A
0009 5A          DEC B                B=B-1
000A 20 FA          BRA FIRST          GO TO FIRST
000C D7 4F    NEXT  STA B R            R=B(=0)
" LOAD R WITH TAPE(I2,I1)
000E DE 4B          LDX I1            X=I1
0010 A5 00          BIT A $00,X          IF ((A.AND.TAPE(I1)).EQ.0) Z=1,ELSE Z=0
0012 27 09          BEQ ENDR          IF (Z=1) GO TO ENDR
0014 5C          INC B                B=B+1
0015 D7 4F          STA B R            R=B(=1)
" LOAD B WITH TURING PROGRAM STM(R,TPC)
0017 D6 4E          LDA B TPC            B=TPC
0019 CB 20          ADD B # $20          B=B+$20
001B D7 4E          STA B TPC            TPC=B
001D DE 4D    ENDR  LDX TPC            X=TPC
001F E6 80          LDA B $80,X          B=TURING PROGRAM STM(R,TPC)
0021 DE 4B          LDX I1            X=I1
" WRITE ON TAPE
0023 C5 80          BIT B # $80          IF ((B.AND.10000000).EQ.0) Z=1,ELSE Z=0
0025 27 04          BEQ WZERO          IF (Z=1) GO TO WZERO
0027 AA 00          ORA A $00,X          A=A.OR.TAPE(I1)
0029 20 03          BRA ENDW          GO TO ENDW
002B 43    WZERO  COM A                A=.NOT.A
002C A4 00          AND A $00,X          A=A.AND.TAPE(I1)
002E A7 00    ENDW  STA A $00,X          TAPE(I1)=A
" MOVE TAPE POINTER
0030 CE 00 4A          LDX # $004A          X=$004A
0033 C5 40          BIT B # $40          IF ((B.AND.01000000).EQ.0) Z=1,ELSE Z=0
0035 27 08          BEQ DECI          IF (Z=1) GO TO DECI
" INCREMENT (I2,I1)
0037 6C 02          INC $02,X          I1=I1+1
0039 28 0A          BVC ENDD          IF(I1.NE.-128) GO TO ENDR
003B 6C 00          INC $00,X          I2=I2+1
003D 20 06          BRA ENDD          GO TO ENDD
" DECREMENT (I2,I1)
003F 6A 02    DECI  DEC $02,X          I1=I1-1
0041 28 02          BVC ENDD          IF(I1.NE.127) GO TO ENDD
0043 6A 00          DEC $00,X          I2=I2-1
" TPC=ADR(R,TPC)
0045 C4 1F    ENDD  AND B # $1F          B=B.AND.00011111
0047 E7 04          STA B $04,X          TPC=B
0049 39          RTS                RETURN

" VARIABLES
004A XX          I2      (I2)          I2
004B 01          $01
004C XX          I1      (I1)          I1
004D 00          $00

```

Listing 1 continued on page 142

The largest selection of software from the world's largest software publisher.

Product LIST NO. 19 1/2

Write for our catalog with full program descriptions and specifications.

DISK OPERATING SYSTEMS

CP/M CONFIGURED FOR:
 APPLE II
 DIGITAL MICROSYSTEMS FDC3
 DURANGO F-85
 HEATH H8 AND H89
 ICOM MICRO DISK
 ICOM 3712
 ICOM 3812
 ICOM 4511/PERTEC D3000
 INTEL MDS
 MICROPOLIS FLOPPY DISK
 MITS/ALTAIR
 MOSTEK MDX
 NORTH STAR
 OSI C3
 PRO-TECH HELIOS
 TRS-80 MODEL I
 TRS-80 MODEL II
 TRS-80 MODEL III
 ZENITH Z89
 MP/M FOR INTEL MDS

HARD DISK INTEGRATION MODULES

CORVUS WITH APPLE II SOFTCARD
 CORVUS WITH S100 AND TRS-80
 MODEL II
 ICOM 4511/PERTEC D3000
 KONAN PLUS CDC PHOENIX
 XCOMP SM/S PLUS CDC PHOENIX
 XCOMP DFC10 FOR PERTEC D3000

SYSTEMS TOOLS

BUG AND uBUG TRS-80 MODEL II
 DESPOOL CP/M
 DISLOG CUSTOMIZATION
 DISTEL DISK
 EDIT UNLOCK
 EDIT-80 WORD-MASTER
 FILETRAN XASM-18
 IBM/CPM XASM-48
 MAC XASM-65
 MACRO-80 XASM-68
 PASM XMACRO-86
 PLINK ZDT
 RAID Z80 DEVELOPMENT
 RECLAIM PACKAGE
 SID ZSID

TELECOMMUNICATIONS

BSTAM BSTMS

LANGUAGES

ALGOL-60 muSIMP
 APL/V80 NEVADA COBOL
 BASIC-80 PASCAL/M
 (COMPILER) PASCAL/MT
 BASIC-80 PASCAL/MT +
 (INTERPRETER) PASCAL/Z
 BDS C COMPILER PL/I-80
 CBASIC-2 SMAL/80
 CIS COBOL S-BASIC
 COBOL-80 TINY C
 FORTRAN-80 W'SMITHS C
 KBASIC COMPILER
 muLISP XYBASIC

LANGUAGE AND APPLICATIONS TOOLS

BASIC UTILITY MDBS.RTL
 DISK M/SORT FOR
 DATASTAR COBOL-80
 FABS PEARL
 FORMS 2 FOR QSORT
 CIS COBOL STRING BIT
 MAGSAM III STRING/80
 MAGSAM IV SUPER-SORT
 MDBS.DRS ULTRASORT II

WORD PROCESSING SYSTEMS AND AIDS

MAGIC WAND TEX
 LETTERIGHT TEXTWRITER III
 MICROSPELL WORD-STAR
 SPELLGUARD WORDINDEX

DATA MANAGEMENT PACKAGES

CONDOR MDBS.QRS
 HDBS WHATSIT?
 MDBS

GENERAL PURPOSE APPLICATIONS

CBS
 SELECTOR III-C2
 SELECTOR IV

MAIL LIST APPLICATIONS

MAILING ADDRESS (PTREE)
 MAIL-MERGE FOR WORD-STAR
 NAD
 POSTMASTER

BUSINESS APPLICATIONS

ACCOUNTS PAYABLE (PTREE)
 ACCOUNTS PAYABLE (SSG)
 ACCOUNTS RECEIVABLE (PTREE)
 ACCOUNTS RECEIVABLE (SSG)
 GENERAL LEDGER II (CPAIDS)
 GENERAL LEDGER (PTREE)
 GENERAL LEDGER (SSG)
 GLECTOR FOR SELECTOR III-C2
 INVENTORY (PTREE)
 INVENTORY (SSG)
 PAYROLL (PTREE)
 PAYROLL (SSG)

WordStar users unite . . . with

WORDINDEX

Designed to assist users of WordStar maintain large documents, **WORDINDEX** is a list-making, tabulating and indexing champion.

Generate a table of contents, a list of figures and a list of tables, a sorted index, with index words on two levels: master and sub-references. In addition, you can re-number section numbers and page references, whenever the document has been changed. All automatically. **WORDINDEX** has the added attraction of user-selectable print control for all headings.

WORDINDEX is also useful for indexing publications not in machine-readable form.

WORDINDEX \$195. Program With Full Documentation

MICROSPELL SPELLING CORRECTION PROGRAM AVAILABLE FOR \$295.

NUMERICAL PROBLEM-SOLVING TOOLS

ANALYST STATPAK
 FPL T/MAKER
 muMATH

OTHER SPECIALIZED APPLICATIONS

DATEBOOK
 ESQ-1
 MASTER TAX
 PAS-3 DENTAL
 PAS-3 MEDICAL
 PROPERTY MANAGEMENT (PTREE)
 STANDARD TAX

BOOKS AND PERIODICALS

APL — AN INTERACTIVE APPROACH
 ACCOUNTS PAYABLE & ACCOUNTS
 RECEIVABLE-CBASIC
 8080/Z80 ASSEMBLY LANGUAGE
 THE CP/M HANDBOOK
 THE C PROGRAMMING LANGUAGE
 FIFTY BASIC EXERCISES
 GENERAL LEDGER-CBASIC

LIFELINES
 PASCAL USER MANUAL AND REPORT
 PAYROLL WITH COST
 ACCOUNTING-CBASIC
 STRUCTURED MICROPROCESSOR
 PROGRAMMING
 USING CP/M — A SELF-TEACHING
 GUIDE

ACCESSORIES

DC 300 DATA CARTRIDGE
 HEAD CLEANING DISKETTE
 FLIPPY DISK KIT
 FLOPPY SAVER

Program names and computer names are generally trademarks or service marks of the author or manufacturing company.

All software products have specific requirements for hardware and additional associated software (e.g. operating system or language).

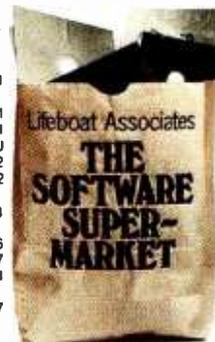
All products are subject to terms and conditions of sale.

Copyright © 1981 Lifeboat Associates. No portion of this advertisement may be reproduced without prior permission.

Ordering Information COMPUTERS SUPPORTED WITH MEDIA FORMAT ORDERING CODES.

ADD5 Multivision	RT Digital Microsystems	A1 IMS 5000	RA Micropolis Mod II	Q2 Research Machines 8 in	A1 TRS-80 Model I + Omikron
AVL Eagle	RB Durango F-85	RL IMS 8000	R1 Morrow Discus	A1 Rex	Q3 8 in
Altair 8800	B1 Dynabyte DB8/2	R1 IMSAI VDP-40	R4 Mostek	A1 SD Systems 5 25 in	R3 TRS-80 Model I +
Altos	A1 Dynabyte DB8/4	A1 IMSAI VDP-42	R4 North Star Single Density	P1 SD Systems 8 in	A1 Shuffleboard
Apple CP/M 13 Sector	RG Exidy Sorcerer + Lifeboat	IMSAI VDP-44	R5 North Star Double Density	P2 Sanyo 7000 5 25 in	RQ TRS-80 Model II
Apple CP/M 16 Sector	RR CP/M	Q2 IMSAI VDP-80	A1 North Star Quad Density	P3 Spacebyte	A1 TRS-80 Model III
BASF System 7100	RD Heath H8 + H17/H27 disk	P4 ISC Intecolor	A1 Nylac Micropolis Mod II	Q2 TE1 5.25 in	R3 Vector MZ
Blackhawk Micropolis Mod II	Q2 Heath H89 + Lifeboat CP/M	P4 8063/8360/8963	A1 Nylac Single Density	Q3 TE1 8 in	A1 Vector System B
Blackhawk Single Density	Q3 CP/M	P7 Intertec Superbrain DOS 0.1	R7 Ohio Scientific C3	A1 TRS-80 Model I	R2 Vista V-80 5 25 in. Single
CDS Versatile 38	Q1 Helios II	B2 Intertec Superbrain DOS 0.5	RJ Onyx C8001	T2 STANDARD	R8 Vista V200 5.25 in. Double
CDS Versatile 4	Q2 ICOM 2411 Micro Floppy	R3 Intertec Superbrain DOS 3 x	RK Perlec PCC 2000	A1 TRS-80 Model I + FEC	RM Vista V200 5.25 in. Double
COMPAL-80	Q2 ICOM 3712	R3 Intertec Superbrain QD	RS Processor Technology	RM Vista V200 5.25 in. Double	P6 Zenith 289 + Heath CP/M
CSSN Backup	T1 ICOM 3812	A1 Kontron PSI-80	RF Helios II	RP TRS-80 Model I + Omikron	P7 Zenith 289 + Lifeboat CP/M
Cromemco System 3	A1 ICOM 4511 5440 Cartridge	A1 MITS 3200-3202	B1 Quay 500	RP TRS-80 Model I + Omikron	P4 Zenith 289 + Magnolia
Cromemco Z2D	R6 CP/M	D1 MSD 5.25 in	RC Quay 520	RE 5.25 in	P7 Zenith 289 + Magnolia
Delta Systems	A1 ICOM 4511 5440 Cartridge	M1 Meca Delta-1 5.25 in	P6 RAIK Single Density	RM CP/M	
Digi-Log Microterm II	RD CP/M	M2 Micromation	A1 RAIK Double Density		
		D2 Micropolis Mod I	Q1 Research Machines 5 25 in		

Lifeboat Associates, 1651 Third Avenue, N.Y., N.Y. 10028
 (212) 860-0300 Telex: 640693



In Germany,
 Intersoft GmbH, Schlossgartenweg 5,
 D-8045 Ismaning Telephone 089/966-444 Telex: 5213643 isof
 In Switzerland,
 Lifeboat Associates GmbH, Aegeristr. 35, CH6340 Baar,
 Telefon: 042/31 2931, Telex: 865265 MICO CH

Listing 1 continued:

```

004E XX      TPC      (TPC)
004F XX      R        (R)

                                TPC
                                R

                                " MAIN

0054 8D AA      MAIN  BSR RUN      BRANCH TO SUBROUTINE RUN
0056 96 4F      LDA A # R      A=R
0058 BD FC BC      JSR REDIS     " SET UP DISPLAY ADDRESS
005B BD FE 3C      JSR OUTHEX    " DISPLAY CONTENTS OF A
005E 01 01 01      NOP          " SPACE FOR ANOTHER JSR
0061 20 F0      BRA MAIN        GO TO MAIN

                                " END MAIN

0080 00          (0,0)          " LOCATIONS $0080 THRU $00BF
0081 81          (0,1)          " RESERVED FOR TURING PROGRAM
00A0 81          (1,0)          " STATEMENTS
00A1 00          (1,1)          " (1,0) = (R,TPC)

0100 XX          " TAPE
THRU XX          " TAPE
01FF XX          " TAPE

                                " XX= LOCATION FILLED JUST PRIOR TO
                                " EXECUTION

```

Listing 2: Listing for implementation of the Practical Turing Machine in FORTRAN.

```

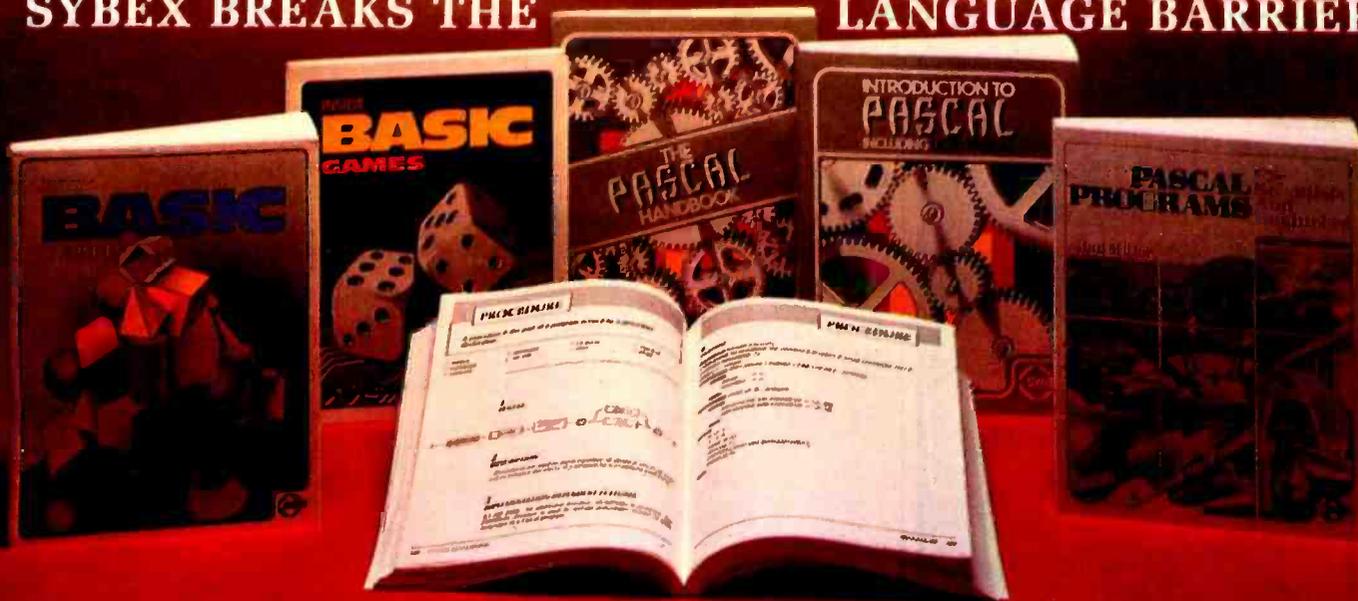
100 *          TURING
110 *          UNIVERSAL TURING MACHINE SIMULATOR. JIM WILLIS , PHYSICS DEPARTMENT
120 *          UNIVERSITY OF NORTH CAROLINA , CHAPEL HILL  NORTH CAROLINA.
130 *          DESIGNED TO RUN ON UNCCC'S VERSION OF IBM'S 360/370 CALL-OS
140 *          TURING
150 DIMENSION ITAPE(128)
160 INTEGER *2 W(2,64),D(2,64),ADR(2,64),TAPE(128),TPC,WI,DI,ADR1,T
170 DATA Y//Y//
180 1000      WRITE(3,100)
190 100      FORMAT(' HOW MANY SPACES IN THE TAPE? 128 MAX. ')
200      READ(1,*) MTAPE
210 IF(MTAPE.GT.128) MTAPE=128
220 1001      WRITE(3,102)
230 102      FORMAT(' INPUT TURING PROGRAM. W0 D0 ADR0 W1 D1 ADR1. W0=2 TO END')
240 NSTM=0
250 1      NDEX=NSTM+1
260 WRITE (3,103) NSTM
270 103      FORMAT(' STM. NO. ',I2)
280 READ(1,*)W(1,NDEX),D(1,NDEX),ADR(1,NDEX),W(2,NDEX),D(2,NDEX),ADR(2,NDEX)
290 IF(NSTM.EQ.64)GOTO 2
300 IF(W(1,NDEX).GT.1)GOTO 2
310 NSTM=NSTM+1
320 GOTO 1
330 2      WRITE(3,104)
340 104      FORMAT(' NO. W0 D0 ADR0 W1 D1 ADR1')
350 DO 3 I=1,NSTM
360 N=I-1
370 WRITE(3,105)N,W(1,I),D(1,I),ADR(1,I),W(2,I),D(2,I),ADR(2,I)
380 105      FORMAT(' ',4I4,' \',3I4)
390 3      CONTINUE
400 WRITE(3,106)
410 106      FORMAT(' INPUT FIRST TURING PROGRAM STM. NO. ')
420 READ(1,*)TPC

```

Listing 2 continued on page 144

SYBEX BREAKS THE

LANGUAGE BARRIER



Let the chips fall where they may. These two books on BASIC assure comprehension and competence.

INSIDE BASIC GAMES

by Richard Mateosian teaches interactive game design and BASIC programming through thorough analysis of eight different kinds of computer games. Programs are presented in Microsoft BASIC with versions for PET/CBM, TRS-80 and APPLE II. 350 pp., 120 illustr., Ref. B245, \$13.95

FIFTY BASIC EXERCISES

by J.P. Lamoitier provides the surest way of learning BASIC—actual practice. Graduated exercises, each containing a detailed explanation, flowchart and sample run, develop skill and competence rapidly. Applications include mathematics, business, operations research, statistics and more. 256 pp., 194 illustr., Ref. B250, \$12.95

Get in gear and accelerate your programming productivity with Pascal's power.

INTRODUCTION TO PASCAL

by Rodney Zaks is a simple yet comprehensive guide to standard and UCSD Pascals: step-by-step presentation with exercises for beginners, complex concepts and extensive appendices for experienced programmers. An indispensable book for everyone who wants to learn Pascal programming. 320 pp., 100 illustr., Ref. P310, \$14.95

THE PASCAL HANDBOOK

by Jacques Tiberghien is an easy-to-read, easy-to-use dictionary containing all the features for most existing versions of Pascal (Standard, Jensen-Wirth, OMSI, UCSD, HP1000, Pascal/Z). Over 180 entries, arranged alphabetically; each includes definition, description, syntax diagram, details of implementation, variations and examples. The perfect reference tool for any Pascal user. 500 pp., 150 illustr., Ref. P320, \$14.95

Scientists and engineers involved in significant work have been delayed by having to reinvent algorithms for a new computer language. No more.

AVAILABLE MAY 1981

PASCAL PROGRAMS FOR SCIENTISTS AND ENGINEERS

by Alan Miller is a comprehensive collection of frequently used algorithms for scientific and technical applications programmed in PASCAL. This time saving book includes programs for curve fitting, fast Fourier transform, approximations, random number generation, integrals, statistical techniques and more. 250 pp., 80 illustr., Ref. P340 \$16.95 paper, \$25.00 cloth

MORE SYBEX BOOKS

YOUR FIRST COMPUTER by Rodney Zaks 280 pp., 150 illustr., 2nd Edition, Ref. C200A, \$7.95

MICROPROCESSORS: FROM CHIPS TO SYSTEMS by Rodney Zaks 420 pp., 250 illustr., 3rd Edition, Ref. C201, \$12.95

MICROPROCESSOR INTERFACING TECHNIQUES by Rodney Zaks & Austin Lesea 464 pp., 400 illustr., 3rd Edition, Ref. C207, \$15.95

PROGRAMMING THE 6502 by Rodney Zaks 392 pp., 160 illustr., 3rd Edition, Ref. C202, \$12.95

6502 APPLICATIONS by Rodney Zaks 288 pp., 207 illustr., Ref. D302, \$12.95

6502 GAMES by Rodney Zaks 304 pp., 140 illustr., Ref. G402, \$12.95

PROGRAMMING THE Z80 by Rodney Zaks 620 pp., 200 illustr., 2nd Edition, Ref. C280, \$14.95

PROGRAMMING THE Z8000 by Richard Mateosian 312 pp., 124 illustr., Ref. C281, \$15.95

THE CP/M HANDBOOK (With MP/M) by Rodney Zaks 336 pp., 100 illustr., Ref. C300, \$14.95

SYBEX MAIL TO:
 SYBEX DEPT. B41
 2344 SIXTH STREET
 BERKELEY, CA 94710
 PHONE ORDERS:
 INSIDE CA 415/848-8233
 TOLL FREE OUTSIDE CA 800-227-2346

NAME _____ SEND ME YOUR FREE CATALOG
 ADDRESS _____
 CITY _____ STATE _____ ZIP _____
 ADD \$1.50/book UPS or 75¢/book 4th class mail or \$8/book overseas airmail
 (CA add tax) Total Amt. Enclosed _____ OR CHARGE MY VISA MC AM EX.
 CARD NO. _____ EXP. DATE _____
 SIGNATURE _____

or at book and computer stores everywhere

WHAT'S BETTER THAN AN ISAM

And Will Turn

MICROSOFT'S
BASIC
COBOL
FORTRAN
DIGITAL'S
PL/I-80
CBASIC
PASCAL/MT+
S-BASIC
CROMEMCO 16K BASIC
Into first class application
languages?

MICRO B+™

The first and most complete
implementation of **B-TREE**
index structures for micro-
computers. **B-TREES** eliminate
index file reorganization.

Search

An index of over
**10,000 Key
Values In Less
Than One
Second**

On A Floppy Disk System
for only

\$260.00!

System Houses:

MICRO B+™

Available in Language C

FAIR COM 2606 Johnson Drive
Columbia, MO 65201
(314) 445-3304

©1980 Fair Com

Shipping \$4 USA / \$8 Foreign
We accept VISA and MASTERCARD

PL/I-80 is a trademark of Digital Research
CBASIC is a trademark of Compiler Systems, Inc.
S-BASIC is a trademark of Topaz Programming
PASCAL/MT+ is a trademark of MT Micro Systems

Listing 2 continued:

```

430 WRITE(3,107)
440 107 FORMAT(' HOW MANY TIMES THROUGH THE TAPE?')
450 READ(1,*)MIT
460 WRITE(3,119)
470 119 FORMAT(' INPUT CHARACTER FOR ZERO. ')
480 READ(1,120)IZERO
490 120 FORMAT(A1)
500 WRITE(3,121)
510 121 FORMAT(' INPUT CHARACTER FOR ONE. ')
520 READ(1,120)IONE
530 "
540 " INITIALIZE TAPE TO ZERO
550 "
560 DO 4 I=1,MTAPE
570 TAPE(I)=0
580 4 CONTINUE
590 KIT=0
600 "
610 " TAPE LIST ROUTINE
620 "
630 KTAPE=1
640 9 KIT=KIT+1
650 DO 32 N=1,MTAPE
660 ITAPE(N)=IZERO
670 IF(TAPE(N).EQ.0)GOTO 32
680 ITAPE(N)=IONE
690 32 CONTINUE
700
710
720
730
740 WRITE(3,118)(ITAPE(I),I=1,MTAPE)
750 118 FORMAT(129A1)
760 IF(KIT.EQ.MIT)GOTO 99
770 "
780 " RUN
790 "
800 200 CONTINUE
810 TPC=TPC+1
820 T=TAPE(KTAPE)+1
830 DI=D(T,TPC)
840 TAPE(KTAPE)=W(T,TPC)
850 IF(DI.EQ.1)GOTO 201
860 KTAPE=KTAPE-1
870 IF(KTAPE.LT.1)KTAPE=MTAPE
880 GOTO 202
890 201 KTAPE=KTAPE+1
900 IF(KTAPE.GT.MTAPE)KTAPE=1
910 202 TPC=ADR(T,TPC)
920 IF(KTAPE.EQ.MTAPE)GOTO 9
930 GOTO 200
940 99 WRITE(3,108)
950 108 FORMAT(' WANT TO CHANGE THE TAPE LENGTH?')
960 READ(1,109)ANSWER
970 IF(ANSWER.EQ.Y)GOTO 1000
980 109 FORMAT(A1)
990 WRITE(3,110)
1000 110 FORMAT(' WANT TO REPROGRAM?')
1010 READ(1,109)ANSWER
1020 IF(ANSWER.EQ.Y)GOTO 1001
1030 GOTO 2
1040 END
    
```

4.4 MEGABYTES FOR YOUR APPLE



Double-Sided, Double-Density 8-Inch Drive Capability is Here ... Now!

The new LOBO DRIVES Model LCA-22 Double Density Floppy Disk Controller has been specifically designed to match your APPLE® to the new double-sided, double-density 8-inch floppy disk drives. Now, you can add up to four 1.1 Megabyte drives (4.4 Megabytes total) and realize all the power and potential of your APPLE computer.

Completely Software transparent, the Model LCA-22 will plug into any chassis slot. You are no longer restricted to slot 7. And, the Model LCA-22 is fully compatible with 3.2. (3.3 DOS systems, PASCAL will be available soon.)

LOBO's new LCA-22 Disk Controller and full line of field-proven, high-reliability disk drives (all LOBO products come with a one year, 100% parts/labor warranty) are available at computer retail stores nationwide. Stop in and see a demonstration at your local dealer today.



LOBO DRIVES INT'L
354 South Fairview Ave.
Goleta, CA 93117
(805) 683-1576

I'm looking to expand my APPLE. Please send me more information on:

- | | |
|---|--|
| <input type="checkbox"/> Model LCA-22 Disk Controller | <input type="checkbox"/> Fixed Disk Drives |
| <input type="checkbox"/> Floppy Disk Drives | <input type="checkbox"/> 5¼-Inch |
| <input type="checkbox"/> 5¼-inch | <input type="checkbox"/> 8-inch |
| <input type="checkbox"/> 8-inch | <input type="checkbox"/> 14-inch |

Name _____

Address _____

City _____ State _____ Zip _____

Phone _____
(area code)

See us at the NCC, booth 4211.

NO FRILLS!
NO GIMMICKS!
JUST GREAT
DISCOUNTS
MAIL ORDER ONLY

ATARI 800

Personal Computer System **\$79900**

NORTHSTAR

Horizon II 32K **234900**
Horizon II Quad **279900**
Horizon II 64K **299900**
Horizon Quad 64K **339900**

TELEVIDEO

912 **74900**
920 **79900**

HAZELTINE

1420 **79500**
1500 **84900**
1510 **104900**
1520 **122900**

OKIDATA

Microline 80 **55900**

SOROC Technology

IQ 120 **69900**
IQ 140 **99900**

CROMEMCO

System 3 **569500**
Z2H **799500**

TELETYPE

43 **94900**
Acoustic Coupler **17900**

DECwriter IV

LA34 **97900**

TEXAS INSTRUMENT

810 Multi Copy
Impact Printer **149900**

We'll meet or beat any advertised prices!

Most items in stock for immediate delivery.
Factory sealed cartons. Full manufacturer's guarantee.

DATA DISCOUNT CENTER

135-53 Northern Blvd., Flushing, N.Y. 11354
Visa • Master Charge • N.Y.S. residents add Sales Tax
Shipping F.O.B. N.Y.

Phone Orders Call 212-465-6609

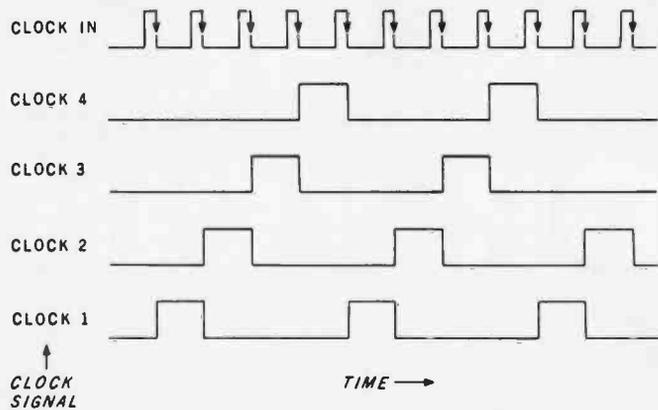


Figure 5: Timing diagram for the four-phase clock. The signals shown here are generated by IC23 and IC24 in figure 3a. Note that within the schematic of figure 3c, the inverted counterparts of clock 2 and clock 3 are also used.

Text continued from page 138:

● entering the DO-0054 command into the trainer (this begins program execution at hexadecimal location 0054).

The value of R is displayed continuously on the leftmost LED of the trainer.

The microprocessor representation of the PTM is easier to implement than the hardwired version. Changes in the length of the tape or the maximum number of program statements are relatively easy to make, but the microprocessor is very slow compared with the hardwired version. Subroutine RUN requires about 150 μ s per cycle as compared with 2 μ s for the hardwired version.

A FORTRAN Version

One of the most useful and comprehensible representations of a PTM is one written as a high-level language program. Listing 2 is a source listing for an interactive FORTRAN program that can be used to simulate a PTM. The run section of this program follows the flowchart in figure 2.

The program is stored in three arrays dimensioned W(2,64), D(2,64), and ADR(2,64). The maximum length of the tape is 128 characters. A shift is made in the subscripts to allow R=0 and TPC=0. Output characters for the tape are chosen by the user rather than being restricted to 0 and 1. Program statements are entered as six-component vectors and can be readily changed. The most important variables are available interactively to the user.

Summary

We have implemented the Practical Turing Machine in three forms—as a hardwired circuit, a 6800 machine code program, and a FORTRAN program. We have found that the hardwire version is the fastest but the most difficult to run or modify, and that the FORTRAN version is the easiest to modify but the slowest in execution. The microprocessor version is a compromise in both speed and utility. ■

Acknowledgments

I would like to thank Tom Ainsworth for his help in the design of the hardwired version, Dr W J Thompson for his guidance during the project, and Alice Glenn for her help in the preparation of the manuscript. The research for this article was supported in part by the United States Department of Energy.

References

1. Arbib, M. *Brains, Machines, and Mathematics*. New York, McGraw-Hill Book Company, 1964.
2. Bernstein, J. "When the Computer Creates." *New York Times Magazine*, February 15 1976.
3. Millen, J.K. "A Universal Turing Machine." December 1976 *BYTE*, pages 114 thru 119.
4. Minsky, M L. *Computation: Finite and Infinite Machines*. Englewood Cliffs NJ: Prentice-Hall, 1967.
5. Munnecke, Thomas. "Designing a Universal Turing Machine: a Software Approach." December 1979 *BYTE*, pages 26 thru 30.
6. Turing, A M. "On Computability with an Application to the Entscheidungsproblem." *Proceedings of the London Mathematical Society*, Volume 42, 1936, pages 230 thru 265.

For those special people who've stepped ahead with a mini-computer



Maxell offers a way to stay ahead.

A Maxell 5 1/4" Mini-Disk will consistently let you maximize the capability of your system today. And as your involvement with it grows, tomorrow as well. Maxell Mini-Disks are all made with the same exacting 100% certification and critical dependability of the Maxell 8" Floppy Disk. So you know your 5 1/4" Maxell Mini-Disks meet or exceed the same ISO and Shugart specifications industry requires.

There are double density Maxell single and double-sided 5 1/4" Mini-Disks for soft and hard sector systems. And 8" Maxell Floppy Disks for every disk drive configuration. See your computer supply dealer or write to us for more information. If you are a computer products dealer, write for the growing opportunities Maxell Business Products Division offers you with our 8" Floppy and 5 1/4" Mini-Disks.

maxell 
BUSINESS PRODUCTS DIVISION

Maxell Corporation of America, Business Products Division, 60 Oxford Drive, Moonachie, N.J. 07074 Tel: 201-440-8020

System Notes

A Relocatable Bootstrap for the Tarbell Disk Controller

Hector M Smith
9852 Dandelion Ave
Fountain Valley CA 92708

Some Z80 microprocessors do not work properly with the Tarbell disk-controller ROM (read-only memory). For example, Ithaca Intersystems recommends that the bootstrap program be relocated to high memory and that a power-on jump to it should be executed. You can make the program independent of memory location by using the Z80 relative-jump instruction.

Listing 1 is a relocatable version of the Tarbell bootstrap loader. Relative jumps are included at hexadecimal locations 0010 and 0016. A test bit instruction is located at hexadecimal 000E.

The original 8080 code is shown in listing 2. In the

code, at hexadecimal locations 000E and 000F, ORA resets the sign flag if the MSB (most significant bit) of INTRQ is 0. If this is the case, JP jumps to RDONE.

Because the Z80 does not have a relative jump instruction activated by a positive test, BIT 7,A is used to check if bit 7 (INTRQ) is 0. If it is, a jump relative to RDONE is executed. At hexadecimal location 0016, a jump relative to RLOOP and NOP was substituted for the original jump.

The modified bootstrap (listing 1) can be located anywhere in memory. A jump to it will boot the CP/M operating system. ■

Listing 1: A Z80 relocatable bootstrap program for the Tarbell disk controller. The mnemonics are TDL Assembler.

ADDR	MACH	LABEL	ASY	LANGUAGE	COMMENTS
CODE					
0000	DB FC	BOOT:	IN	WAIT	;WAIT FOR HOME.
0002	AF		XRA	A	;COMPLETE.
0003	6F		MOV	L,A	;SET L=0.
0004	67		MOV	H,A	;H&L=0.
0005	3C		INR	A	;SET A=1.
0006	D3 FA		OUT	SECT	;SECTOR=1.
0008	3E 8C		MVI	A,8CH	;READ SECTOR.
000A	D3 F8		OUT	DCOM	
000C	D2 FC	RLOOP:	IN	WAIT	;WAIT FOR DRQ OR INTRQ.
000E	CB 7F		BIT	7,A	;TEST BIT 7
0010	28 07		JRZ	RDONE	;DONE IF INTRQ
0012	DB FB		IN	DDATA	;READ A BYTE OF DATA.
0014	77		MOV	M,A	;PUT INTO MEMORY.
0015	23		INX	H	;INCREMENT POINTER
0016	18 F4		JMPR	RLOOP	;DO IT AGAIN
0018	00		NOP		;FILLS EMPTY SPACE
0019	DB F8	RDONE:	IN	DSTAT	;READ DISK STATUS.
001B	B7		ORA	A	;SET FLAGS.
001C	CA 7D 00		JZ	07DH	;IF ZERO, GO TO SBOOT.
001F	76		HLT		;DISK ERROR, SO HALT.
		WAIT	=	OFCH	
		SECT	=	OFAH	
		DCOM	=	OF8H	
		DDATA	=	OF8H	
		DSTAT	=	OF8H	

Listing 2: Original 8080 code before modification for the Z80 microprocessor.

000E	B7	ORA	A
000F	F2 19 00	JP	RDONE
0016	C3 0C 00	JMP	RLOOP

Lifelines.

The serious publication for the serious software user.

WHAT LIFELINES READERS
READ ABOUT IN
MARCH

March 1981 Vol. 1 Issue #10

LIFELINES

- From the Software Evaluation Group:
A Review of the Configurable Business System
- Osborne/McGraw-Hill's General Ledger, a Tutorial by One of Its Authors.
- BASIC Comparisons: An Introduction to SBASIC.*
- Details on Volume 48 from The CP/M Users Group.*
- Some Biting Comments on the Industry from the Mysterious Zoso.

Lifelines is the publication dedicated to keeping you up-to-date on happenings in the explosive micro-computer world.

Lifelines specializes in news about software for CP/M* and similar operating systems.

Lifelines does it with a guarantee of high level, in-depth analysis of software uses and capabilities.

Lifelines does it with valuable information necessary to make intelligent software buying decisions.

Lifelines does it with the latest information on The CP/M Users Group.

Lifelines does it with thought provoking discussions on many of the more controversial issues facing computer users.

How can you live without Lifelines?

Subscribe Now!

\$18.00 for twelve issues: U.S., Canada, and Mexico.

\$40.00 for twelve issues: all other countries.

\$2.50 for each back issue: U.S., Canada, and Mexico.

\$3.60 for each back issue: all other countries.

All orders must be pre-paid by check to: LIFELINES, 1651 Third Avenue, New York, N.Y. 10028—Checks must be in U.S. \$, drawn on a U.S. bank. Or use your VISA or MASTERCARD. Call (212) 722-1700

LIFELINES



*SBASIC is a trademark of Topaz Programming

*CP/M is a trademark of Digital Research, Inc.

The CP/M Users Group is not affiliated with Digital Research, Inc.

A Closer Look at the TI Speak & Spell

Peter Vernon
31 Georgina St
Newtown NSW 2042
Australia

Congratulations to Michael Rigsby on his article "Dissecting the TI Speak & Spell" (September 1980 BYTE, page 76). He is not alone in desiring an economical voice-output device for his computer, and the Speak & Spell is an excellent choice. Economy is one reason, and the circuitry of this device has features that make it potentially one of the most flexible and comprehensive speech synthesizers available.

The problem is how to interface the Speak & Spell to a computer. Mr Rigsby's approach is the first step, but it allows only a spelling computer, not a talking one. In order to achieve more, it is necessary to know something about the workings of the device. This information is difficult to obtain. Texas Instruments has not been very informative, although considering the investment it has in speech technology this is perhaps understandable. Thus, the Speak & Spell is an irresistible challenge to the experimenter.

Mr. Rigsby has, however, made one fundamentally incorrect assumption: the TI Speak & Spell is most definitely *not* based on the SN76477N complex-sound generator, nor does it store words, or even phrases, as individual pulses in memory. As I will show, it uses an entirely different technique.

The Heart of the Unit

The TMC0281NL is a proprietary Texas Instruments integrated circuit that is virtually an entire digital signal processor, with timing and decoding circuits, a 10-pole digital lattice filter, and a D/A (digital-to-analog) con-

verter. All of this is contained on a tiny piece of silicon just 44 mils square. This is the heart of the speech synthesizer.

Also on the board is the controller, the TMC0271NL, which is a member of the TMS-1000 microprocessor family. The TMC0271 shares the same basic architecture as the TMS-1000 used in TI's calculators, but it has been modified to enhance its BCD (binary-coded decimal) arithmetic capabilities. It also has an expanded instruction set and an output multiplexer to reduce the number of pinouts required in its role as a controller for the speech synthesizer IC (integrated circuit).

The Speak & Spell is an irresistible challenge to the experimenter.

As Mr Rigsby guessed, the other two integrated circuits on the board are high-density ROMs (read-only memories). The TMC0350 family are 128 K-bit ROMs, organized as 16 K by 8 bits. They incorporate an internal 18-bit address counter/register and two 8-bit output buffers, with the four high-order bits of the address driving a 1-of-16 device-select decoder and the other 14 bits addressing the ROM array directly.

Linear Predictive Coding

The circuitry is only part of the story. The real secret of the Speak & Spell and other Texas Instruments speech-synthesis devices is a tech-

nique called LPC (*linear predictive coding*). This technique makes it possible to encode a complex speech waveform with relatively little data. A speech signal is highly redundant, made up of a few basic waveforms that are repeated to produce speech sounds. Essentially, LPC eliminates the redundancy inherent in the speech signal and retains only the data required to drive the speech synthesizer.

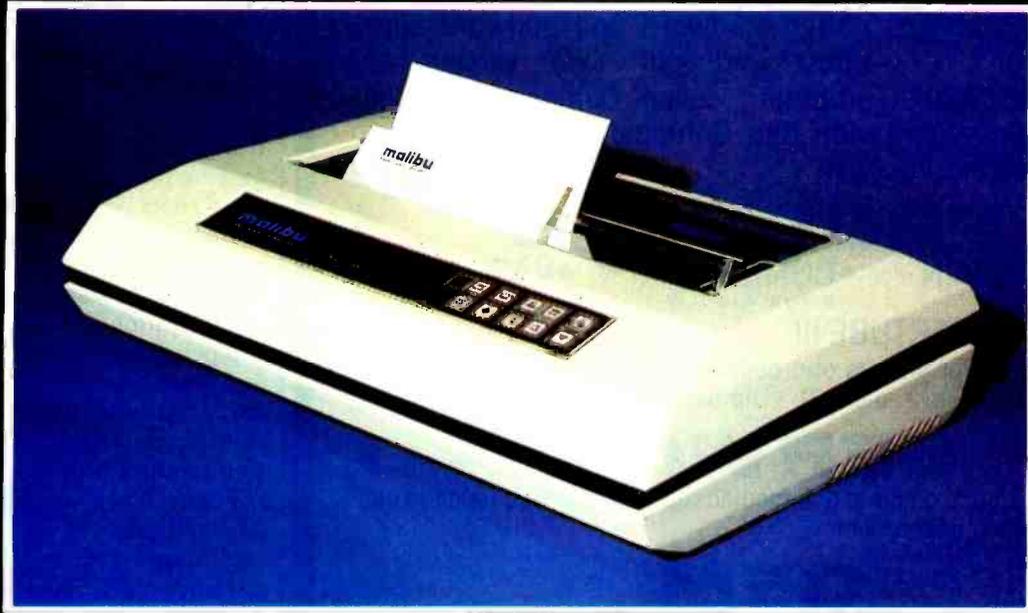
The TMC0281 can be thought of as an electronic model of the human vocal tract. The data input is a description of the filter parameters necessary to model the vocal tract as its characteristics change over time. Codes for twelve synthesis parameters are stored in the ROMs. These parameters are ten filter coefficients, and pitch and energy information.

The filter parameters are derived from samples of actual speech and are encoded by a complex mathematical algorithm that makes it possible to predict a speech waveform based on information derived from previous waveforms. Because of the finite-time response of the human vocal tract, only a fixed number of speech sounds can follow a particular vocalization.

To produce speech, the controller specifies the starting point of a string of data stored in the ROMs. The ROM output provides the pitch, amplitude, and filter parameters from which the synthesizer constructs the speech waveform.

The input to the filter is either a periodic or random sequence of pulses. A random sequence of pulses is used to recreate unvoiced sounds,

The One Printer Solution for the Two Printer Problem.



HIGH SPEED DATA PROCESSING

The new Dual-Mode 200 brings speed and uncompromising print quality to business and professional applications.

Financial statements, inventory reports, labels and more are printed at data processing speeds from 165 cps to 250 cps.

Fully adjustable tractors and a friction feed platen provide precise forms handling for pin-feed and single sheet paper.

Complete "Dot Control" graphics is standard with resolution to 120 x 144 dots per inch.

Interfacing is easy with both E.I.A. RS-232C serial and an ASCII parallel port.

LETTER QUALITY WORD PROCESSING

The Dual-Mode 200 also features letter perfect print you will be proud to use for business letters and reports. Letter Mode speeds range from 42 cps to 60 cps.

The standard Titan 10 pitch font is complemented by an array of optional fonts including Elite 12 pitch, italics, proportionally spaced, OCR-A, scientific and foreign character sets.

Up to 12 font selections may be stored in the printer and interchanged while printing.

The Dual-Mode 200 accepts standard daisy-wheel print commands for word processing system compatibility.

It's the perfect solution for the two printer problem.

The Dual-Mode 200 Printer for the one printer office.

Call or write today for complete specifications

2301 Townsgate Road, Westlake Village, CA 91361, (805) 496-1990

a subsidiary of Datameetrics Corporation

malibu
Electronics Corporation

DOTS DO IT BETTER™

ATTENTION DEALERS

SUPERBRAIN & COMPUSTAR



We're the West's largest distributor of Intertec products to dealers. We offer hardware and software support and our own version of Intertec's CARE® program, called Comdex. We sell Superbrains world-wide and Compustars in our region. Our prices are the best!

PRODUCTS

- SUPERBRAIN
64k, QD Models
- COMPUSTAR
Models 10, 15, 20, 30, 40
- HARD DISCS
10, 32 & 96 mb
- INTERTUBE III
- EMULATOR

Plus a full line of printers and peripheral equipment, including MPI, NEC, QUME, C.Itoh, Anadex, TI, Vista and others.

SERVICE

Rapid turnaround on parts and module replacement, and repair in our trained service department.

OEM

We have the best prices on Intertec products to the OEM market, and we make available the same fast service on parts, modules and warranty repairs.

SOFTWARE

We're more than order-takers. Our software specialists stand ready to give our dealer network the support you want and need to make you successful. Our Superbrain software is the best and you'll like our prices.

	C BASIC	M BASIC
Accounts Receivable.....	X	X
Accounts Payable.....	X	X
General Ledger.....	X	X
Payroll.....	X	X
Restaurant Payroll.....	X	
Job Costing.....	X	X
Mailing List (NAD).....	X	X
Restaurant Menu Costing and Inventory.....	X	
Client Billing.....	X	
Inventory.....	X	X

LANGUAGES

C Basic
M Basic
Pascal (UCSD)
Fortran
Cobol

UTILITY PROGRAMS

Pearl, Q Sort and Link 80

WORD PROCESSING

Magic Wand, Word Pro,
Word Star, Data Star

PEACHTREE SOFTWARE

- BUY ONE PROGRAM
OR ANY

FOR ORDERING CALL

TOLL FREE 1-800-426-2963

PHONE (206)453-9777 TELEX: 152 556 TAC



A Division of Computer Marketing Corporation

INTERNATIONAL

11058 Main, Suite 125, Bellevue, WA 98004

such as "f" or "s," while a periodic sequence creates voiced sounds such as "a." The pitch information either varies the frequency of the periodic pulses or, if all the bits are zero, selects random noise as the input to the lattice filter. An amplification factor is also input to the synthesizer and adjusts the amplitude of the excitation source to produce sounds of varying intensity.

The lattice filter of the synthesizer has ten stages. Each stage carries out two multiplications and two additions on its two digital inputs before passing the results backward and forward to its neighbors. The operations of the ten stages are carried out sequentially, as are the operations within each stage. Through careful consideration of timing and the use of a pipeline approach, only one adder and one multiplier are needed to carry out the mathematical operations. Each separate arithmetic operation requires only 6 μ s.

Figure 1 is a block diagram of the basic elements of the TMC0281. The multistage lattice filter uses the parameters K_1 thru K_n to digitally filter the amplified excitation signal, and passes its output to a D/A converter connected to the speaker.

The coefficients of the filter are updated approximately every 20 ms. However, because of the redundancies in speech patterns, a complete set of parameters is not always required. Sections of the data stream may be replaced by a single "repeat" bit, cutting the data required to control the filter from a maximum of 49 bits to a minimum of 4, thus conserving memory space.

During speech the TMC0281 accesses the ROMs directly until it receives an end-of-phrase command and returns control to the TMC0271 controller. Five lines are used to transfer data and commands within the system. One of these lines is the processor data clock, which determines when the data on the other four lines is valid. These are the five lines mentioned by Mr Rigsby.

Timing

Timing for the synthesizer is based on a 50 Hz frame rate—so a new speech segment is read from the ROM every 20 ms. The speech patterns coded in the ROM are sampled at a rate of 10 kHz, which corresponds to the maximum bandwidth of speech—5

FLOATS LIKE A BUTTERFLY™

Introducing the Butterfly™ switch. The first Key Tronic capacitive keyboard with linear feel. For years our customers have been successfully using tactile feel, however, we've had input from the field that a lot of you like linear feel. Key Tronic now offers both. We want to be your keyboard supplier.

This patented solid-state keyboard uses the same electronics as our proven tactile design. You still get N-key rollover (a must in any medium to high speed data entry environment) at no extra charge. The same double-shot

molded keytops with over 20,000 legends and over 300 shapes are still available from the leader.

Please call or write for further information. You'll be glad you did.



 **key tronic**
INTERNATIONAL KEYBOARDS

P.O. BOX 14687 SPOKANE, WASHINGTON 99214 U.S.A. PHONE (509) 928-8000 — TWX 510 773-1885

The reachable star.

modern with exclusive 100-watt acoustic cups, crystal controlled oscillator, and built-in diagnostics and indicators. It's packaged inside an attractive injection molded case...and we stand behind the STAR with a two year warranty!

STAR models are available that interface directly with RS232 machines such as APPLE, ATARI, and NORTH STAR or IEEE 488 machines such as the PET, and that operate with either U.S. or European frequencies.



Available throughout the U.S., Canada, and Europe. For information and nearest dealer, call toll free (800) 227-2078, or (415) 447-2252 in California.

Livermore
DATA SYSTEMS INC.

2050 Research Drive, Livermore, CA 94550

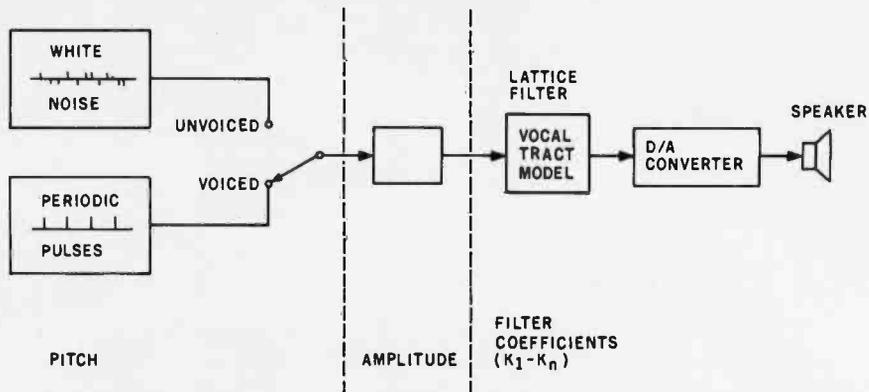


Figure 1: Block diagram of the heart of the TI Speak & Spell—the Texas Instruments TMC0281NL integrated circuit. The TMC0281NL is a proprietary circuit that is virtually an entire digital signal processor and can be thought of as an electronic model of the human vocal tract. It includes timing and decoding circuits, a 10-pole digital lattice filter, and a D/A converter. Speech synthesis takes place through a process called LPC (linear predictive coding), which makes it possible to encode a complex waveform with relatively little data. Either pseudo-random noise (for unvoiced sounds) or periodic pulses (for voiced sounds) are amplified and fed to the lattice filter, which models the vocal tract in accordance with coefficients stored in two external 16 K by 8-bit ROMs (read-only memories). A maximum of 49 bits is needed to specify each sound pattern, which is updated every 20 ms. This results in an overall data rate of 2400 bps (bits per second). The TMC0281NL is controlled by a TI TMC0271 microprocessor, a specialized member of the TMS-1000 microprocessor family.

kHz. (The maximum bandwidth for telephone-quality speech is 3.5 to 4.5 kHz.) An 800 kHz oscillator is divided by four to produce the major system clock. This four-phase clock controls the transfer of data within the system. The individual bit patterns in each 20 ms frame are clocked into the synthesizer at a rate corresponding to the sample frequency of 10 kHz. It is this clock which produces the 0.1 ms pulses measured by Mr Rigsby.

A maximum of 49 bits is needed to specify the sound pattern that will be produced every 20 ms. This is an overall data rate of about 2400 bps (bits per second). One hundred seconds of speech time thus requires the storage of 240,000 bits of information, which corresponds well with the 256,000 bits of storage provided by the two TMC0351 ROMs.

Capabilities and Challenge

Because the Speak & Spell reconstructs speech sounds from a constant-excitation signal filtered under digital control, it is potentially capable of reproducing any sound at all. The challenge for the experimenter is to determine what information needs to be input to create a particular sound. Trial and error seems to be the only approach. With

much work it would be possible to determine which combinations of data are needed to produce each phoneme of the English language. (All words are made up of combinations of particular sound units called *phonemes*. About 42 phonemes are used in the English language.) These phoneme patterns could be stored in memory and arranged to produce any word. At 49 bits per phoneme and 42 phonemes, only 2058 bits are required. The problem is, of course, to find the right bits.

Perhaps the best place to start would be the connector provided for the attachment of expansion modules. The module-select key on the keyboard of the Speak & Spell is used to signal the controller that an expansion module is in place and that it should instruct the synthesizer to access this module rather than the ROMs on the main circuit board. By using this signal it is possible to force the synthesizer to accept data that is input on the module connector. The system clock can be used to govern the rate of this data input. Experimenting with this approach produces a weird and wonderful series of sounds. At present, my computer (an Exidy Sorcerer) can only grunt and squeak, but after all, that's how we all started! ■

SSS ANSI '66 STANDARD FORTRAN IV WITH RATFOR

FOR CP/M



TOGETHER AT LAST

SSS FORTRAN & RATFOR are the critic's choice!

The SSS FORTRAN compiler is fast, efficient, and complete (full 1966 ANSI standard with extensions). The RATFOR compiler compiles into FORTRAN allowing the user to write structured code while retaining the benefits of FORTRAN. Together they form an incredible team!

SSS FORTRAN Specifics

SSS FORTRAN makes full FORTRAN IV available to microcomputers. SSS FORTRAN meets and exceeds the ANSI 1966 FORTRAN standard. The compiler supports many advanced features not found in less complete implementations, including: complex arithmetic, character variables, and functions. SSS FORTRAN will compile up to 600 lines per minute! Recursive subroutines with static variables are supported. ROMable ".COM" files may be generated.

FEATURES

- Code generation: ROMable ".COM" files or intermediate code files (saves disk space). External routines may be called.
- Data types: Byte, integer, real, double precision, complex, logical, character and varying length strings.
- Operations: All standard operations plus string comparisons, assignments, and .XOR.
- Constants: Hexadecimal, decimal, and character literals with features to imbed control characters.
- Statements: ANSI 1966 standard with multiple statement lines, statements may end with a ".".
- Controls: Map, List, and Symbol table output options.
- I/O: Read, Write, Append, Rewind, Close, Delete, Rename, Search, sequential and Random I/O on disk files. Supports all CP/M devices. The User can add device handlers to use custom I/O devices.
- Errors: Over 200 distinct compiler error messages, precision and illegal instruction warnings during execution.
- Interrupts: FORTRAN programs may be interrupted at any time; the stack pointer is always preserved.

FEATURING

SSS RATFOR

RATFOR is a preprocessor that compiles to SSS FORTRAN. SSS RATFOR allows the use of contemporary loop control and structured programming techniques. SSS RATFOR is similar to FORTRAN '77 in that it supports such things as:

REPEAT ... UNTIL WHILE IF ... THEN ... ELSE
Begin End Brackets Macro Defines

SSS RATFOR is supplied with *source code*. The source code is distributed in both RATFOR and SSS FORTRAN. Not only does this prevent obsolescence, but allows the user to add enhancements as desired.

System Requirements & Prices

SSS FORTRAN requires a 32k CP/M system. Z80 only.

SSS FORTRAN with RATFOR: \$325.00

SSS FORTRAN alone: \$250.00

RATFOR alone: \$100.00

(Sold only with valid SSS FORTRAN license)

CP/M Formats: 8" soft sector, 5" Northstar, 5" Micropolis Mod II, Vector MZ, Superbrain DD/QD

All Orders and General Information:
SUPERSOFT ASSOCIATES
P.O. BOX 1628
CHAMPAIGN, IL 61820
(217) 359-2112
Technical Hot Line: (217) 359-2691
(answered only when technician is available)



*CP/M REGISTERED TRADEMARK DIGITAL RESEARCH

SSS FORTRAN is the copyright of
Small Systems Services, Urbana, Illinois

SuperSoft

First in Software Technology

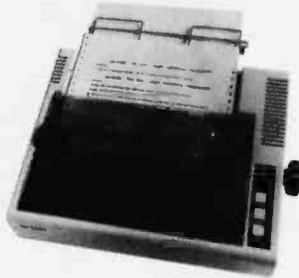
EAST COAST OFFICE

ΩMEGA SALES COMPANY

CALL TOLL FREE 1-800-556-7586

2ND SPECIAL OF THE MONTH!!

**EPSON
MX-80
PRINTER**

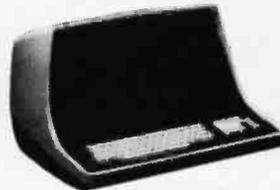


\$479

INTERFACES: APPLE INTERFACE & CABLE \$90, RS*232-\$70,
IEEE \$55, TRS*80 CABLE \$35



**ATARI 800
\$75900**



**INTERTEC
SUPERBRAIN**
32K - \$244900
64K - \$264900
QD - \$319500

**NORTHSTAR
HORIZON II
32K QUAD. DENS.
\$297500**

NEC MONITOR \$21900



ATARI 400
8K - \$39900
16K - \$49900

**RADIO SHACK
16K LEVEL II
MODEL 3
\$87500**

**RADIO SHACK
64K MODEL 2
\$344900**

**ANADIX
DP-9500
\$124900**

SOROC
120 - \$630
140 - \$949
available in limited quantities

TELEVIDEO 912C - \$67900, 920C - \$73900

- 4. Stock shipments shipped usually same day or next day.**
- 5. All equipment factory fresh with manufacturer's warr.**
- 6. No hidden charges - We live by our published prices.**

**ΩMEGA SALES Co - EAST COAST - 12 MEETING ST.
CUMBERLAND, RI 02864 TEL 1-401-722-1027**



PRICES SUBJECT TO CHANGE WITHOUT NOTICE.



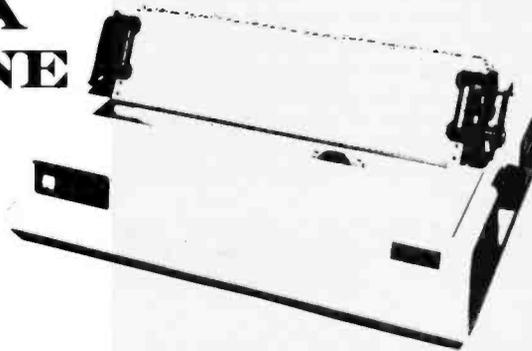
WEST COAST GRAND OPENING!!!

ΩMEGA SALES COMPANY

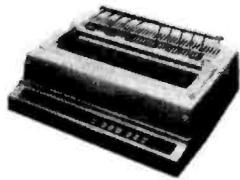
CALL TOLL FREE 1-800-235-3581

**GRAND OPENING
SPECIAL OF THE MONTH!!**

**OKIDATA
MICROLINE
83**



\$929



**DIABLO
630
\$199500**
(TRACTOR \$200)



**NEC
SPINWRITER
5510-5530
\$239500**
(TRACTOR \$200)

**APPLE II+
48K-\$115000**

**C. ITOH STARWRITER 25
PARALLEL OR SERIAL.
\$149500**



**APPLE DISK DRIVE
DOS 3.3 w/CONTROLLER
\$54500**

**OKIDATA
MICROLINE-80
\$46900**

**BASE II
\$64900**

**CBM
CALL
FOR
PRICE**

**HAZELTINE
1420
\$799**

- 1. TWO LOCATIONS TO SERVE YOU BETTER.**
- 2. NO SURCHARGE FOR CREDIT CARDS.**
- 3. WE ACCEPT C. O. D.'S.**

**ΩMEGA SALES Co - WEST COAST - 3353 OLD CONEJO RD #102
NEWBURY PARK CA 91320 TEL 1-805-499-3678**

Clubs and Newsletters

Zips 00000—10000

1. *Syntax ZX80*
2. The Harvard Group, Bolton Rd, RD 2, Box 457, Harvard MA 01451
3. Ann Zevnik, Editor, (617) 456-3661
5. News about the Sinclair ZX80 microcomputer.

1. Gosub TRS-80 Users Group
2. POB 712 Worcester MA 01613
3. Jim Mercanti, (617) 845-1851, (617) 458-7263
4. Gosub TRS-80 Users Group Buffer
5. Noncommercial.

1. TRUGEM (TRS-80 Users Group of Eastern Massachusetts)
2. 3 Driscoll Dr, Framingham MA 01701
3. Ronald M Egalka, Secretary, (617) 877-4520
4. *The TRUGEM Newsletter*
5. TRS-80 hardware and software; peripherals from Radio Shack and independents; Programs Exchange Library (non-commercial); demonstrations and sales of commercial hardware and software encouraged.

1. New England Computer Society
2. POB 198 Bedford MA 01730
3. Bob Waite, President (617) 448-6351 home; (617) 897-3221, ext 2499, work
4. *NECS Newsletter*
5. User Groups: PET, Apple, 6800, Digital Group, and TRS-80. CBBS (Computerized Bulletin Board System), (617) 864-3819.

1. The Boston Computer Society

DIRECTORY

The following is the fourth BYTE Clubs and Newsletters Directory. The directory was compiled from information supplied by the various clubs listed. A form was sent to all clubs and newsletters listed in the third directory requesting up-to-date information. If the form was not returned, we deleted the club from the fourth directory. In addition, the listing was correlated with back issues of the magazine and materials on file in the BYTE offices. If information is missing in one or more categories, it means the data was not provided. We will be keeping the file available and updating it for the next directory; so, if there are errors, omissions, or if you have a new club that has just been formed, send the information to Charley Freiberg, Clubs and Newsletters Editor, BYTE Publications Inc, POB 372, Hancock NH 03449.

The listing follows this form: 1. Name of organization or name of publication; 2. Mailing address; 3. Contact person and telephone number; 4. Newsletter or publication; 5. Special interests.

2. 3 Center Plz, Boston MA 02108
3. (617) 720-0597
4. *The Boston Computer Society Update* (an enormous publication with nationwide industry exclusives and news of New England)
5. User Groups: PET, Sorcerer, OSI, North Star and others. Subgroups: education, business applications, Pascal and beginner tutorials.

1. *Classroom Computer News*
2. POB 266, Cambridge MA 02138
3. Lloyd Prentice, (617) 787-0420
5. This bimonthly newsletter is interested in education, curriculum development, and related topics.

1. Technical Education Research Centers
2. 8 Eliot St, Cambridge MA 02138
3. Robert Tinker, Director or Susan Warner-Mills, Assistant, (617) 547-3890
4. *Hands On!* (A Forum for Science and Technology Educators)

5. Applications to education, especially science.

1. RICH (Rhode Island Computer Hobbyists)
2. POB 599, Bristol RI 02809
3. Emilio D Iannuccillo
4. Yes
5. We are an active group dedicated to keeping abreast of current technology, plus lending a hand to each other regarding hardware and software. We also give help and advice to newcomers into the world of microprocessors.

1. PIE (PET Information Exchange)
2. 27 Leicester Way, Pawtucket RI 02860

1. SNAC (Southern New Hampshire Apple Core)
2. Computerland of Nashua, 419 Amherst St, Nashua NH 03060
3. Don Fairchild, Treasurer, (603) 434-5626
4. S.N.A.C.
5. This group is involved in all aspects of home computing using Apple systems.

1. Manchester Users Group
2. 346 S Taylor St, Manchester NH 03103
3. Scott, (603) 624-0089
4. Yes
5. TRS-80s.

1. Southern Maine TRS-80 Group
2. 15 Mountain View Rd, Cape Elizabeth ME 04107
3. Douglas Stewart, (207) 767-2351
4. *Byte Babble*
5. TRS-80s.

1. Doctor's Computer Club
2. 42 E High St, East Hampton CT 06424
3. Dr Aziz Ghaussy, (203) 267-2400
4. *Medical Computer Journal Newsletter*
5. Application of computers in medical practices.

1. *The Pocket Computer Newsletter*
2. POB 232, Seymour CT 06483

1. *Computers in Psychiatry/Psychology*
2. 26 Trumbull St, New Haven CT 06511
3. Marc D Schwartz, MD, Editor, (203) 562-9873
5. This publication is for professionals interested in the use of computers in their work.

1. Connecticut Computer Club
2. 18 Ridge Ct W, West Haven CT 06516
3. Leo Taylor, Secretary
4. *CCC Newsletter*
5. We have two talks per meeting; generally one on software and one on hardware. The club does not specialize in any one machine.

1. *APL Market Newsletter*
2. POB 5314, Mt Carmel CT 06518
3. Raymond C Jordan, (203) 288-0283

Corvus Lowers the Price of Admission to the Winchester Club.

Here's the price breakthrough you've been waiting for on Winchester disk systems. It's our new 5 1/4-inch 5-million byte Winchester that adds cost effective mass storage to over 15 of the most popular microcomputers. Now everyone can enjoy the improved reliability, increased storage capacity, and faster speed of sealed-environment Winchester technology.

You can start with 5 million bytes, then expand the system with up to three add-on drives of 5, 10, or 20 million bytes. Our 5 million byte system has all of the advanced features of the larger capacity Corvus systems, including our low cost MIRROR back-up and multi-user CONSTELLATION network that allows up to 64 computers to share the Corvus data base and peripherals such as printers.

Want the full story? Contact your local computer store.



For Apple TRS-80 LSI-11 Zenith
SuperBrain Pet S-100 Bus
Alpha Micro

*** **CORVUS SYSTEMS**
2029 O'Toole Avenue
San Jose, California 95131
408/946-7700 TWX: 910-338-0226



Clubs and Newsletters

1. Amateur Computer Group of New Jersey
2. 1776 Raritan Rd, Scotch Plains NJ 07076
3. Sol Libes, (201) 277-2063
4. ACG-NJ News
5. User Groups: 8080/Z80, 6800, KIM-1, TRS-80, PET, CP/M, 1802, S-100, Apple, and Pascal. We also have software libraries and tutorials.

1. OSI Users Group
2. 4 Swimming River Rd, Lincroft NJ 07738
3. Bob Childs, (201) 747-8888

1. Data Processing Club
2. c/o Dennis M Lloyd, Business Studies Division, Gloucester County College, Tanyard Rd, Sewell NJ 08080
3. (609) 468-5000, ext 242
4. Interested in microcomputer programs inside and outside of the classroom.

Zips 10000—20000

1. New York Amateur Computer Club
2. POB 106, Church Street Sta, New York NY 10008
3. Garry Sawyer, (212) 864-4595.
4. New York Amateur Computer Club Newsletter
5. Anything to do with computers.

1. Computer Careers News
2. 135 W 50th St, New York NY 10020
3. Connie Winkler, Editor, (212) 582-9617
5. Careers publication for processing professionals.

1. Feedback From Fujitsu
2. c/o Ruder & Finn Inc, 110 E 59th St, New York NY 10022
3. Darrell J Aherin, (212) 593-6317
5. News of the Japanese

computer, telecommunications, and electronics industries.

1. Lifelines
2. 1651 Third Ave, New York NY 10028
3. Mary Anna Feczo, (212) 722-1700
5. This publication is for CP/M users.

1. Association for Computers and the Humanities
2. Queens College, Flushing NY 11367
3. Joseph Raben, (212) 520-7407
4. ACH Newsletter
5. Humanities applications.

1. Small Computer News
2. Edwards Publications, 78-56 86th St, Flushing NY 11385
3. (212) 441-4082

1. D G Independent User's Group
2. POB 316, Woodmere NY 11598
3. Lloyd Kishinsky, (516) 374-6793
4. Bridge
5. Digital Group computers.

1. Long Island Computer Association
2. 3788 Windsor Dr, Bethpage NY 11714
3. A M Stone, Editor, (516) 731-1649
4. The Stack
5. User Groups: S-100, TRS-80, and 6502.

1. Digiac Corporation
2. 175 Engineers Rd, Smithtown NY 11787
3. James D Gobetz, President, (516) 273-8600
4. MAPS Digest
5. For MP/M users.

1. CAMS (Capital Area Micro Computer Society)
2. POB 348, Ridge Rd, RD #1, Scotia NY 12302
3. Stanley L Mathes, (518) 372-3767
4. Occasional

5. Subgroups for Apple (associated with International Apple Corps), TRS-80, S-100, and other groups.

1. Sphere Microcomputer Group
2. 2 Tor Rd, Wappingers Falls NY 12590
3. Jeffrey Brownstein, DDS, (914) 297-3950
4. Sphere Newsletter
5. 6800 microcomputers.

1. CHIP-S Microcomputer Club
2. POB 504, Syracuse NY 13201

1. Mohawk Valley Microcomputer Club
2. 706 Lee St, Rome NY 13440
3. Rich Weaver
4. Micros Along the Mohawk
5. Several special interest groups: 6800, 8080/Z80, and beginners.

1. RAMS (Rochester Area Microcomputer Society)
2. POB 90808, Rochester NY 14609
3. Erwin Rahn, (716) 473-3184
4. Memory Pages
5. Special interest groups: UFORTH (University of Rochester FORTH) and 6800/6809/68000. Users groups: North Star and CP/M.

1. Monroeville Apple Users Club
2. Dr G J Harloff
3. 579 Carnival Dr, Pittsburgh PA 15239

1. Central Pennsylvania Computer Club
2. 3263 Bull Rd, York PA 17404
3. Cletus Hunt III, (717) 764-4977
4. Data Dump
5. Special interests: SS-50 bus and TRS-80 systems.

1. Wyoming Valley TRS-80 Club

• TRS-80 • APPLE 2 • ATARI • SCORCERER •

SCORCERER • TRS-80 • APPLE 2 • ATARI • SCORCERER • PET

FREE CATALOG
over 150 items
ORDER TOLL FREE
(800) 327-7172

IN FLORIDA (305) 862-6917
'nuf said

TRS-80 • APPLE 2 • ATARI • SCORCERER

(305) 862-6917

AI  **Adventure**
INTERNATIONAL

A DIVISION OF SCOTT ADAMS, INC

BOX 3435 • LONGWOOD, FLA. 32750

← Circle 108 on Inquiry card.

If you write software, write Digital Research.

We can help you bring your products to market.

Independent Software Vendors (ISV's) are the key to solving the software crunch in the 1980's. To help you bring your products to market, Digital Research introduces the ISV Support Plan — designed to assist you in:

Developing Your Product

- With the fast and powerful PL/I-80™ Programming System
- ISV Seminars covering high level applications programming

Getting Established in Your Market

ISV Seminars cover:

- Designing a marketing strategy
- Advertising
- Writing Manuals
- Assuring software security
- Supporting and updating products

On-Going Support Includes:

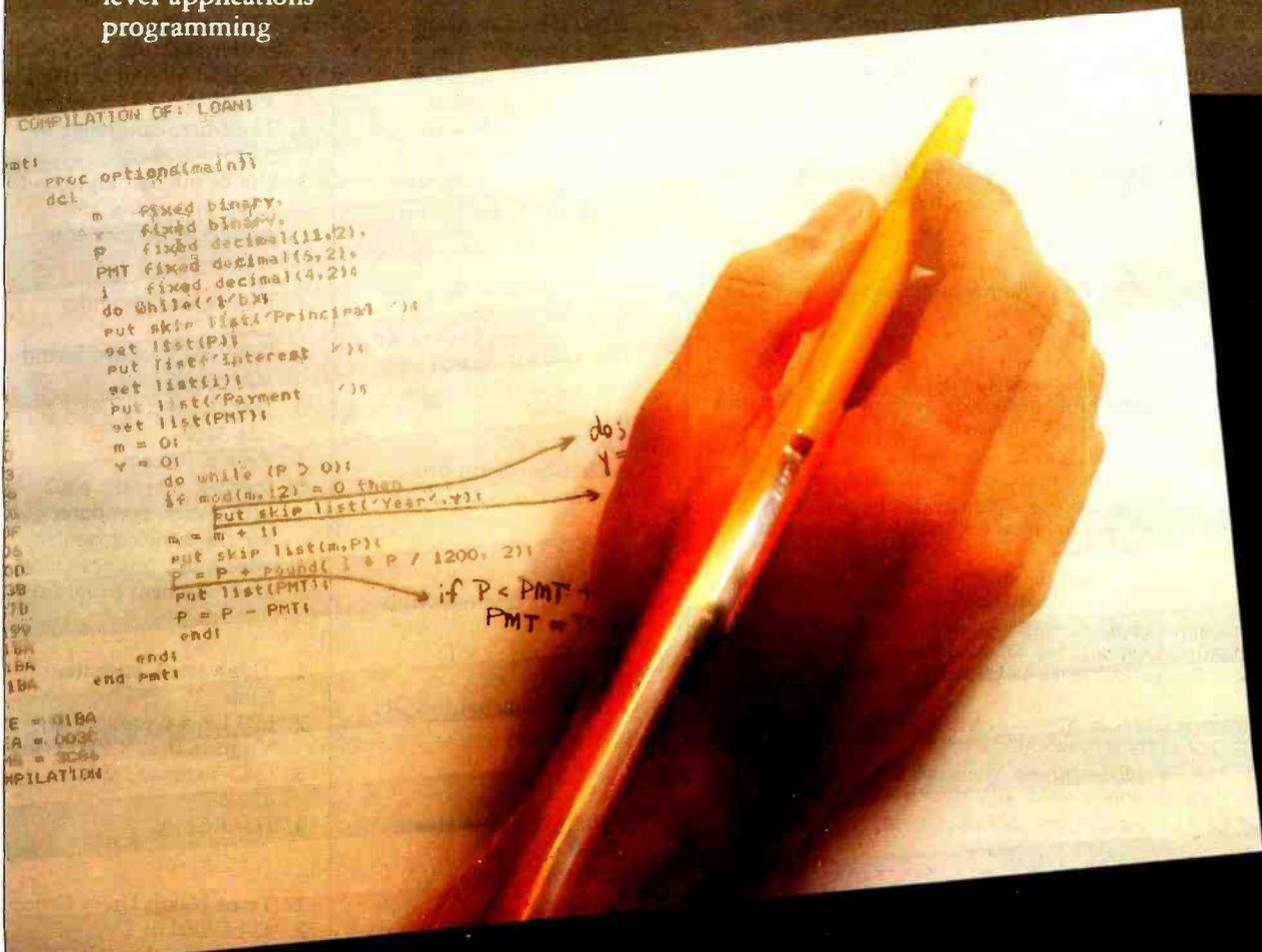
- Legal and technical information
- Distribution channels
- Printing facilities
- Free product listing in our Applications Software Catalog

All this plus the world's largest software marketplace — the CP/M® customer base.

So why do it alone? Write Digital Research. We'll send you our free brochure detailing the ISV Support Plan.

 **DIGITAL RESEARCH®**

P.O. Box 579
Pacific Grove, CA 93950
(408) 649-3896
TWX 910 360 5001



```
COMPILATION OF: LOAN1
mt:
proc options(main)
dcl
  m fixed binary,
  v fixed binary,
  P fixed decimal(11,2),
  PMT fixed decimal(5,2),
  i fixed decimal(4,2);
do while(1/bx)
  put skip list('Principal ');
  set list(P);
  put list('Interest ');
  set list(i);
  put list('Payment ');
  set list(PMT);
  m = 0;
  v = 0;
  do while (P > 0);
  if mod(m,12) = 0 then
    put skip list('Year ',v);
    m = m + 11;
    put skip list(m,P);
    P = P + round(1 * P / 1200, 2);
    put list(PMT);
    P = P - PMT;
  ends;
end pm1;
E = 01BA
A = 003C
M = 3C54
MPILATION
```

Visit us at the West Coast Computer Faire and the NCC

Clubs and Newsletters

- 302 Wyoming Ave, Kingston PA 18704
- Art Prutzman, (717) 287-1014
- Special interests: TRS-80 uses and modems.

- Delaware Valley Computer Society**
- POB 651, Levittown PA 19058
- Howard Kalodner, (215) 742-6612
- DVCS Newsletter*
- TRS-80 users group.

- PACS (Philadelphia Area Computer Society)**
- POB 1954, Philadelphia PA 19105
- Dick Moberg, Eric Hafler; Hot line (215) 925-5264
- The Data Bus*
- Users groups for all major microcomputers, courses on languages, computers for children, and other groups.

Zips 20000—30000

- Buss: The Independent Newsletter for Heath Company Computers*
- 325-B Pennsylvania Ave SE, Washington DC 20003
- Charles Floto, (202) 544-0484
- News on items that are hardware- and software-compatible with Heath Company computers and Zenith Data Systems.

- Battery Lane Publications**
- POB 30214, Bethesda MD 20014
- Eric Balkan, (301) 770-2726
- Computer Consultant*
- Information of interest to free-lance and corporate consultants.

- Washington DC CP/M Users Group**
- 7315 Wisconsin Ave,

- Washington DC 20014
- Winston Riley III, (301) 986-1234
- Public-domain software exchange, review of operating systems, languages, and packages.

- WACS (Washington Amateur Computer Society)**
- 4201 Massachusetts Ave, #168, Washington DC 20016
- Robert Jones, Director
- JWACS*
- Interested in I/O Selectric conversions; inexpensive terminals and personal systems; 9900, 6800, 8080/Z80 hardware and software.

- Washington Apple Pi**
- POB 34511, Washington DC 20034
- Bernie Urban, (301) 229-3458; club phone (301) 468-2305
- Washington Apple Pi*
- Education, medical, Pascal, assembly language, games, helping neophytes in computer programming.

- TI Programmable Calculator Club**
- 9213 Lanham Severn Rd, Lanham MD 20801
- Maurice E T Swinnen, Editor
- TI PPC Notes*
- All AOS system programmable calculators.

- PEEK(65)*
- POB 347, Owings Mills MD 21117
- Al Peabody, (301) 268-0561
- This is a journal for OSI users.

- CHUG (Capital Heath Users' Group)**
- POB 341, Fairfax VA 22030
- Dale Grundon, Secretary
- > CHUG*
- Interested in all Heath computers and related equipment.

- AMRAD (Amateur Radio Research and Development Corporation)**
- 1524 Springvale Rd, McLean VA 22101
- Paul L Rinaldo, (703) 356-8918
- AMRAD Newsletter*
- Special interests: amateur radio and computers, computers and communications devices for the deaf, amateur computer networking.

- WAKE (Washington Area KIM Enthusiasts)**
- 5112 Williamsburg Blvd, Arlington VA 22207
- Ted Beach
- Monthly
- KIM and other 6502 single-board computers.

- The MicroComputer Investors Association**
- 902 Anderson Dr, Fredericksburg VA 22401
- Jack M Williams, (703) 371-5474
- The MicroComputer Investor*
- Use of microcomputers to assist in making and managing investments.

- Delmarva Computer Club**
- POB 36, Wallops Island VA 23337
- Jean Trafford, (804) 824-3400
- Peek-n-Poke*
- Special interests: 6502 processors, computer aids for the handicapped, education, business, and entertainment programs.

- Tidewater Computer Club**
- 677 Lord Dunmore Dr, Virginia Beach VA 23464
- C D Yeoman, (804) 420-6379
- Hard Copy*

- Triad Heath Users Group**
- 424 Cliffdale Dr, Winston-Salem NC 27104
- Hughes Hoyle, (919) 378-1050; Steve Minor, (919) 765-7717

The WORKSHEET Problem-Solving Language

Want to play "What-if"? Want to do Real Estate Analysis, Family Budgeting, Taxes, Company Cash Flow; want to simulate complex and interrelated processes? WORKSHEET is a powerful language designed for the purpose of writing programs to solve these and all other problems that involve a row-column "spreadsheet". Even novice programmers are solving complicated problems on the first day!

WORKSHEET is not a hybrid text editor or a toy. It is a complete, self-documenting model-building system. List the assumptions that went into your budget with the SHOWFIL program—even the boss will understand!

Change the assumptions, the relationships, or the data, and produce a new spreadsheet, neatly captioned, in minutes.

Model too big to fit on a single page? Format it dynamically—one page of 12 (or any number) columns, or 2 pages of 6 columns, or whatever tells your story best.

Conditional evaluation of a variable? Reference to variables in different rows, several columns back? No problem!

Sample models include portfolio valuation, real estate evaluation, iterative solution of a Diophantine equation, family budget, product profit based on exponentially damped growth of sales.

Use it for tough, professional jobs—it's the only CP/M modeling system that can handle them!

Requires 48K CP/M system and Microsoft Basic, C Basic or North Star Basic running under CP/M with Matchmaker II.

WORKSHEET Language disk (5" or 8" CP/M) \$199.95 (specify version)

80-Page Manual only \$ 19.95

The SoHo Group
140 Thompson St., Suite 4-B
New York, NY 10012

Note: CP/M, Microsoft, and North Star are registered trademarks of Digital Research, Microsoft, and North Star Computers, respectively.

Compupro WELCOMES YOU to the 16 BIT WORLD...

at a
**SPECIAL
PACKAGE
PRICE!**

- Upgrade 8 bit systems
- All boards assembled & tested

Here's the nucleus of a truly exceptional S-100 system:

1. 16 bit/8 bit Dual Processor (w/6 MHz 8088)
2. System Support 1
3. Disk 1 DMA Floppy Disk Controller (w/BIOS for CP/M * 2.2)
4. 32K of fast static RAM (w/IEEE 24 bit extended addressing)
5. Sorcim's powerful PASCAL/M*-8086 software on disk
6. Digital Research's CP/M *-86 software on disk
7. I/O and Disk Controller cables, plus full documentation on all hardware and software

*PASCAL/M is a trademark of Sorcim; CP/M is a registered trademark of Digital Research

Total Package Price: \$2495

- ORDER BEFORE MAY 1ST

AND WE'LL ADD AN EXTRA 32K OF STATIC RAM FREE!

DON'T MISS OUT!

AVAILABLE AT FINER COMPUTER STORES, OR ORDER DIRECTLY FROM US.

CompuProTM

OAKLAND AIRPORT, CA 94614

division of

GODBOUT
ELECTRONICS

(415) 562-0636



Terms: Californians add tax. Allow for shipping (excess refunded). VISA and Mastercard orders call (415) 562-0636, 24 hrs. Include street address for UPS

WESTICO... Because getting good software fast is hard.

To get your software tomorrow, call Westico today. (203) 853-6880.

Westico understands your micro-computer software needs. We know you want a good selection of software without the hassle of hunting all over for it... We know you want it fast... And we also know you want a product backed by service. With Westico you get all three.

We have an extensive list of

quality software products for the serious microcomputer buyer — accounting, professional time accounting, text processing, planning and analysis, telecommunications, data management, development tools. And the list is growing.

Dial-up the 24-Hour Hotline (203) 853-0816 (300 baud)

It's an on-line catalog, updated each day! See displays of all products and the latest version numbers and prices. Build a trial order without any obligation. Complete the order only if you wish. We also offer 24-hour delivery service. Call, write, Telex or dial-up today. C.O.D., Master Card and VISA accepted.

Powerful Products from Westico

ASCOM program for time sharing and data transfers. • Transfers files between computers • Conversation mode controls remote computers • Batch mode by command files • Commands to display directories and type files

ASCOM can log-on a time sharing system to retrieve stock exchange data for storage and analysis. Batch mode can make the log-on, password, data query, and storage automatic. ASCOM can transmit program files to another micro running ASCOM — locally, or remotely through a modem.

MINIMODEL™ Financial Planning Tool — does big financial planning jobs at micro prices — for cash flow projections, financial forecasting, venture analysis, project planning and risk analysis. • Model size limited only by disk file size. • Operating results can be fed into models. • Time horizon advances to eliminate old data • Consolidates models into higher level models • Consolidated models are processed under their own rule set • Report content and format totally under user control.



CP/M™ programs for TRS-80 Model II, Apple with Soft-Card™, Vector Graphic, iCom, Cromemco, North Star, Micropolis, Ohio Scientific, SuperBrain and more.

	Software & Manual	Manual alone	System Requirements
ACCOUNTING:			
GENERAL LEDGER <i>Peachtree™</i>	\$550	\$40	A,D,I,L
ACCOUNTS RECEIVABLE <i>Peachtree</i>	550	40	A,D,I,L
ACCOUNTS PAYABLE <i>Peachtree</i>	550	40	A,D,I,L
INVENTORY CONTROL <i>Peachtree</i>	650	40	A,D,I,L
PAYROLL <i>Peachtree</i>	550	40	A,D,I,L
CLIENT WRITE-UP <i>Peachtree</i>	990	40	A,D,I,L
PAS-3 MEDICAL <i>Artificial Intelligence</i>	990	40	A,C,I
PAS-3 DENTAL <i>Artificial Intelligence</i>	990	40	A,C,I
PROPERTY MANAGEMENT <i>Peachtree</i>	990	40	A,D,I,L
PROFESSIONAL TIME ACCOUNTING:			
PTA <i>Asyst Design</i>	595	40	A,C,I
PTA Demo <i>Asyst Design</i>	75	40	A,C,I
ESQ-1 Legal <i>Micro Information</i>	1495	50	A,C,I,L
ESQ-1 Legal Demo <i>Micro Information</i>	75	50	A,C,I
DATEBOOK™ <i>Organic Software</i>	295	25	A,I
TEXT PROCESSING:			
WORDMASTER™ <i>MicroPro</i>	145	25	A,K,L
WORDSTAR™ <i>MicroPro</i>	450	40	A,F,K,L
MAIL-MERGE™ <i>MicroPro</i>	125	25	A,F,K,L
WORDSEARCH™ <i>Keybits</i>	195	40	A,F
TEXTWRITER <i>Organic Software</i>	125	20	A
PLANNING & ANALYSIS:			
MINIMODEL <i>Financial Planning</i>	495	50	A,C,I,L
STATPAK <i>NW Analytical</i>	500	40	A,D,I
MILESTONE™ <i>Organic Software</i>	295	25	A,I
TELECOMMUNICATIONS:			
ASCOM <i>DMA</i>	125	10	A,T
DATA MANAGEMENT:			
CBS <i>DMA</i>	395	40	A,F,K
CBS LABEL OPTION <i>DMA</i>	80	10	A,F,K
MAGSAM III <i>MAG</i>	145	25	A,C or D,F
MAGSAM IV <i>MAG</i>	295	25	A,C,F,K
SELECTOR IV <i>Micro-Pro</i>	395	25	A,C,G,K
PRISM/IMS <i>MAG</i>	495	55	A,C,F,K
PRISM/ADS <i>MAG</i>	795	55	A,C,F,K
DEVELOPMENT TOOLS:			
PL/I-80™ <i>Digital/Research</i>	500	35	B,F,L,P
BASIC-80 <i>Microsoft</i>	350	25	A,F,L
BASIC COMPILER <i>Microsoft</i>	395	25	A,F,L
S-BASIC™ <i>Topaz</i>	295	25	A,F
NEVADA COBOL <i>Ellis Computing</i>	150	25	A
CBASIC-2™ <i>Compiler Systems</i>	120	15	A
PASCAL/M™ <i>Sordim</i>	175	20	A,G
GENERAL SUBROUTINE PAK <i>Asyst Design</i>	295	30	A,C,K
APPLICATION UTILITIES <i>Asyst Design</i>	495	30	A,C,K
PASCAL/MT+™ <i>MT Microsystems</i>	425	30	A,G
MISCELLANEOUS:			
SUPERSORT I <i>MicroPro</i>	225	25	A,L
SURVEYOR <i>Peachtree</i>	550	40	A,D,I,L
STRING BIT™ <i>Keybits</i>	65	15	A
STRING/80™ <i>Keybits</i>	95	15	A
STRING/80 SOURCE <i>Keybits</i>	295	n/a	A
ULTRASORT II™ <i>CCS</i>	165	15	A

SYSTEM REQUIREMENT CODES

All software has specific requirements for proper operation such as computer type, equipment configuration and support software.

Check the following codes for system requirements to be certain your system will accept the software offered.

- | | |
|-------------------------------------|--|
| (A) CP/M version 1.4 or higher. | (I) Business system: 48K memory, 200K dual disk drives, cursor addressable terminal, and 132 column printer. |
| (B) CP/M version 2.0 or higher. | (K) Cursor addressable terminal. |
| (C) CBASIC-2. | (L) signed license required for shipment. |
| (D) MBASIC version 4.51. | (O) specify 8080, Z80, or CDOS. |
| (E) BASIC-80 version 5.0 or higher. | (P) give CP/M serial number. |
| (F) 48K memory or greater. | (T) serial port and modem. |
| (G) 56K memory or greater. | (Z) Z80 CPU. |
| (H) 64K memory. | |

Specify disk format: North Star Single or Double, Micropolis Mod I or Mod II, 8" single density, Ohio Scientific, SuperBrain or Apple.

Prices do not include shipping or C.O.D. In CT add 7 1/2% sales tax.

*Manual price will be credited against later purchase of software.

Dealer inquiries invited.

Copyright © 1981 Westico, Inc.

WESTICO
The Software Express Service

25 Van Zant Street • Norwalk, Connecticut 06855
(203) 853-6880 • Telex 643-788

1. Carolina Apple Core
2. POB 31424, Raleigh NC 27612
3. Joseph H Budge, (919) 489-4284
4. From The Core
5. Apple computer users group.

1. TRS-80 Users Group
2. 7554 Southgate Rd, Fayetteville NC 28304
3. R Gordon Lloyd
4. TRS-80 Users Group Newsletter
5. We are interested in all aspects of the TRS-80.

1. TIPS Users Group
2. 101 Brookbend Ct, Mauldin SC 29662
3. Fred Holmes, (803) 288-5664
4. TIPS Newsletter
5. Special-purpose stand-alone systems and homebrew computers.

Zips 30000—40000

1. Digital Publications Inc
2. 3169 Holcomb Bridge Rd, Suite 307, Norcross GA 30071
3. John Rapp, Publisher, (404) 451-1156
4. Mini-Micro, free software exchange
5. Software exchanges and publications for Data General, IBM, and DEC PDP-11 and PDP-8 systems.

1. Culpepper and Associates Inc
2. 4922 Heatherdale Ln, Atlanta GA 30360
3. Warren Culpepper, (404) 451-3797
4. Salt 'n' Pepper
5. Special interests: software product management.

1. CSRA Computer Club
2. POB 284, Augusta GA 30903
3. Jim Graves, President, (404) 738-1378
4. CSRA Computer Club Newsletter

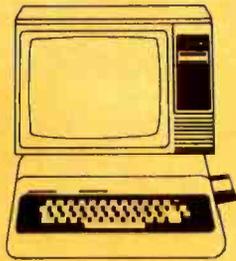


TSE-HARDSIDE

6 South St., Milford, NH 03055 (603) 673-5144
TOLL FREE OUT-OF-STATE 1-800-258-1790



MODEL II \$3599.



COLOR COMPUTER
\$359.



POCKET
COMPUTER
WITH INTERFACE
\$259.



MODEL III \$919.

TRS-80 COMPUTERS

Mod I, 64K RAM (#26-4002) \$3599.00
Mod III, 16K RAM (#26-1062) \$919.00
Mod III, 48K RAM (#26-1062+) \$1039.00
Pocket Comp w/Inter (#26-3501+) \$259.00

Color Comp, 4K RAM (#26-3001) \$359.00
Color Comp, 16K RAM (#26-3001+) \$399.00
Color Comp, Ext BASIC (#26-3002) \$529.00

MODEL I DISK DRIVES

HARDSIDE 40-track Dr (#7-40) \$329.00
PERCOM TFD-40 Dr (#7-99) \$379.00
PERCOM TFD-100 Dr (#7-100-1) \$399.00
HARDSIDE 80-track Dr (#7-80) \$449.00
PERCOM Dual TFD-100 Dr (#7-100-2) \$799.00

PERCOM Data Sep (#7-03) \$29.95
PERCOM Doubler (#7-07) \$199.95
HARDSIDE Ext Cable (#7-02) \$15.95
HARDSIDE 2-Dr Cable (#7-04) \$29.00
HARDSIDE 4-Dr Cable (#7-05) \$39.00

MODEL I PERIPHERALS

COMM-80 Interf (#4-80) \$159.00
CHATTERBOX Interf (#4-81) \$239.00
DISK-80 Interf, 16K RAM (#4-82) \$339.00
DISK-80 Interf, 16K RAM (#4-83) \$369.00
BUSY BOX Interf (#4-01) \$99.95
LYNX Communications Interf (#19-80) \$229.00
RS Expan Interf 32K RAM (#26-1140-32) \$399.00
16K Memory Kit TRS-keypad (#5-1102-1) \$59.00
16K Memory Kit, TRS-Interf (#5-1102) \$59.00

ORCHESTRA-80 (#15-03) \$79.95
Upper/Lower Mod Kit (#15-02) \$24.95
CPU Speed-up Mod kit (#15-04) \$37.50
Video Reverse Mod kit (#15-05) \$23.95
2-port TRS-BUS Ext (#15-12) \$29.95
3-port TRS-BUS Ext (#15-13) \$39.95
TRS-80 Model I Dust Cover Set (#16-01) \$7.95
TRS-80 Model I Carrying Case (#17-201) \$109.00
TRS-80 Monitor Carrying Case (#17-202) \$84.00

Dual Joysticks for Color Comp (#26-3008) \$24.95
VISTA Model II 8" Disk Dr 1 (#7-4001) \$939.00
VISTA Model II 8" Disk Dr 3 (#7-4002) \$1795.00

CTR-80A Cass Recorder & Cable (#26-1206) \$59.95
TRS-80 Model III Dust Cover (#16-05) \$7.95

TERMS: Prices and specifications are subject to change. HARDSIDE accepts VISA & MASTERCARD. Certified checks and Money Orders; Personal checks accepted (takes 3 weeks to clear). HARDSIDE Pays all shipping charges (within the 48 states) on all PREPAID orders OVER \$100.00. On all orders under \$100 a \$2.50 handling charge must be added. COD orders accepted (orders over \$250 require 25% deposit) there is a \$5.00 handling charge. UPS Blue Label, and Air Freight available at extra cost. TRS-80 is a trademark of Tandy Corp.

- Users groups: TRS-80, Apple, and 6800.

- Albany Computer Club
- Albany Junior College, 2400 Gillionville Rd, Albany GA 31707
- Dr Donald Cook, (912) 439-4205
- Our interest covers all microcomputers.

- Level II Club
- 4406 W Lawn Ave, Tampa FL 33611
- D Griffith
- We are interested in trading original software.

- ASCII, Sol User's Group
- POB 10325, Tampa FL 33679
- J Brockway, (813) 837-4655
- ASCII
- Sol computers.

- CAMS (Central Alabama Microcomputer Society)
- 6375 Pinebrook Dr, Montgomery AL 36117
- Lewis E Garrison, (205) 272-8462
- READY
- TRS-80 hardware and software.

- National Association of Computer Stores
- 3255 S US 1, Ft Pierce FL 33450
- Steven W Koerner, Executive Director, (305) 465-9450
- Monthly newsletter

Zips 40000-50000

- ACSCO (Amateur Computer Society of Central Ohio)
- 215 Delhi Ave, Apt J, Columbus OH 43202
- Paul Pittenger, President, (614) 267-3412
- I/O
- Graphics and personal networks.

FROM THE AUTHORS
OF THE MAGIC WAND™



The next generation of business software

If you've been searching for a complete line of quality software for your small business computer, your search is over. Designer Software is pleased to announce *Phoenix*™, the first line of business software to include both professional word processing and general accounting.

Word Processing

We designed *Phoenix*™ Word Processing to compete with high-priced, dedicated word processors. It is completely new from top to bottom and is unlike any other word processing software currently available. *Phoenix*™ is more powerful than WordStar™, more flexible than Magic Wand™ and easier to use than either. We built "human engineering" into the product to make it easy for non-technical personnel to use. The commands are simple and logical; the documentation is well-written and organized; and the training program is something that, frankly, you'll have to see to believe.

Accounting

Phoenix™ Accounting includes the five general applications and a growing number of specific applications. Each accounting package was designed by CPA's and written in COBOL with an underlying assembly-language database for

speed. All of the general accounting packages — General Ledger, Accounts Payable and Receivable, Payroll and Inventory—have been field-tested, some for as long as two years. Specific applications include Fixed Assets Accounting, Mailing List Maintenance, Tenant Processing, Financial Projection, and Time/Billing. We are developing more all the time.

Documentation for *Phoenix*™ Accounting is as revolutionary as it is for *Phoenix*™ Word Processing. We don't just teach you which buttons to push and leave it at that. We take the time to explain the accounting principles behind the packages, because we think that you can use our products better if you understand *why* we ask you to do certain things. And we've made a special effort to make the manuals entertaining as well as informative so that you will want to read them.

See us at the Faire

We are unveiling *Phoenix*™ at the Sixth Annual West Coast Computer Faire. If you are planning to attend, we hope that you will drop by booth 1018-20 to see us. If you can't make it this year, write, call or contact us via The Source and we'll send you more information.

Designer Software only sells through dealers. Dealer inquiries invited.

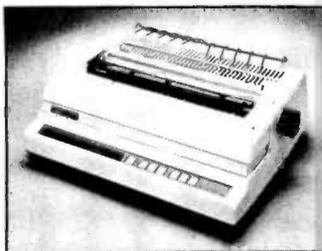
Designer Software™

HOUSTON

**3400 Montrose Boulevard • Suite 718
Houston, Texas 77006
(713) 520-8221 • SOURCE TCU671**

Magic Wand is a trademark of Small Business Applications, Inc.
Word Star is a trademark of Micro Pro International.

MICROMAIL HAS WHAT YOUR SYSTEM NEEDS.



DIABLO 630

The Diablo Model 630 is a reliable, high quality, full-character serial printer for anyone who is seeking superior print quality at a low cost. This is the first Diablo printer to offer complete interchangeability between metal and plastic print wheels. And the sophisticated and discerning user does not sacrifice print quality to obtain this versatility. Every aspect of the Diablo 630 design has been focused on maintaining outstanding print quality. Terminals also have self-test, extensive internal diagnostics and automatic bidirectional printing.

\$1,999.00

With Adjustable Forms Tractor add \$200.00

ANADEX

Standard features include expanded and compressed print, underlining, true lower-case descenders, RS-232C, Parallel, and 20mA interfaces, fast bi-directional printing, and high-resolution graphics.

DP-9599 \$1299.00
DP-9501 \$70.00
2K Expanded Buffer Option

TEXAS INSTRUMENTS

Fast, reliable, and widely supported, the TI 810 has proven itself to be a solid printer for business or industry.

810/2 \$1,549.00
 (includes upper/lower case option)
810/2 VFC/CP \$1,679.00
 (includes u/l case, forms control & compressed print)

Prices good through May 15, 1981

PRINTERS

ANADEX

DP 9000 \$1199
DP-9001 \$1199
 Just like the 9500/9501, but 5 inches narrower. Uses paper up to 9.5 inches wide.

DIABLO

1640 RO \$2525
 Uses plastic daisywheels, prints up to 45 c.p.s.
1650 RO \$2675
 Uses metal daisywheels, prints up to 40 c.p.s.

C.R.T.'s

Tele Video

912C \$ 725
920C \$ 795
950 \$ 995
 NEW! Features a detachable keyboard & programmable function keys.

SOROC

IQ120 \$ 689
IQ140 \$1099
IQ135 \$ 849
 NEW! Microprocessor controlled, programmable function keys.

C. ITOH

CIT100 \$1625
DEC VT-100 \$1650

TELEPRINTERS

DEC

LA 34 \$ 969
 Dot-matrix, 30 c.p.l. Adjustable character sizes & line spacing.
LA 34 AA \$1099
 Includes programmable forms length control.

TELETYPE

43 \$ 999
 Very reliable 30 c.p.s. teleprinter. Ideal for use with 300-baud acoustic couplers or modems.

DIABLO

1640 KSR \$2830
 Uses plastic daisywheels, prints up to 45 c.p.s.
1650 KSR \$2940
 Uses metal daisywheels, prints up to 40 c.p.s.

1. Midwest Affiliation of Computer Clubs
2. POB 20205, Columbus OH 43220
3. Douglas Troughton, (614) 574-8152
4. MACC-Pack, and Computerfest
5. Promoting personal computing by helping member clubs in any way possible.

1. TI 99/4 Users of Cincinnati
2. 8075 Spring Garden Ct, West Chester OH 45069
3. Larry Morrow, (513) 777-7042
5. Exchange of information and ideas concerning the TI 99/4.

1. DMA (Dayton Micro-computer Association)
2. c/o Dayton Museum of Natural History, 2629 Ridge Ave, Dayton OH 45414
3. Gary Turner, (513) 848-6911
4. Data Buss
5. Numerous special interest groups and help for beginners.

1. Apple-Dayton Users Group
2. 4819 Leafburrow Dr, Dayton OH 45424
3. Dick Peschke, Secretary,



Gone with the wind.

We could lose our national symbol... the majestic bald eagle.

Once man drives eagles out of their nesting areas, they rarely return. Today there are only about 900 pairs of eagles known to be nesting in the lower 48 states.

We can save the eagle by establishing eagle preserves. You can help. Join the National Wildlife Federation, Department 102, 1412 16th Street, NW, Washington, DC 20036.



Let's keep the eagle around another hundred years.



MICROMAIL • BOX 3297 • SANTA ANA, CA 92703
 (714) 731-4338

To Order: Send check to MICROMAIL, P.O. Box 3297, Santa Ana, CA 92703. Personal or company checks require two weeks to clear. Visa/MasterCard accepted. C.O.D. requires a 15% deposit. **Handling:** Add 3% to orders less than \$750, 2% to orders \$751 - \$2,000, 1% to orders over \$2,000. **NOTE:** Handling charges are waived on orders pre-paid in advance by check. **Shipping:** We ship FREIGHT COLLECT via UPS or Motor Freight. Air and Express delivery is available.



SAVE \$50

We design and manufacture a complete line of industry compatible microcomputer assembled and tested boards and kits for your system. All are S-100 bus compatible and use the Z-80 microprocessor.

With over 25,000 boards and hundreds of computer systems installed throughout the world, SD Systems offers you both proven and state-of-the-art products! We provide you with a complete family of kits for all your systems needs —

SBC 100/200 — A 2.5/4 megahertz range of single board computers which are effective standing alone or combined with the complete SD board range.

ExpandoRAM III — For use with 250/200 nanosecond RAM, these high density boards offer 16 to 64K memory; the ExpandoRAM II can achieve RAM capacities up to 256K using 64K chips.

Versafloppy III — A floppy disk controller for up to four drives, supporting single/double density and single/double-sided disk formats.

VDB-8024 — A full function visual display board with a Z-80 controller that adds display capabilities to your system.

Z-80 Starter Kit — A low-cost entry into the world of microcomputers designed primarily for education and experimentation.

Prom 100 — A specialty board of SD Systems which allows you to program 2708/2716/2732 proms.

SD SYSTEMS

P.O. Box 28810 • Dallas, Texas 75228 • Telex 6829016

YOU CAN SAVE \$50

when you purchase any two SD Systems board kits from participating DEALERS and present coupons included in any two kits to participating DEALERS listed below. Coupons must be presented to participating DEALERS by 10-15-81.

A.S.A.P. COMPUTER PRODUCTS
Signal Hill, Ca. 213-595-6431

Q. T. COMPUTER SYSTEMS, INC.
Lawndale, Ca. 213-970-0952

S-100
Clark, N.J. 201-382-1318

COMPUTERS, ETC
Dallas, Texas 214-644-5030

JADE COMPUTER PRODUCTS
Hawthorne, Ca. 800-421-5500

COMPUTER CENTRE
Swansea, England, U.K.
44-792-460023

ARCON ELECTRONICS LTD
Toronto, Ontario, Canada
416-868-1315

RATIONAL SYSTEMS
Newport Pagnell,
Buckinghamshire, U.K.
0908-611349

ALPHA BYTE STORES
Calabasas, Ca. 213-883-8594

ARISIA MICRO SYSTEMS
Mississauga, Ontario Canada
416-274-6033

SIRTON PRODUCTS
Surrey, England, U.K.
UK-01-660-5617

SD

GIFTS FROM PROMETHEUS NEW for APPLE II⁽¹⁾ Advanced products at Down-to-Earth PRICES

DUAL SERIAL CARD-1.

All functions of two independent serial cards on one board—plus more. Provides Apple II⁽¹⁾ users with two simultaneous asynchronous serial channels. DSC-1 appears as two separate logical serial cards to the Apple II⁽¹⁾. Fully software compatible with all Apple II's⁽¹⁾ and Microsoft software. 2716 EPROM used for easy driver modification. In addition, the second serial channel supports these extra features:

- Strapable DCE/DTE.
- Secondary RS-232 handshake functions (DCD, DTR, DSR)
- Strapable logical slot location and hardware looks like it's another slot.

Order: PP-DSC-1 @ \$189.00 each.

DUAL SERIAL/PARALLEL CARD-1. As with the Dual Serial Card-1 (above), the Dual Serial/Parallel-1 provides Apple users with simultaneous use of one full serial port and one parallel port. Both ports strapable for any Apple peripheral slot. Fully compatible with all Apple and Softcard (CP/M) software. Drivers for serial interface and Centronics parallel interface are contained in modifiable industry standard EPROM. Serial port is configured like DSC-1. **Order: PP-DSP-1 @ \$189.00 each.**

MEMORY EXPANSION MODULE-1. Expand your Apple II⁽¹⁾ to a full 64K RAM system with highest quality 16K dynamic RAMS. Fully buffered to provide reliable operation — even with fully loaded Apples. Total compatibility with Microsoft Softcard⁽²⁾/CP/M⁽³⁾ and all Apple software. Supplied complete with installation instructions and test program. **Order: PP-MEM-1 @ \$149.50 each.**

PASCAL MT+ MEM-1. A modular native Z-80 code Pascal compiler. ISO standard. Includes a MEM-1 (detailed above). Have a full Pascal compiler at half the Apple price. Requires a Microsoft Softcard⁽²⁾ and two disk drives. Note that the Pascal MT+ alone is normally \$250.00. **Order: PP-PMT-1 @ \$299.00 each.**

16K RAM ADD-ON KITS. For TRS-80 and Apple II⁽¹⁾. Eight (8) full-specification industry standard 16K RAMS. These are not seconds. **Order: PP-RAK-16 @ \$29.00 each.**

All Prometheus boards are completely tested and burned-in prior to shipment. One-year warranty covers parts and labor. **MONEY BACK GUARANTEE:** Order now without risk. Boards may be returned, in good condition, after up to 10 days of trial for a full and prompt cash refund. California: add 6% tax; BART Counties, 6½%. Orders under \$150, add \$3.00 postage, for handling charge. Freight allowed on orders over \$150. Dealer inquiries invited.

Quantity discounts available.



PROMETHEUS

PROMETHEUS PRODUCTS INCORPORATED

4509 Thompson Ct. • Fremont, CA 94538 • (415) 791-0266

Registered Trade Marks: (1) Apple Computers, Inc. (2) Microsoft Consumer Products (3) Digital Research, Inc.

(513) 236-3619

4. Apple-Dayton Newsletter

1. TRI-STATE Computer Club
2. 2669 Highmeadow Ct, RT 1, Wheelersburg OH 45694
3. Douglas Troughton, (614) 574-8152
4. Yes
5. Special interests: TRS-80, Apple, OSI, KIM, PDP-11, and 6800 systems.

1. AIM-65 User's Group
2. R R#2, Spencerville OH 45887
3. Donald Clem, (419) 647-6576
4. Target
5. Special interests: AIM-65 and 6502-related information.

1. Apple One Library
2. 51625 Chestnut Rd, Granger IN 46530
3. Joe Torzewski, (219) 272-4670
5. We actively support the Apple I computer.

1. Northern Indiana Computer Hobbyist Exchange
2. 927 S 26th St, South Bend IN 46615
3. Eric Bean, (219) 288-2101
4. NICHE Newsletter

1. Evansville Computer Club
2. c/o National Sharedata Corporation, POB 3895, Evansville IN 47737
3. Robert Heerdink
5. Special interests: S-100, TRS-80, Bally, and Apple systems.

1. The Midwest Buss
2. 441 E Bernhard, Hazel Park MI 48030
3. Art Blundell, (313) 547-3011
5. Special interests: our buy-and-sell forum and swapping news from club to club.

1. Sorcerer's Apprentice Computer User's Group

THE WORLD
OF
CRYSTAL PRESENTS...

SANDS OF MARS



If you are the owner of an Apple, Pet, Atari, or TRS-80 and also have a disk drive, we have some of the finest fantasy software in the world for you. For those systems with sound capability, our games have Crystalsonics — a newly developed concept in tone generation. For Apple and Atari there are some truly superlative hires graphics. In fact, Sands of Mars offers 3-D graphics and flight simulation landing. It includes over 186 full screen hires maps of Martian terrain.



We now serve over 30 countries around the world. Dealership and distributor inquiries are welcome. Special rates are available on larger orders. We have 48 hours delivery to anywhere in the continental United States. We are also looking for experienced programmers and new game software. Our royalty terms are extremely generous. If you have what you consider to be a quality product that you would like to have marketed please give us a call. If you would like to be a member of the Crystal User's Club and be eligible to receive free user contributed software, please submit a program of any type and a \$10.00 membership fee. In return you will receive a Crystal Membership Card, a copy of The House of Usher, and a year's subscription to Crystal Vision.

HOUSE OF USHER — Wander through a haunted house. Rooms and scenery in 15 color hires graphics. We offer a \$100.00 prize to the first person to solve the mystery. Over 200 monsters, objects and perils. \$24.95

GALACTIC QUEST — Crystalsonics hires graphics - the ultimate space adventure. Vegan warships attack and fire in real time simulation. Land on and trade with over 64 star systems in 3 galaxies. Allow 6-12 hours for play. \$29.95

SUMER — Travel back through time to ancient Sumeria in the middle east. You are given 10 years as king to restore this kingdom to prosperity. Plant, war, consult the astrologers - very hard to beat! \$19.95

LITTLE CRYSTAL — Especially designed anthology for children from ages 5 to 80. Includes Mr. Music which turns your Apple into an organ of sorts, gunk where two weird monsters shoot it out and many other educational as well as entertaining programs for children. True unique addition for kids who always feel left out of Dad or Mom's computerizing. \$39.95

SANDS OF MARS — What we at Crystal believe to be the finest adventure game available to date. In addition to hires graphics and super tone routines where the user's system will support it, this game provides landing simulation, animation, and revolutionary 3-D graphics. It is the ultimate in space adventure and may take several weeks or months to play. It is the Odyssey of the Starship Herman on its maiden flight to Mars. The initial flight is animated and paddle controlled. The flight through space is in Hires 3-D Graphics with many animated scenarios. You must land your starship on Mars. It will lack enough fuel and supplies for a return voyage. You must lead your party through hundreds of Hires maps of Martian terrain and subterranean passages. You then will secure adequate resources for take off, navigate your ship back to earth and attempt a successful touchdown. There is a mystery buried in the ancient city of Lemuria beneath the sands of Mars. We offer a \$100.00 prize to the first space gamer to discover it. Good luck! \$39.95

LASAR WARS — Crystalsonics hires graphics - protect the planet earth from a full scale alien invasion. Over three types of invading craft and hundreds of approach simulations. The game speaks for itself! \$29.95

WORLD WAR III — Crystalsonics hires graphics - for you war game freaks, this is it! Iran and Iraq - nuclear missiles - hires 3-scene battlefield - demolition squads - tanks - strategy. Custom designed for two arm chair generals. Save the world from nuclear holocaust! \$29.95

BENEATH THE PYRAMID — Crystalsonics hires graphics - brand new! Explore the pyramids and miles of winding secret tunnels beneath them. Enter at the Sphinx and find the hidden treasure chamber. All in hires with very aggressive monsters and many many perils. To win you must find the golden cat and your way out!!! \$29.95

For more information you may write or call:
Crystal Computer, 12215 Murphy Avenue, San Martin, California 95046 (408) 683-0696

Spring at Microhouse

Cleaning

Sweep up savings on leading hardware and software!

We at Microhouse would like to thank you worldwide for your tremendous response to our wide range of discounted hardware and software. To serve you better, call or write us anytime for your hardware and software needs. If you don't see it, ask!

We will attempt to meet or beat any advertised price!

Software Manual
List & Manual/Only

Software

- WORDSTAR** The premier word processing software from MicroPro \$495.00 \$322/\$440
- MAILMERGE** option for wordstar 2.X \$150.00 \$110/\$25
- WORDMASTER** by MicroPro. \$150.00 \$119/\$26
- SUPERBORT I** by MicroPro. Can be used as a stand-alone program or can be linked to programs with a Microsoft format. \$250.00 \$189/\$25
- SUPERBORT II** A stand-alone-only version of above. \$200.00 \$185/\$25
- DATASTAR** by MicroPro. \$350.00 \$289/\$35
- SPELLGUARD** checks 20 pages of copy for spelling mistakes and typos in less than a minute. Can be used with many CP/M[®] word processors (including WordStar). Lets operator review words it judges as potential errors. Operator may then change the suspect word or add it to SPELLGUARD's 20,000 word dictionary (dictionary size limited only by disk space). \$295 \$230/\$20
- DBASE II**, the assembly-language relational Database Management System for CP/M[®]. No need for host language. Handles up to 85,000 records (up to 32 fields of 1K each). English-like commands. Report generator with user-definable full-screen operation. Will read existing ASCII files. \$700 \$628/\$200
- TCS/Atlanta INTERACTIVE ACCOUNTING SYSTEM** for small businesses. New release. Each package can be used alone or post automatically to the General Ledger. Available in compiled version (no support language needed) or in source (MBASIC required). Needs 48K RAM, 132-col. printer. 24x80 CRT and CP/M[®] **COMPARE AT UP TO \$530/pkg.**
GENERAL LEDGER \$75/\$25
ACCOUNTS RECEIVABLE \$75/\$25
ACCOUNTS PAYABLE \$75/\$25
ACCOUNTS PAYABLE \$75/\$25
PAYROLL \$75/\$25
ALL FOUR \$259/\$25
SAMPLE PRINTOUT BOOK of ALL FOUR. \$15
- STRUCTURED SYSTEMS ACCOUNTING SYSTEM** (Requires CBASIC2, 2 disk drives, 24x80 CRT, 132-column width printer). **LIST: \$1250.00 each**
GENERAL LEDGER \$699/\$49
ACCOUNTS RECEIVABLE \$699/\$40
ACCOUNTS PAYABLE \$699/\$40
PAYROLL \$699/\$40
INVENTORY \$337/\$40

- BASIC 80** by Micro. Version 5.2 and 4.51 included. \$350.00 \$299/\$30
- BASIC COMPILER** by Microsoft. Language compatible with MBASIC. Includes MACRO 80 assembler \$395.00 \$330/\$30
- COBOL 80 Compiler** by Microsoft. \$750.00 \$640/\$30
- MSORT** by Microsoft. \$138/\$15
- COBOL 80 WMSORT**. Saving by buying both at the same time. \$759/\$40
- WhiteSmith's "C" COMPILER**. Conforms to full UNIX[®] version 7 C language. \$630.00 CALL/\$30
- STACKWORKS FORTH**. For Z80 or 8080 CPU (specify). Supplied in source. Assembler included. \$175.00 \$125/\$30
- FORTRAN 80** by Microsoft. \$500.00 \$390/\$30
- MACRO 80** by Microsoft. Assembler for 8080 and Z80 \$200.00 \$140/\$20
- PASCALIM** compiler by SORCIM. Full Wirth implementation. Produces P-code. \$175.00 \$139/\$20
- PASCALIZ** compiler by ITHACA INTERSYSTEMS. Produces Z80 native assembly code. \$395.00 \$359/\$30
- UCSD PASCAL**. \$350.00 \$299/\$50
- muSIMP/muMATH** by Microsoft. muSIMP is a fast, efficient interpreter for sophisticated mathematical functions of up to 811 digits. muMATH is a package of programs written in muSIMP. Requires 40K. \$250.00 \$225/\$26
- NAD (Name & Address)**. \$100.00 \$68/\$20
- OSORT** by Structured Systems. \$100.00 \$68/\$20
- ANALYST** by Structured Systems. \$250.00 \$195/\$20
- CBS - Configurable Business System**. Requires no support language! \$363/\$40
- DIAGNOSTICS I** by Supersoft. \$75.00 \$48/\$20
- DIAGNOSTICS II**. \$100.00 \$62.50/\$20
- TERM**. \$150.00 \$94/\$20
- DATEBOOK** by Organic Software. \$295.00 \$258/\$25
- EDIT 80** by Microsoft. \$120.00 \$82/\$20
- TEXTWRITER III** by Organic Software. \$125.00 \$110/\$20
- LETTERRIGHT** by Structured Systems. \$200.00 \$135/\$20
- MAXELL 8" SINGLE-sided** Double Density Diskettes (Box 10). \$57.50 \$43.75
- MAXELL 8" DOUBLE-sided** Double Density Diskettes (Box 10). \$87.50 \$66.25
- MAXELL 5 1/4" SINGLE-sided** Double Density (Box 10) \$55.50 \$37.50
- MAXELL 5 1/4" DOUBLE-sided** Double Density (Box 10) \$82.50 \$62.50
- WABASH 8" SINGLE-sided**, single-density (Box 10). \$29.51 \$27.24
- WABASH 8" DOUBLE-sided**, double-density (Box 10). \$49.79 \$45.96
- SCOTCH HEAD CLEANING DISKETTES** includes two diskettes and bottle of cleaning solution. For single or double sided drives \$30.00 \$20.70

Hardware

- EPSON MX80 DOT MATRIX PRINTER** with its ingenious removable printhead, bidirectional and logic-seeking, adjustable tractor, line print quality and standard features make this a real bargain. Parallel interface. \$645.00 \$519.00
 - SERIAL or IEEE 488 INTERFACE** for the MX80 \$55.00 \$43.70
 - APPLE INTERFACE CARD** for the MX80 (when ordered with the MX80) \$85.00 \$68.75
 - TRS-80 EXPANSION CABLE**. (for MX 80) \$35.00 \$30.60
 - APPLE CABLE**. \$25.00 \$21.90 (for MX 80)
 - EPSON MX70**, plain-Jane version of the MX80. Monodirectional, 80 cps. Graftrax II Graphics included. Adjustable tractor. Parallel version only. \$450 \$378.00
 - DIABLO 630 RO PRINTER** uses plastic and metal print wheels. Fewer working parts mean less down time. Speed: 40 cps bidirectional, logic-seeking. \$2185.00 \$1999.00
 - IDS PAPER TIGER 580**, the 15" tiger. 150 cps, bidirectional, logic-seeking, 9-wire staggered printhead. Fixed & proportional text, automatic text justification. Up to 220 col. Parallel & serial interfaces. \$1895 \$1484
 - IDS PAPER TIGER 460**. \$1295.00 \$1072.00
 - C. ITOH STARWRITER I** letter quality printer. Uses Diablo printhead and ribbons. 25 cps. Bidirectional logic-seeking. Self-test. Friction feed. Parallel interface. \$1895 \$1431
 - STARWRITER I Serial version** \$1060 \$1502
 - TELEVIDEO 950C**, the newest and smartest TeleVideo. All features of the 920C plus detachable keyboard, smooth scrolling, split screen, graphics characters, 25th status line, 19.2 kbaud max speed, buffered aux. port. \$1195 \$995
 - ANADEX 9500 or 9501**. \$1437.00 \$1380.00
 - ANADEX DP8000** \$995.00 \$776.00
 - CENTRONICS 704-1**. \$2280.00 \$1636.00
 - CENTRONICS 737-1**. \$995.00 \$770.50
 - BIG DISCOUNTS ON DYNABYTE, CROMEMCO, NORTHSTAR AND IMS SYSTEMS**. Call or write for prices!
- ASK FOR YOUR FREE DISKETTE CASE WITH YOUR SPRING ORDER!**
- PRICES AND SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.
CALL OR WRITE FOR FREE CATALOG
CP/M is a registered trademark of Digital Research.
UNIX is a registered trademark of Bell Labs.
APPLE is a registered trademark of Apple Computers.

medicine, dentistry, health sciences, and micro- and minicomputers.

1. ICCA (International Computer Chess Association)
2. ICCA, Vogelback Computing Center, Northwestern University, Evanston IL 60201
3. B Mittman, (312) 492-3682
4. ICCA Newsletter
5. Computer chess.

1. CHICATRUG (Chicago TRS-80 Users Group)
2. 203 N Wabash, Rm 1510, Chicago IL 60601
3. Emmanuel B Garcia Jr
4. CHICATRUG News
5. TRS-80s.

1. Quad City Computer Club
2. 4211 7 Ave, Rock Island IL 61201
3. John Greve, (309) 786-8187
5. General-interest club.

1. SCAMPUS (SC/MP Users Society)
2. POB 132, Knob Noster MO 65305
3. Tom Bohon, Coordinator, (816) 563-2650
4. SCAMPUS Newsletter
5. Anything to do with National Semiconductor's SC/MP I and II integrated circuits (systems, controllers, etc).

1. Financial Systems Report
2. c/o Syntax Corporation, 4500 W 72nd Ter, Prairie Village KS 66208
3. Vernon K Jacobs, (913) 362-9667
4. Financial Systems Report
5. This 8-page monthly newsletter provides information about computer systems for financiers.

1. Lincoln Micro-Computer Club
2. 1209 Garber Ave, Lincoln NE 68521
3. Hubert Paulson Jr, (402) 435-1507



Microhouse
511 North New Street Bethlehem, PA 18088 (215) 868-8219

Clubs and Newsletters

2. POB 1131, Troy MI 48099
3. Don Gottwald, (313) 792-3867
4. *Sorcerer's Apprentice*
5. This club is interested in any topics concerning the Exidy Sorcerer microcomputer.

1. OSI-MUG (OSI Michigan Users Group)
2. 3247 Lakewood Ave, Ann Arbor MI 48103
3. (313) 761-5358

1. SEMCO (South Eastern Michigan Computer Organization)
2. POB 02426, Detroit MI 48202
3. Information number, (313) 775-5320
4. *Data Bus*
5. Special interests: networking, TRS-80, Atari, 6800, 650X, Heath, Digital Group, CP/M, S-100, and any aspect of computing.

1. Detroit Interact Group
2. 15356 Prevost, Detroit MI 48227
3. Stephen Cook, (313) 272-7594
4. *Interaction Newsletter*
5. Special interests: the Interact computer.

1. Flint 6500 Users Group
2. POB 4310, Flint MI 48504
3. R Riley, (313) 695-1117, 7-8 PM weekdays

1. ERCC (Educational, Recreational Computer Club)
2. POB 325, Owasso MI 48867
3. John Horvath, (517) 725-2835
4. *ERCC Newsletter*
5. Emphasis on educational, recreational, business, and scientific uses of computers.

1. Battle Creek Area Microcomputer Club
2. 8587 Q Dr N, Battle Creek MI 49017

3. Jeff Stanton, (616) 763-9685, evenings
4. Yes
5. Special interests: mostly the TRS-80.

1. Heath User's Group
2. Hilltop Rd, St Joseph MI 49085
3. Bob Ellerton, (616) 982-3463
4. *REMark*
5. Heath hardware and software.

1. Microcomputer Users International
2. c/o Jack Decker, 1804 W 18th St, Lot #155, Sault Ste Marie MI 49783
3. Jack Decker, (906) 632-3248; in Ontario, Canada, Phil Barton or Frank Gardner, (705) 942-1363
4. *Northern Bytes*
5. Serving microcomputer users in Sault Ste Marie Ontario/Michigan area. We wish to exchange

newsletters with other clubs.

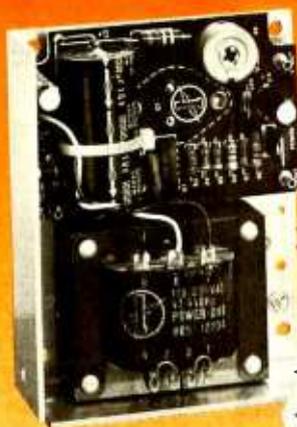
Zipps 50000-60000

1. Eastern Iowa Computer Club
2. POB 1189, Cedar Rapids IA 52406
3. Sam Dillon, (319) 377-0889
4. Bimonthly

FOR ALMOST A DECADE...

\$24.95

...AND STILL HOLDING



Model HB5-3/OVP
\$24.95 Single Qty.

5V at 3A with Built-in OVP

Power One's Case models started at \$24.95. Over 200,000 models later, they're still only \$24.95!

- 115/230 VAC Input
- OVP Built-in
- .05% Regulation
- 2-Year Warranty
- 2-Hour Burn-in
- UL Recognized
- CSA Certified

Get all the details on our 125 standard linear and switching power supplies.

FREE!

New 1981 Product Catalog... plus our new Tour Guide. Phone or write for your copies today!



POWER-ONE D.C. POWER SUPPLIES

Power-One, Inc. • Power One Drive • Camarillo, CA 93010
(805) 484-2806 • (805) 987-3891 • TWX 910-336-1297

SEE OUR COMPLETE PRODUCT LISTING IN EEM & GOLDBOOK

CPU's & SUPPORT CHIPS	
8080A	- 5.95
8085A	- 12.95
AMD 2901	- 13.95
8205	- 3.95
8212	- 2.70
8216	- 2.90
8226	- 2.75
8228	- 2.00
8251	- 6.95
8259	- 6.55
8257 (AM9517)	- 8.95
2804 S10	- 17.95
8275	- 16.95
FD1791	- 34.95

RAM's	
2114L3	- 3.95
4116-3	- 3.75
4116-2	- 6.75
21102-3	- 3.99
2102-4	- 3.00
MK4027-3	- 3.50
MK4096-11	- 2.95
7M54045-25	- 6.50
MS4050NL	- 3.95
2101-1	- 2.45
2107B/5280	- 1.75
MM5292	- 3.45
MK4008P	- 1.95

C/MOS	
4001	- 25 4027 - 45 4081 - 25 74C74 50
4002	- 25 4028 - 60 4082 - 25 74C70 70
4006	- 85 4029 - 60 4083 - 75 74C80 100
4007	- 27 4032 - 35 4084 - 175 74C85 140
4008	- 45 4034 - 225 4501 - 95 74C86 - 50
4009	- 85 4035 - 87 4502 - 75 74C88 - 90
4010	- 45 4040 - 80 4511 - 75 74C93 - 95
4011	- 35 4042 - 85 4514 - 95 74C95 - 175
4012	- 25 4043 - 100 4515 - 95 74C157 - 175
4013	- 37 4044 - 75 4516 - 180 74C160 - 120
4014	- 70 4046 - 80 4518 - 120 74C161 - 115
4016	- 65 4049 - 45 4520 - 70 74C163 - 110
4017	- 70 4061 - 80 74C00 - 27 74C113 - 130
4021	- 80 4062 - 110 74C02 - 27 74C114 - 130
4018	- 45 4053 - 110 74C04 - 40 74C125 - 130
4019	- 45 4053 - 110 74C04 - 40 74C125 - 130
4020	- 70 4056 - 70 74C08 - 30 74C132 - 130
4021	- 80 4062 - 110 74C02 - 27 74C114 - 130
4022	- 100 4071 - 35 74C14 - 120 74C26 - 695
4023	- 25 4072 - 25 74C20 - 37 74C26 - 695
4024	- 35 4076 - 80 74C22 - 45
4025	- 25 4077 - 35 74C23 - 75

TRANSISTOR SPECIALS	
2N1307 PNP GE TO 5	\$ 40
2N4044 PNP GE TO 5	3.11 00
HEP 6014 - PNP GE TO 3	\$.85
TIP 131 NPN Si SWITCHING	\$.95
2N6233 NPN Si SWITCHING POWER	\$ 1.95
MRF 8004 J CB RF TRANSISTOR NPN	\$.75
2N3772 NPN Si TO 3	\$ 1.00
2N4508 PNP Si TO 3	\$ 1.00
2N5086 PNP Si TO 18	\$ 4.00
2N4137 NPN Si TO 18	\$ 1.95
2N3919 NPN Si TO 3 RF	\$ 1.50
2N1450 NPN Si TO 18	\$ 3.00
2N3767 NPN Si TO 66	\$ 1.00
2N2222 NPN Si TO 18	\$ 4.00
2N2907 NPN Si TO 18	\$ 1.00
2N3905 NPN Si TO 3	\$.60
2N3904 NPN Si TO 3	\$ 1.00
2N3906 NPN Si TO 92	\$ 1.00
2N5296 NPN Si TO 220	\$.55
2N6109 PNP Si TO 220	\$.55
2N6300 NPN Si TO 3	\$ 1.95
TIP 318 NPN Si TO 220	\$.60
TIP 229 PNP Si TO 220	\$.55
TIP 34 PNP Si	\$.55
TIP PNP Si U8A	\$.60

UART's	
AYS 1013	- 3.75
TR 16C26	- 3.95
AYS 8660	- 1.95
PT1482B	- 3.25

ROM's	
2708	- 6.95
2716	- 12.95
2516	- 19.95
2532	- 29.95
8223	- 3.95
82523	- 2.95
825112	- 7.95
825115	- 6.95
825123	- 4.95
825126	- 2.95
825129	- 3.25
825130	- 3.45
825131	- 3.95
AM218C	- 6.95

INTERFACE & DRIVERS	
1488	- 90
1489	- 1.10
8130	- 2.50
8131	- 2.50
8830	- 2.50
8833	- 2.50
8834	- 2.00
8837	- 2.00
8838	- 2.00
8T380	- 2.00

SHIFT REGISTER	
MM1402	- 1.75
MM1403	- 1.75
MM1404	- 1.75
MM5013	- 2.50
MM5016	- 2.50
MM5055	- 2.50
MM5056	- 2.50
MM5057	- 2.50
MM5058	- 2.50
MM5060	- 2.50

PRINTED CIRCUIT BOARD	
4" x 6" DOUBLE SIDED	
EPOXY BOARD 1/16" thick	
\$.60 ea.	51/2.60

EPOXY GLASS VECTOR BOARD	
1/16" thick with 1/10" spacing	
4 1/2" x 6 1/2"	\$ 1.95

DATEL'S DAC-08BC	
8 bit DAC	- \$9.95

7 WATT LD 65 LASER DIODE IR \$8.95			
74520	30 74586	60 74581	125
74520	30 74589	180 74589	175
74520	40 745112	85 745174	140
74520	45 745133	745175	140
74520	40 745135	150 745194	110
74510	30 745138	125 745213	150
74511	35 745139	110 745268	140
74516	40 745140	745269	150
74520	40 745153	110 745280	150
74520	40 745157	125 745373	225
74522	40 745167	125 745374	250

25 watt Infra Red Pulse (SG 2006 equiv.) Laser Diode (Spec sheet included) \$24.95	
2N3820 P FET	\$.45
2N5457 N FET	\$.45
2N2646 UJT	\$.45
ER 900 TRIGGER DIODES	4/1.00
2N 6028 PROG. UJT	\$.65

CLOCK CHIPS	
MM5387AA	\$.95
MM5314	\$4.75
MM5316	\$4.95

TANTALUM CAPACITORS	
22UF 35 V 5/1.00	10UF 10V - \$.40
.47UF 35 V 5/1.00	22UF 10V - \$.30
.88UF 35 V 5/1.00	15UF 16V 3/1.00
1UF 35V 5/1.00	30UF 6V 5/1.00
2.2UF 20V 5/1.00	33UF 20V \$.60
3.3UF 20V 4/1.00	100UF 15V \$.70
4.7UF 15V 5/1.00	150UF 15V \$.95
6.8UF 35V 3/1.00	

SANKEN AUDIO POWER AMPS	
Si 1010 G 10 WATTS	\$.750
Si 1020 G 20 WATTS	\$ 11.00
Si 1030 G 30 WATTS	\$ 13.50
Si 1050 G 50 WATTS	\$ 25.00
200 PRV 1A LASCR	.95

RS232 CONNECTORS	
DB 25P male	\$.325
DB 25S female	\$.425
HOODS	\$.150

SPECIALS

4116-3 RAM's - 8/\$24.00
15% ALL 74LS SERIES

LEADER OSCILLOSCOPES
 WE CARRY A FULL LINE OF HIGH QUALITY, LOW PRICED OSCILLOSCOPES WITH A TWO YEAR WARRANTY.

COMPARE PRICE & FEATURES
LB0517 50 MHz D.T. CAL. DELAY \$1950.00

OSCILLOSCOPES	
LBO-302	10 MHz, D.T., 3" Compact \$ 790.00
LBO-308S	20 MHz, D.T., 3" Portable AC/DC 950.00
LBO-310A	4 MHz, S.T. Recur. Sweep 275.00
LBO-507A	20 MHz, S.T., 5" 810.00
LBO-508A	20 MHz, D.T., 5" 835.00
LBO-511	10 MHz, S.T., 5" 420.00
LBO-513	10 MHz, S.T., 1mv Sens. 495.00
LBO-514	10 MHz, D.T., 1mv Sens. 645.00
LBO-515B	30 MHz, D.T. Cal. Delayed Sweep 1,530.00
LBO-520	30 MHz, D.T. w/Delay Line 1,100.00

SPECIALS GOOD THRU APRIL 1981

CRYSTALS \$3.45 ea.	
2.000 MHz	6.144 MHz
4.000 MHz	8.000 MHz
3.000 MHz	10.000 MHz
3.57 MHz	18.000 MHz
5.000 MHz	18.432 MHz
6.000 MHz	20.000 MHz

MINIATURE MULTI-TURN TRIM POTS	
100, 5K, 10K, 20K, 250K, . . .	\$.75 each . . . 3/2.00

NO. 30 WIRE WRAP WIRE SINGLE STRAND	
100'	\$.40

ALCO MINIATURE TOGGLE SWITCHES	
MTA 106 SPDT	\$ 1.05
MTA 206 DPDT	\$ 1.70
MTA 206 P DPDT CENTER OFF	\$ 1.85
MSD 206 P DPDT CENTER OFF LEVER SWITCH	\$ 1.85

SCR's		TRIAC's	
100	1.5A	100	1.5A
200	.70	200	.84
400	1.20	400	1.30
600	1.80	600	2.00

FP 100 PHOTO TRANS.	
RED, YELLOW, GREEN OR AMBER LARGE LED'S 2" 6/1.00	\$.50
RED/GREEN BIPOLAR LED'S	\$.55
MLED32 RLED	\$.75
MWD14B PHOTO DARL. XTOR	\$.75
TL1-118 OPTO-ISOLATOR	\$.75
IL-5 OPTO-ISOLATOR	\$.80
1 WATT ZENERS: 3, 4, 5, 6, 8, 8.2, 9, 10, 12, 15, 18, or 22V	6/1.00

SFC 3301 - 50 PRV 30A	
FAST RECOVERY DIODE (35ns)	\$.225
20KV 250MA DIODE	\$.190

SILICON POWER RECTIFIERS						
PRV	1A	3A	12A	50A	125A	240A
100	.06	.14	.35	.90	3.70	8.00
200	.07	.20	.40	1.30	4.25	12.00
400	.09	.25	.65	1.50	6.50	15.00
600	.11	.30	.80	2.00	8.50	18.00
800	.15	.35	1.00	2.50	10.50	22.00
1000	.20	.45	1.25	3.00	12.50	26.00

IN 4148 (IN914)	
15/\$1.00	
.1 or .01 uf 25V ceramic disc. caps.	
16/\$1.00, 100/\$5.00	

7 SEGMENT DISPLAYS	
FSC 8024-4 digit	DL-707 C.A., 3" \$.75
C.C. 8" display	DL 747 C.A., 6" \$1.50
FLD 503 C.C., 5"	HP3400, 8" C.A. \$1.95
DL-704, 3" C.C.	HP3405, 8" C.C. \$1.95

TTL IC SERIES	
7400	- 17 7450 - 17 74161 - 80
7401	- 17 7472 - 35 74162 - 120
7402	- 17 7473 - 35 74163 - 95
7403	- 17 7474 - 47 74164 - 85
7404	- 24 7475 - 49 74165 - 85
7405	- 24 7476 - 45 74166 - 105
7406	- 33 7480 - 45 74167 - 135
7407	- 35 7483 - 60 74170 - 150
7408	- 27 7485 - 75 74173 - 130
7409	- 24 7486 - 42 74174 - 85
7410	- 17 7490 - 50 74175 - 75
7411	- 22 7491 - 50 74176 - 75
7412	- 22 7491 - 55 74177 - 75
7413	- 42 7492 - 50 74180 - 75
7414	- 30 7493 - 50 74181 - 90
7416	- 33 7494 - 60 74190 - 120
7417	- 37 7495 - 60 74191 - 120
7420	- 17 7496 - 60 74192 - 79
7425	- 35 74107 - 50 74181 - 90
7427	- 35 74121 - 35 74194 - 85
7428	- 33 74122 - 39 74195 - 85
7430	- 17 74123 - 42 74196 - 85
7432	- 27 74125 - 46 74197 - 87
7437	- 27 74125 - 45 74279 - 95
7438	- 27 74145 - 75 74275 - 225
7440	- 17 74149 - 150 74367 - 80
7441	- 85 74150 - 110 74367 - 80
7442	- 50 74151 - 65 74368 - 65
7443	- 50 74152 - 65 74369 - 65
7445	- 70 74153 - 55 75255 - 150
7446	- 75 75154 - 110 75491 - 105
7447	- 75 74155 - 75 75492 - 105
7448	- 75 74157 - 65 8158 - 110

FULL WAVE BRIDGE			
PRV	2A	8A	25A
200	.80	1.30	2.20
400	1.00	1.85	3.30
600	1.30	1.90	4.40

DIP SOCKETS	
8 PIN	.17 22 PIN .30
14 PIN	.20 24 PIN .35
16 PIN	.22 28 PIN .40
18 PIN	.25 40 PIN .60

74LS SERIES	
74LS00	- 22 74LS151 - 119
74LS02	- 22 74LS152 - 119
74LS03	- 22 74LS156 - 119
74LS04	- 27 74LS157 - 85
74LS05	- 27 74LS180 - 100
74LS08	- 27 74LS181 - 100
74LS10	- 25 74LS182 - 100
74LS11	- 35 74LS183 - 100
74LS12	- 35 74LS184 - 100
74LS13	- 80 74LS185 - 125
74LS15	- 80 74LS186 - 125
74LS16	- 35 74LS170 - 170
74LS17	- 35 74LS173 - 100
74LS21	- 25 74LS174 - 100
74LS22	- 25 74LS175 - 100
74LS23	- 45 74LS190 - 125
74LS24	- 45 74LS191 - 125
74LS25	- 45 74LS192 - 90
74LS26	- 45 74LS193 - 90
74LS27	- 35 74LS194 - 110
74LS28	- 35 74LS195 - 80
74LS29	- 35 74LS196 - 80
74LS30	- 55 74LS197 - 90
74LS31	- 55 74LS198 - 90
74LS32	- 25 74LS241 - 150
74LS33	- 25 74LS242 - 150

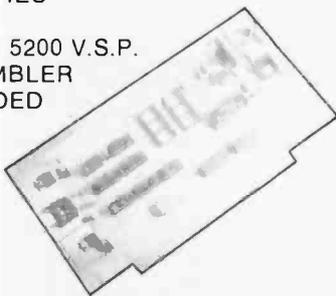
2716 (5V) \$8.95 4116 200NS \$3.50 2114L 300NS \$3.75

NEW! IT TALKS

"FAST TALKERS S-100"

LOW DATA RATE S100 SPEECH BOARD

- * UNLIMITED SPEECH POSSIBILITIES
- * S100 INTERFACE
- * USES TEXAS INSTRUMENT TMS 5200 V.S.P.
- * SOFTWARE VOICE DATA ASSEMBLER
- * 32 WORD VOCABULARY INCLUDED
- * AUDIO AMP W/SPEAKER
- * ASSEMBLED AND TESTED



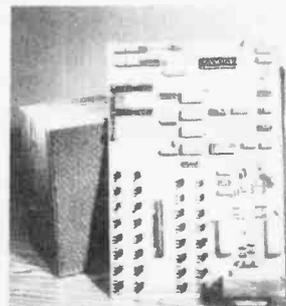
NEW TECHNOLOGY SPEECH PROCESSOR
ALLOWING UNLIMITED SPEECH POSSIBILITIES
DELIVERY FROM STOCK

TMS-5200 VOICE SYNTHESIS PROCESSOR
Chip with Data Sheet \$69.00

\$329.

"CONTROL TALKER II"

- * 110V 50/60 HZ
- * 32 INPUT LINES (TTL)
- * 32 10 AMP (50V) OUTPUT LINES
- * Z80 BASED SYSTEM
- * 8K PROM (SOCKET)
- * 1K RAM
- * VOICE OUTPUT
- * SINGLE BOARD
- * STEPPING MOTOR CONTROL (UP TO 8)



Control Talker II can be used to control stepping motors, relays, counters, etc., and support a variety of uses including robotics, telephone dialer, digital access, security, auto drilling, measuring, counting and virtually unlimited applications with added speech output to advise of status etc. Put one to work for you today!

\$550.

Double Sided QUME DRIVES

DATATRAK 8

OUR PRICE **\$540.00**
(Regularly) \$808.00)

Order Number	Our Price
2032A	
32K Static MEM-50NS	1560.00
2039B	
32K Static MEM-300NS	640.00
2032C	
32K Static MEM-200NS	639.00
2065G	
64K Dynamic MEM-200NS	569.00
2181A	
16K Static MEM-50NS	257.00
2110G	
16K Static MEM-200NS	290.00
2116K	
16K BD only	67.00
2202A	
Mainframe 110-60	366.00
2422A	
Floppy Controller	320.00
2710A	
4-Port Serial I/O	279.00
2718A	
Serial Parallel I/O	290.00
2720A	
4-Port Parallel I/O	200.00
2810A	
2-80 CPU Bd	235.00

Order Number	Our Price
1114A	
12K Rom/Prm Bd	\$ 63.00
2422A	
Calendar Click Bd	103.00
2462A	
Programmable Timer	90.00
2470A	
402 Converter	97.00
2490A	
GP1B IEEE 488	230.00
2710A	
Serial Async Bd	127.00
2712A	
Serial Synch Bd	152.00
2720A	
Parallel Interface Bd	99.00
2720B	
Centronic Parallel Interface	99.00
2811B	
Arithmetic Processor with Diskette	329.00
2811C	
Arithmetic Processor with Rom	329.00

Part#	Case	Price
78105	TO92	45
78L12	TO92	45
78L15	TO92	45
79L05	TO92	65
79L1C	TO92	65
79L15	TO92	65
7805P	TO220	1.20
7812P	TO220	1.20
7815P	TO220	1.20
7805K	TO3	1.25
7812K	TO3	1.50
7815K	TO3	1.50
7905K	TO3	1.60
7912K	TO3	1.66
7915K	TO3	1.66
309H	TO39	95
309K	TO3	1.25
317P	TO220	1.95
317K	TO3	2.95
323K	TO3	5.50
337A	TO220	2.40
337A	TO3	3.80
350K	TO3	5.75

Part#	Price
SV1	5.75
SV1 8432	5.75
SV2	5.75
SV2 4576	5.75
SV3 579	5.75
SV4	4.50
SV5 068	4.50
SV6 112	4.50
SV6 112	4.50
SV8	4.50
SV10	4.50
SV12	4.50
SV14 31818	4.50
SV15	4.50
SV18	4.50
SV18 432	4.50

Value	1+	25+	100+
4.7pf	.07	.06	.04
10pf	.07	.06	.04
22pf	.07	.06	.04
33pf	.07	.06	.04
39pf	.07	.06	.04
47pf	.07	.06	.04
58pf	.07	.06	.04
100pf	.07	.06	.04
150pf	.07	.06	.04
220pf	.07	.06	.04
270pf	.07	.06	.04
330pf	.07	.06	.04
470pf	.07	.06	.04
001mf	.07	.06	.04
0022mf	.07	.06	.04
0033mf	.07	.06	.04
0047mf	.07	.06	.04
01mf	.07	.06	.04
022mf	.10	.08	.06
033mf	.10	.08	.06
047mf	.11	.09	.07
1mf	.14	.12	.10

Part#	1+	25+	100+
S8LT	15	11	08
S16LT	18	16	14
S18LT	21	18	16
S20LT	31	26	20
S22LT	33	28	22
S24LT	35	29	24
S28LT	41	34	28
S40LT	53	47	40

Part#	1+	25+	100+
SV8WT	37	33	30
S14WT	48	43	39
S16WT	53	48	43
S18WT	61	55	50
S20WT	65	77	69
S22WT	69	80	72
S24WT	86	86	77
S28WT	122	111	99
S40WT	175	157	140

Value	Volts	1+	25+	100+
1mf	35	.35	.30	.26
15mf	35	.35	.30	.26
22mf	25	.35	.30	.26
33mf	35	.35	.30	.26
47mf	35	.35	.30	.26
58mf	35	.35	.30	.26
1mf	35	.35	.30	.26
1.5mf	35	.45	.39	.33
2.2mf	35	.45	.39	.33
3.3mf	35	.50	.42	.36
4.7mf	35	.50	.42	.36
6.8mf	35	.55	.46	.44
10mf	25	.85	.72	.61
15mf	35	1.19	1.00	.84
22mf	25	1.30	1.09	.92
33mf	25	1.35	1.12	.95
47mf	25	1.55	1.29	1.05
100mf	6v	2.95	2.48	2.08

QTY	Price Per 100 Pk:	1/4WT	1/2WT
100 up		\$1.70	\$1.80
1,000 up		1.50	1.60
5,000 up		1.30	1.40
10,000 up		1.10	1.20

Part#	Price
1N5231B	20
1N5239B	20
1N5242B	20
1N5245B	20
1N5248B	20
1N5250B	20
1N5252B	20
1N5255B	20

Value	1+	25+	100+
001mf	.13	.11	.08
0012mf	.13	.11	.08
0015mf	.13	.11	.08
0018mf	.13	.11	.08
0022mf	.13	.11	.08
0027mf	.13	.11	.08
0033mf	.13	.11	.08
0039mf	.13	.11	.08
0047mf	.13	.11	.08
0056mf	.13	.11	.08
0068mf	.13	.11	.08
0082mf	.13	.11	.08
01mf	.13	.11	.08
012mf	.13	.11	.08
018mf	.13	.11	.08
022mf	.14	.12	.09
027mf	.14	.12	.09
033mf	.14	.12	.09
039mf	.15	.13	.10
047mf	.15	.13	.10
056mf	.16	.13	.10
068mf	.17	.14	.11
082mf	.17	.14	.11
1mf	.18	.15	.12
12mf	.20	.17	.14
15mf	.22	.18	.15
18mf	.24	.20	.16
22mf	.26	.22	.17
27mf	.30	.25	.20
33mf	.33	.28	.23
39mf	.37	.31	.25
47mf	.40	.34	.30

Part#	Price
74LS00	32
74LS01	32
74LS02	32
74LS03	32
74LS04	32
74LS05	32
74LS08	32
74LS09	35
74LS10	38
74LS12	39
74LS13	32
74LS14	65
74LS15	35
74LS16	35
74LS17	125
74LS18	95
74LS19	115
74LS20	115
74LS22	36
74LS26	35
74LS27	39
74LS28	37
74LS30	36
74LS32	40
74LS37	38
74LS38	39
74LS40	36
74LS42	95
74LS47	115
74LS48	115
74LS51	32
74LS54	38
74LS55	34
74LS73	49
74LS74	49
74LS75	63
74LS76	65
74LS83	95
74LS85	125
74LS86	55
74LS90	79
74LS92	70
74LS93	75
74LS95	99
74LS107	85
74LS109	80
74LS112	82
74LS113	82
74LS114	82
74LS123	105
74LS125	10
74LS126	70
74LS132	95
74LS136	53
74LS138	85
74LS139	85
74LS148	175
74LS151	79
74LS152	79
74LS154	205
74LS157	115
74LS158	115
74LS160	85
74LS162	85
74LS162	85
74LS163	95
74LS165	110
74LS165	110
74LS166	255
74LS170	190
74LS173	355
74LS174	125
74LS175	95
74LS181	235
74LS190	115
74LS191	115
74LS192	115
74LS196	99
74LS193	115
74LS195	115
74LS240	105
74LS241	105
74LS242	145
74LS243	145
74LS244	105
74LS245	115
74LS251	129
74LS261	249
74LS265	65
74LS271	165
74LS283	105
74LS365	85
74LS367	85
74LS368	85
74LS372	165
74LS375	99
74LS376	115
74LS377	115
74LS378	115
74LS390	175
74LS391	175
74LS395	135
81LS96	135
81LS97	135
81LS98	135

Part#	Price
1N4733A	30
1N4739A	30
1N4742A	30
1N4744A	30
1N4746A	30
1N4747A	30
1N4749A	30

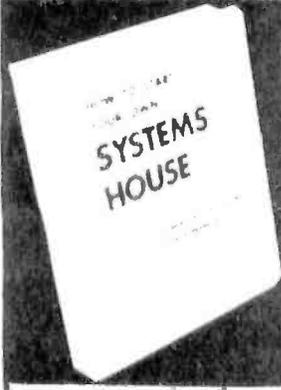
Part#	Price
74LS152	79
74LS151	79
74LS154	205
74LS157	115
74LS158	115
74LS160	85
74LS162	85
74LS162	85
74LS163	95
74LS165	110
74LS165	110
74LS166	255
74LS170	190
74LS173	355
74LS174	125
74LS175	95
74LS181	235
74LS190	115
74LS191	115
74LS192	115
74LS196	99
74LS193	115
74LS195	115
74LS240	105
74LS241	105
74LS242	145
74LS243	145
74LS244	105
74LS245	115
74LS251	129
74LS261	249
74LS265	65
74LS271	165
74LS283	105
74LS365	85
74LS367	85
74LS368	85
74LS372	165
74LS375	99
74LS376	115
74LS377	115
74LS378	115
74LS390	175
74LS391	175
74LS395	135
81LS96	135
81LS97	135
81LS98	135

Part#	Price
4000	35
4002	35
4002	35
4002	35
4006	105
4006	105
4008	115
4009	45
4010	45
4011	35
4012	35
4013	50
4014	85
4015	75
4016	55
4017	105
4018	95
4019	55
4020	110
4021	110
4022	75
4023	35
4024	35
4025	35
4026	145
4027	50
4028	

ENTREPRENEURS NEEDED

MORE THAN EVER IN THE MICRO-COMPUTER INDUSTRY.

The shortage of knowledgeable dealers/distributors is the #1 problem of microcomputer manufacturers. Over 300 new systems houses will go into business this year, but the number falls short of the 1200 needed. It is estimated that the nationwide shortage of consultants will be over 3000 by 1981. The HOW TO manuals by Essex Publishing are your best guide to start participating in the continued microcomputer boom.



\$36. No. 10

HOW TO START YOUR OWN SYSTEMS HOUSE

6th edition, March 1980

Written by the founder of a successful systems house, this fact-filled 220-page manual covers virtually all aspects of starting and operating a small systems company. It is abundant with useful, real-life samples: contracts, proposals, agreements and a complete business plan are included in full, and may be used immediately by the reader.

Proven, field-tested solutions to the many problems facing the small systems house are presented.

From the contents:

• New Generation of Systems Houses • The SBC Marketplace • Marketing Strategies • Vertical Markets & IAPs • Competitive Position/Plans of Major Vendors • Market Segment Selection & Evaluation • Selection of Equipment & Manufacturer • Make or Buy Decision • Becoming a Distributor • Getting Your Advertising Dollar's Worth • Your Salesmen: Where to Find Them • Product Pricing • The Selling Cycle • Handling the 12 Most Frequent Objections Raised by Prospects • Financing for the Customer • Leasing • Questions You Will Have to Answer Before the Prospect Buys • Producing the System • Installation, Acceptance, Collection • Documentation • Solutions to the

Service Problem • Protecting Your Product • Should You Start Now? • How to Write a Good Business Plan • Raising Capital



\$28. No. 16

HOW TO BECOME A SUCCESSFUL COMPUTER CONSULTANT

by Leslie Nelson, 2nd revised edition, Jan 1981

Independent consultants are becoming a vitally important factor in the microcomputer field, filling the gap between the computer vendors and commercial/industrial users. The rewards of the consultant can be high: freedom, more satisfying work and doubled or tripled income. **HOW TO BECOME A SUCCESSFUL COMPUTER CONSULTANT** provides comprehensive background information and step-by-step directions for those interested to explore this lucrative field.

• Established consulting markets • How to get started • Itemized start-up costs • Are you qualified? • Beginning on a part-time basis • The Marketing Kit • Should you advertise? • Five marketing tips • Getting free publicity • How much to charge • When do you need a contract? • Sample proposals • Which jobs should be declined • Future markets • The way to real big money • Avoiding the legal pitfalls • How consultants' associations can help you • The National Register of Computer Consultants • How others did it: real-life sample cases • and much more.



\$30. No. 32

FREE-LANCE SOFTWARE MARKETING

3rd edition, June 1980

Writing and selling computer programs as an independent is a business where • you can get started quickly, with little capital investment • you can do it full time or part time • the potential profits are almost limitless. Since the demand for computer software of all kinds is growing at an explosive rate, the conditions for the small entrepreneur are outstanding.

This manual will show you how to sell your own computer programs using these proven techniques: • direct to industries • through consulting firms • through manufacturers of computer hardware • in book form • mail order • through computer stores. It will show you how to profitably sell and license all types of software ranging from sophisticated analytical programs selling for thousands of dollars, down to simple accounting routines and games for personal computers.

The book will guide you step by step through the process of marketing, advertising, negotiating a contract, installing software, training users and providing maintenance and support. It also contains sample software contracts that have been used in actual software transactions. Also included are tips on how to negotiate with a large corporation, ways of avoiding personal liability, techniques for obtaining free computer time and hints on how to run a free-lance software business while holding a full-time job.

ESSEX PUBLISHING CO. Dept. 2
285 Bloomfield Avenue • Caldwell, N.J. 07006

Order books by number. Send check, money order (U.S. \$), VISA or Master Charge. Publisher pays 4th class shipping. For UPS shipping (USA only) add \$1.00 per book. For Air Mail shipping add \$2.50 per book in the U.S.A. \$3.00 in Mexico, Central America. \$12.00 per book elsewhere. N.J. residents add 5% sales tax.
 Bill Me No Bill N.E. Check enclosed Credit card 4th class UPS Air

Name _____
Address _____
City _____ State _____ Zip _____
Card # _____ Exp. _____
For faster shipment on credit card orders call (201) 783-6940 between 9 and 5 Eastern time.

5. We have an ABBS (Apple Bulletin Board System) on (402) 423-8086.

1. **Compusers**
2. POB 2064, Hastings NE 68901
3. Rocky Friend, President; or Dorothy Friend, Secretary
4. **Compusers**
5. We have a number of different makes of micro-computers and are interested in all subjects concerning computer use.

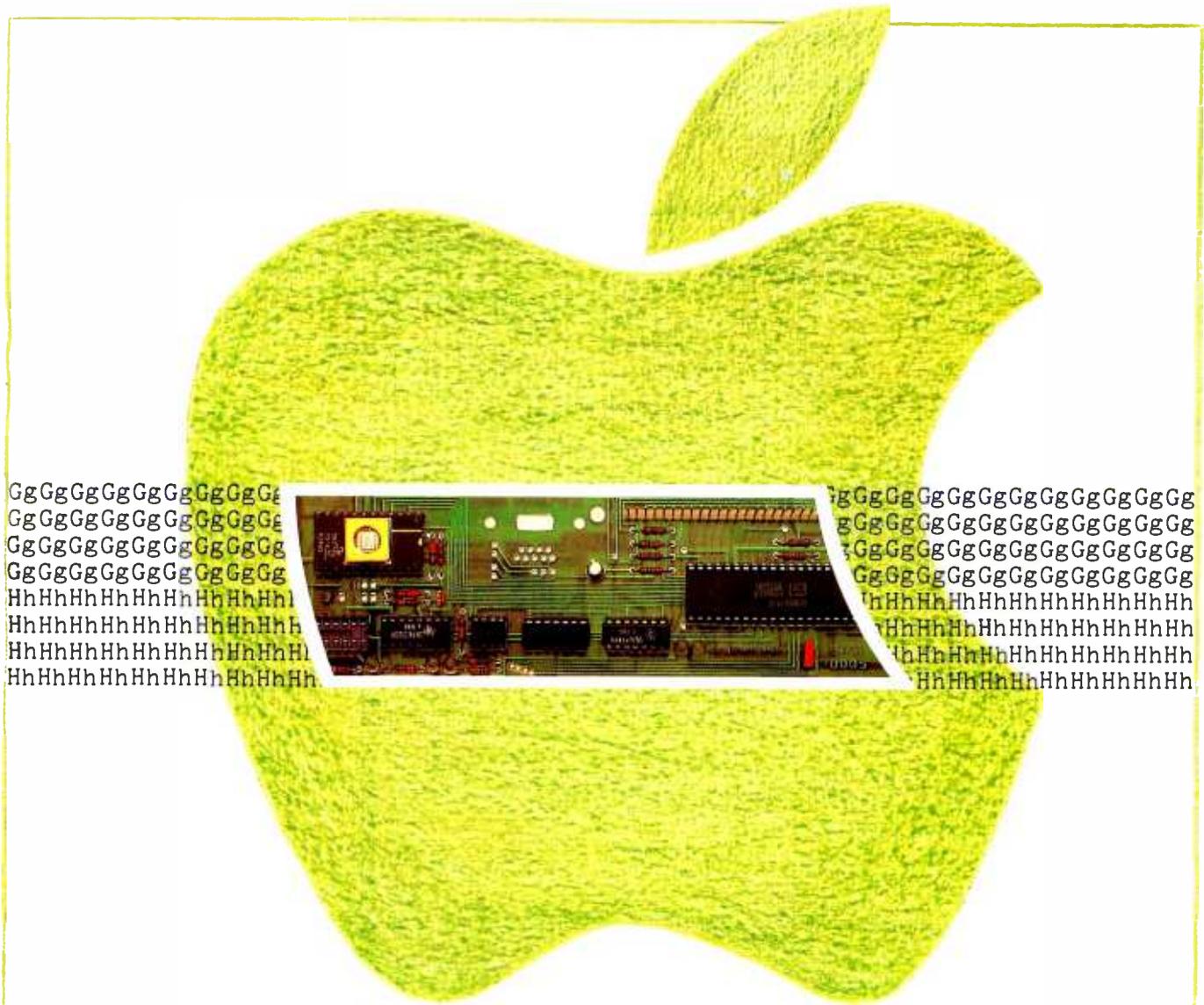
Zip 70000-80000

1. 99/4 Home Computer Users Group
2. POB 95148, Oklahoma City OK 73143
3. Charles LaFara, (405) 787-8521
4. Monthly newsletter
5. We have a program exchange and are looking for more information on TI BASIC.

1. The Tulsa Computer Society
2. POB 1133, Tulsa OK 74101
3. Mike Parr, (918) 492-8292
4. I/O Port
5. Everything!

1. Theatre Computer Users Group
2. 104 N St Mary, Dallas TX 75214
3. Mike Firth, (214) 827-7734
4. TCUG Notes
5. Special interests: the use of computers in live drama.

1. FWAUG (Fort Worth Apple Users Group)
2. 1401 Hillcrest Dr, Arlington TX 76010
3. Lee Meador, (817) 461-1981
4. FWAUG Newsletter
5. Apple hardware and software.

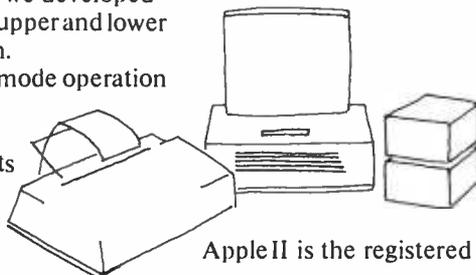


APPLE II Computer – now with genuine upper/lower case

We used to think the sophistication of the Apple II/ PLUS could not be improved upon. With increasing availability of business software capital letters on the screen are not sufficient. Especially for wordprocessing and the PASCAL editor the lack of lower case was disturbing.

After searching for a better solution we developed a new keyboard-encoder to implement upper and lower case in the keyboard and on the screen.

- typewriter mode or ALPHA-LOCK mode operation
- all keys with AUTOREPEAT
- four character sets including FULL ASC II, and EUROPEAN sets
- no soldering, no wiring
- simply replace the plug-in encoder-board



Apple II is the registered trademark of apple computer, inc.

Fix your system today, so tomorrow you're not stuck with just capital letters.

Ask your Apple dealer for the new keyboard-encoder from BASIS. For \$ 125,00 you save time and get a new clear screen.

BASIS
INCORPORATED



Clubs and Newsletters

1. Club 1802
2. POB 985, Dickinson TX 77539
3. John I. Hubisz, (713) 938-4098
4. Newsletter
5. Our activities are for beginners in microcomputing. We use ELFs and other 1802-based boards that employ simple controls.

1. High Plains TRS-80 Users Group

2. POB 30545, Amarillo TX 79120
3. Tom Whittenburg, (806) 374-9711

1. Permian Basin Amateur Computer Group
2. c/o Ector School District, POB 3912, Odessa TX 79760
3. John Rabenaldt, (915) 697-4607 (after 6 PM) or (915) 332-9151 (9 AM to 5 PM)
5. Special interests: Selectric interfaces, color displays,

MECA tape, and Altair 8800 systems.

1. Apple π
2. 415 E 43rd, Odessa TX 79762
3. Larry Brown
5. Apple II microcomputers.

1. Permian Basin TRS-80 Users Group
2. Rt #4, POB 1455, Odessa TX 79763
3. Allan D Emert, (915) 381-3138
5. TRS-80 Model I.

Zip 80000—90000

1. Denver Amateur Computer Society
2. POB 1235, Englewood CO 80150
3. Larry Costa, (303) 428-2929
4. *INTERRUPT*
5. We are a broad-interest club.

1. Southern Colorado Computer Club
2. Computer Shack, 1635 S Prairie, Pueblo CO 81005
3. Tom Thomas, (303) 564-3545
4. Monthly newsletter

1. Utah Computer Association
2. 378 E 9800 S, Sandy UT 84070
3. Lawrence N Barney, (801) 571-9661
4. *UCA Bits*
5. Special interests: advanced software, hardware, CP/M, and Pascal.

1. SNPCS (Southern Nevada Personal-Computing Society)
2. 1405 Lucilee St, Las Vegas NV 89101
3. Cy or Edna Wells, (702) 642-0212
4. *Hard Copy*
5. Both hardware and software; exchange of information and experience; and guidance and encouragement for new hobbyists. We participate in fairs and exhibitions.

Zip 90000—99999

1. Poly 88/8813 Users Group
2. 13022 Psomas Way, Los Angeles CA 90009
3. Pat or Roger Lewis
4. *Poly 88/8813 Users Group Newsletter*
5. Software exchange.

1. LA Apple Users Group
2. 9513 Hindry Pl, Los Angeles CA 90045
3. Philip A Wasson, (213) 649-1428

*** * * WRITE OR CALL FOR FREE CATALOGUE * * ***

CALIFORNIA COMPUTER SYSTEMS HIGH IN QUALITY LOW IN PRICE

Z80 CPU, 4 Mhz, with one serial port; 12 slot S-100 mainframe, disk controller, 64K Dynamic Ram, CP/M 2.2 \$1,645.
 Interfaced to 2 Shugart 8" single sided, double density drives mounted in our own, beautiful MAX BOX with power supply and fan \$1,250.
 A complete S-100 system for under \$3,000. THE BEST BUY ON THE MARKET.

IMS 5000 and 8000 Systems
 Outstanding long term reliability and performance. These systems feature a Z80A CPU, S-100 bus, double density drives (either single or double sided), DMA disk controller, 64K RAM, 2 serial & 1 parallel port. Prices include the very finest implementation of CP/M available in the entire industry. Hard disk and multi user software options. Desk top or desk enclosed. 5000 DT with dual, single sided mini drives \$3,225.
 8000 DT with dual single sided 8" drives \$4,755.

PER SCI—THE KING AND QUEEN OF DRIVES!
 Model 299B: Dual headed drives, total 3.2 MB unformatted \$2,300.
 Model 277: Dual 8 inch drives, voice coil positioned, IBM compatible 1600 K BYTES per drive unformatted \$1,210.
 Slimline cabinet and power for either 277 or 299 \$ 300.

DRIVES
 The MAX BOX: Manufactured by John D. Owens Associates, 8" dual drive cabinet complete with power supply & fan. Will hold Qumes, Shugarts or Siemens. Excellent design and engineering \$ 325.
 With 2 Shugart 800K drives \$1,250. With 2 QUME Double sided drives \$1,650.

MPI B51	\$265	B52	\$365.	B92	\$500.	Shugart	\$ 450.
---------	-------	-----	--------	-----	--------	---------	---------

HAZELTINE 1500	\$925.	IMS MEMORY 16 K static	\$350.
1510	\$1,030	32 K static	\$650.
		64 K Dynamic with parity	\$755.

AMPEX DIALOGUE 80 CRT	\$950.	TEI MAINFRAMES, S—100	
Removable keyboard, 2 page memory (4 optional), block transmit		12 slot, table top	\$500.
		22 slot, table top	\$670.
		Rack mounts, add	\$ 50.
		50 Hz 220 volts, add	\$ 50.

CENTRONIC'S 737	\$780	TELEVIDEO CRTs	
Same as TRS 80 Model IV		912	\$.780. 920 \$.850. 950. \$1,050.
Apple serial parallel interface	\$195.		

EPSON MX80B	\$550.		
-------------	--------	--	--

WE EXPORT: Overseas Callers: TWX 710 588 2844
 Phone 212 448-6298 or Cable: OWENSASSOC

SEE OUR AD FOR NEW PRODUCTS ON PAGE 18

JOHN D. OWENS
 Associates, Inc.
 12 Schubert Street
 Staten Island, New York 10305
 212 448-6283 212 448-2913 212 448-6298

1. The San Fernando Valley 6502 Users Club
2. 3816 Albright Ave, Los Angeles CA 90066
3. Larry Goga, (213) 398-6086
5. This club is open to all owners of 6502-based computers including KIM, SYM, and AIM. PET and Apple owners are also welcome.

1. SuperLetter
2. Abrams Creative Services, 369 S Crescent Dr, Beverly Hills CA 90212 (213) 277-1588
5. Newsletter for SuperBrain users.

1. OSI Users Independent
2. 6061 Lime Ave #2, Long Beach CA 90805
3. Charles Curley, (213) 422-3673
4. OSI Users Independent Newsletter
5. OSI computers and software.

1. ELF of the Valley
2. 2670 Calle Abedul, Thousand Oaks CA 91360
3. Richard Cox, (805) 492-4128
5. RCA 1802 microcomputers.

1. CompuColor/Intecolor Users Group
2. 5250 Van Nuys Blvd, Van Nuys CA 91401
3. Stan Pro, (213) 788-8850
4. Bulletin
5. We are an international group of color-computer users, with over 1000 programs in our library.

1. The Cursor Group
2. POB 266, North Hollywood CA 91603
4. The Cursor
5. User group of the Bally Arcade.

1. ET-3400 Users Group
2. 11231 Oak St, El Monte CA 91731
3. Charles Van Dyke, (213) 443-2237; CompuServe acct 70250,413

1. San Diego Heath User's Group
2. 12202 Kingsford Ct, El Cajon CA 92021
3. Jim Quinn, President, (714) 561-2540; Cliff Dudley, Secretary, (714) 697-8796
4. Coming soon
5. Special interests: the exchange of ideas, information, and assisting Heath computer users.

1. CIE (Computer Informa-

- tion Exchange)
2. POB 158, San Luis Rey CA 92068
3. Bill McLaughlin, (714) 757-4849
4. CIE People's Software News
5. Special interests: TRS-80.

1. Apple for the Teacher
2. 9525 Lucerne St, Ventura CA 93004
3. David Miller, Editor,

- (805) 647-1063; Ted Perry, President, (916) 961-7776
4. Apple Educators' Newsletter
5. Education using Apple II microcomputers.

1. International Apple Core
2. POB 976, Daly City CA 94017
3. Ken Silverman, (415) 878-5382
4. The Apple Orchard

*** * * TELETYPE MODEL 43 INVENTORY SALE * * ***

<p>TELETYPE Model 4320 AAA \$ 885. 220V. model with transformer installed inside cabinet \$ 985. Model 43ASR, 8 level, 1" tape . \$2,595. Limited supply of Model 45 available.</p> <p>TELEBUFFER 43 ASR \$945. Circuit card designed for internal installation in the Model 43 Teletype. Changes the 43 into a buffered send/receive device, enabling it to function as a Telex without paper tape. Provides from 4K to 16K bytes of internal memory for storage of message. Contents of memory may be edited and manipulated in preparation for transmission. Options include forms control and answer back.</p> <p>IBM 3101 CRT Model 10 \$1,195. Model 20 \$1,395. Selectric-like, detached keyboard. 9x16 dot matrix. Maintenance contract from IBM only \$70 per year</p> <p>ITHACA INTERSYSTEMS Full S-100 IEEE Compatibility! Full 24 address bits. DMA disk controller. SYSTEM 2A includes 20 slot mainframe with front panel, 64K Dynamic RAM. Z80 CPU, 4 MHZ, extended addressing capability. 4 parallel, 2 serial I/O floppy controller. Our discounted price, \$3,415.</p> <p>MARINCHIP SYSTEMS M9900 Elegant 16 bit CPU, S-100 compatible, multi user, multi processor operating system. BASIC, FORTH, META, PASCAL, Word processor, text editor. CPU kit and software package . \$ 550. Assembled \$ 700. Complete system, 64KB, two drives \$4,995.</p> <p>MICROANGELO \$2,280. High resolution graphics system. 15", 22MHZ, green phosphor screen, 72 key keyboard; includes complete cabling and software. From SCION. S-100 Graphics card \$ 960.</p>	<p>GRAPHICS SOFTWARE On line, real time, for the M9900 to drive the Microangelo. For use in design of PC board masks, IC masks and other applications. \$1,000.</p> <p>CORVUS HARD DRIVES We are the S-100 CORVUS dealer in the New York area. MODEL 11, Hard Disk System. \$4,820. Mirror Backup System \$ 715.</p> <p>TARBELL Double density controller \$420. Cables \$ 40. Complete TARBELL Product Line Available.</p> <p>UPGRADE DEC LA 35/36 \$750. Increases baud rate to 1200. Microprocessor controlled. Many options available. Enthusiastic user response. Long-term reliability. From DataSouth.</p> <p>Communications Software from Hawkeye Grafix Enables communications from a micro to a terminal or to another micro, mini or maxi computer. Object Code \$75. Source Code \$250.</p> <p>3M SCOTCH® Diskettes</p> <table border="1"> <thead> <tr> <th></th> <th>1 BOX</th> <th>5 BOXES</th> </tr> <tr> <th></th> <th>Price</th> <th>Price</th> </tr> <tr> <th></th> <th>of ten</th> <th>per box</th> </tr> </thead> <tbody> <tr> <td>Model 740, 8" single sided, single density . . .</td> <td>\$29.00</td> <td>\$26.50</td> </tr> <tr> <td>Model 741, 8" single sided, double density . . .</td> <td>38.00</td> <td>35.00</td> </tr> <tr> <td>Model 743, 8" double sided double density . . .</td> <td>46.50</td> <td>42.50</td> </tr> <tr> <td>Model 744, 5 1/4" soft sectored single sided, single density . . .</td> <td>29.00</td> <td>26.50</td> </tr> </tbody> </table> <p>CAT from NOVATION Originate/Answer back \$175. CAT-D \$185. Connects directly to telephone line with a plug-in jack. Eliminates need for acoustic coupler. AUTO-CAT \$240.</p>		1 BOX	5 BOXES		Price	Price		of ten	per box	Model 740, 8" single sided, single density . . .	\$29.00	\$26.50	Model 741, 8" single sided, double density . . .	38.00	35.00	Model 743, 8" double sided double density . . .	46.50	42.50	Model 744, 5 1/4" soft sectored single sided, single density . . .	29.00	26.50
	1 BOX	5 BOXES																				
	Price	Price																				
	of ten	per box																				
Model 740, 8" single sided, single density . . .	\$29.00	\$26.50																				
Model 741, 8" single sided, double density . . .	38.00	35.00																				
Model 743, 8" double sided double density . . .	46.50	42.50																				
Model 744, 5 1/4" soft sectored single sided, single density . . .	29.00	26.50																				

WE OFFER A FULL RANGE OF EXPERT CONSULTING SERVICES

JOHN D. OWENS
Associates, Inc.
SEE OUR AD ON FACING PAGE

Clubs and Newsletters

5. Apple hardware and software.

1. **Homebrew Computer Club**
2. POB 626, Mountain View CA 94042
3. Robert Reiling, (415) 967-6754
4. *Homebrew Computer Club Newsletter*
5. Information exchange on all systems.

1. **Proteus**
2. 1690 Woodside Rd, 219, Redwood City CA 94061

1. **FORTH Interest Group**
2. POB 1105, San Carlos CA 94070
3. Roy Marteus, (415) 962-8653
4. *FORTH Dimensions*
5. The FORTH language.

1. **San Francisco Apple Core**
2. 1515 Sloat Blvd, Suite 2, San Francisco CA 94132
3. Randy Fields, (415) 775-7965
4. *Cider Press*
5. Apple computers.

1. **CUssP**
2. POB 784, Palo Alto CA 94302
3. Dave Dameron, Editor
4. *CUssP Newsletter*
5. Cromemco computers and systems.

1. **INSUA (International North Star User's Association)**

2. POB 1318, Antioch CA 94509
3. William Banaghan
4. *The Compass*
5. For North Star computer users.

1. *Arcadian*
2. 3626 Morrie Dr, San Jose CA 95127
3. R Fabris, (408) 742-6048 (8 AM to 4 PM) or (408) 258-4586 (6 to 10 PM)
5. For the Bally/AstroVision Arcade.

1. **CUE (Computer-Using Educators)**
2. Independence High School, 1776 Education Park Dr, San Jose CA 95133
3. Don McKell, (408) 926-7378
4. Bimonthly newsletter
5. Computers in education.

1. **Pascal/Z Users Group**
2. 7962 Center Pky, Sacramento CA 95823
5. The purpose of our group is to encourage the use of Pascal.

1. **68XX(X) User Group**
2. POB 18081, San Jose CA 95158
3. Ray Boaz, (408) 269-9522
5. All 68XX(X) microcomputers and related hardware and software.

1. **SYM-1 Users Group**
2. POB 315, Chico CA 95927

3. H R Luxenburg, (916) 895-8751
4. *SYM-Physis*
5. Graphics, voice, music, word processing, and intercomputer communications for the SYM-1.

1. **Group/380**
2. POB 1131, Mt Shasta CA 96067
3. Mokurai Cherlin
4. *Group/380 News*
5. IBM 370-compatible microcomputers.

1. **The Aloha Computer Club**
2. POB 4470, Kailua HI 96734
3. Roger Wickenden, President, (808) 262-4673
4. *The Debugger*
5. Anything to do with microcomputers.

1. **Z80 Microfans—A Sorcerer Users Group**
2. POB 12504, Portland OR 97212
3. C Douglas Auburg, Editor, (206) 694-7769, evenings
4. *Z80 Microfans Newsletter*
5. Special interests: sharing problems, tips, and solutions in the use of the Exidy Sorcerer.

1. **Portland Computer Society Inc**
2. POB 17371, Portland OR 97217
3. Neal J Bonome, (503) 654-5932
4. *Portland Computer Society Newsletter*
5. Information exchange for

all types of microcomputers.

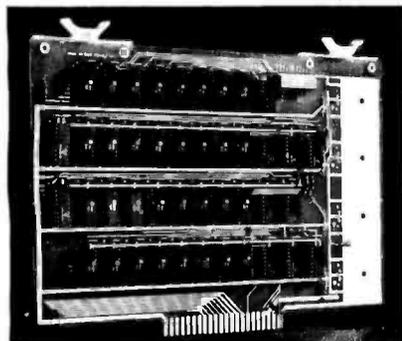
1. **Salem Area Computer Club**
2. POB 7715, Salem OR 97303
3. Kenneth Ernst, (503) 393-1173
4. *SACC Newsletter*
5. Users groups: Apple, TRS-80, PET, and VisiCalc.

1. *Home Computers*
2. POB 616, Silverton OR 97381
5. General information on personal computers.

1. **Atari Computer Enthusiasts**
2. 3662 Vine Maple Dr, Eugene OR 97405
3. M R Dunn, Editor,
4. *A.C.E. Newsletter*
5. This group is dedicated to the use of Atari microcomputers.

1. **Hex Users Group**
2. 36012 Military Rd S, Auburn WA 98002
3. Charles Worstell, (206) 927-6038
4. Newsletter on an irregular basis
5. Special interests: 6800 and 6809 small systems.

1. **PN HUG (Pacific Northwest Heath Users Group)**
2. c/o POB 993, Bellevue WA 98009
3. Jan N Johnsen, (206) 464-5666



VAK-4 DUAL 8K-RAM ~~\$270.00~~ \$325.00 plus shipping
VAK-2 8K-RAM (1/2 populated) \$239.00

Special thru 4/30/81
VAK for \$299.00

VAK-4 16K STATIC RAM BOARD

- Designed specifically for use with the AIM-65, SYM-1, and KIM-1 microcomputers
- Two separately addressable 8K-blocks with write protect.
- Designed for use with the VAK-1 or KIM-4* motherboards
- Has provisions for mounting regulators for use with an unregulated power supply
- Made with 1st quality 2114 static ram chips
- All IC's are socketed
- Completely assembled, burned-in, and tested

We manufacture a complete line of high quality expansion boards. Use reader service card to be added to our mailing list, or U.S. residents send \$1.00 (International send \$3.00 U.S.) for airmail delivery of our complete catalog.

*Product of MOS Technology

RNB ENTERPRISES
INCORPORATED

2951 W. Fairmount Avenue • Phoenix, AZ 85017 • (602) 265-7564
Please note new address

This printer costs less than \$450. Beat that... if you can.



Epson.

This is the Epson MX-70. The lowest priced dot matrix printer you can buy. Now, that in itself should make it very attractive to a lot of people. But you ain't heard the half of it.

To begin with, the MX-70 has a lot more in common with our now-famous MX-80 than just the name. Like unequalled Epson reliability. And technological breakthroughs like the world's first disposable print head. But frankly, the MX-80 packs a lot more power than some people need. So we built the MX-70 to be a no-frills printer. At a no-frills price.

But the MX-70 is still a great little printer. We give you 80 CPS unidirectional printing. Top-of-form recognition. Programmable line feed and form lengths. Plain paper printing. An easy-to-read 5x7 matrix. Self test. And an adjustable tractor feed.

That's what you'd expect

from a basic little printer. But here's something you wouldn't expect: the finest graphics package on the market today. Free.

We call it GRAFTRAX II. And it means 480 dots across the page, resolution to 60 dots per inch, and a graphic image free of the jitter and overlap that plagues other printers. You get cleaner grays and finer point resolution.

So now you've got a choice. You want more power and extra functions, you buy the MX-80.

You want a basic little printer that prints, and keeps on printing, you buy the MX-70. They're both at your dealer now.

But at this price, you'd better hurry.



EPSON
EPSON AMERICA, INC.

23844 Hawthorne Boulevard • Torrance, California 90505 • (213) 378-2220

Clubs and Newsletters

4. Newsletter published every other month
5. Special interests: Heath H-8 and H-89 microcomputers.

1. NW PET Users Group
2. 2565 Dexter N #203, Seattle WA 98109
3. Richard Ball, (206) 284-9417
4. Newsletter
5. PET users group.

1. Apple Puget Sound Program Library Exchange

2. 304 Maine Ave S, Suite 300, Renton WA 98055
3. Dick Hubert, (206) 271-4514
4. Call—A.P.P.L.E.
5. Everything related to the Apple II.

1. SPOHUG (Spokane Heath Users Group)
2. RFD #1, Box 676, Spokane WA 99204
3. Charles K Ballinger, President, (509) 448-9727
4. SPOHUG Newsletter
5. Special interests: Heath H-8 and H-89 computers.

1. I-SUG
2. POB 1542, St Catharines, Ontario, L2R 7J9, Canada
5. Interested in Exidy Sorcerer microcomputers.

1. Kitchener—Waterloo Microcomputer Club
2. Reading Room—E2-3354, Electrical Engineering Department, University of Waterloo, Waterloo, Ontario, N2L 3G1, Canada
3. Roger Sanderson, work (519) 885-1211, ext 3815
5. Special interests: 6800 and 6809 SwTPC systems.

1. TRACE (Toronto Region Association of Computer Enthusiasts)
2. POB 6922, Station A, Toronto, Ontario, M5W 1X6, Canada
3. Ross Cooling, (416) 488-3314
4. TRACE

1. CPE (Central Program Exchange)
2. Department of Computing & Mathematical Sciences, The Polytechnic, Wulfruna St, Wolverhampton, WV1 1LY, England
3. Judith Brown, 0902 27371, ext 93
4. Program Exchange
5. Microcomputer usage in schools and educational computer-aided learning.

Foreign Clubs and Newsletters

1. Computer Education Group of Victoria
2. POB 245, Niddrie, Victoria 3042, Australia
3. Greg Johnstone, (03) 336-1855
4. COM-3
5. Educational uses of computers.

1. Brazilian Microcomputer Club
2. Rua Sambaiba, 516, Leblon, Rio de Janeiro 22450, Brazil
3. Douglas Gilson, 274-2439
5. Special interests: exchanging programs and ideas with other clubs.

1. Apple's British Columbia Computer Society
2. #101-2044 W 3rd Ave, Vancouver, British Columbia, V6J 1L5, Canada
3. Gary Little, (604) 731-7886

4. Applegram
5. Apple II microcomputers.

1. Apple-Can
2. POB 696, Station B, Willowdale, Ontario, M2K 2P9, Canada
3. Louis H Milrad, (416) 961-6691 or 223-0599
4. Yes
5. All areas concerning microcomputers.

1. Association of Computer Experimenters
2. c/o B Murphy, 102 McCraney St, Oakville, Ontario, L6H 1H6, Canada
3. B Murphy, (416) 845-1630
4. Ipso Facto
5. Special interests: CDP 1802 microprocessor-based hobby computers.

1. OSMIE (Ontario Society for Microcomputers in Education)
2. Unit for Computer Science, McMaster University, Hamilton, Ontario, L8S 4K1, Canada
3. N Solntseff, (416) 525-9140, ext 4689
5. All educational uses of microcomputers.

1. The Ottawa Computer Group
2. POB 5691, Station F, Ottawa, Ontario, K2C 3M1, Canada
3. John Mainwaring, President, (613) 725-9441; or Dennis Tubie, Secretary, (819) 561-1645
4. OCG Newsletter
5. Special interests: microprocessors and computer bulletin board.

1. North London Hobby Computer Club
2. c/o D.E.C.E. Polytechnic of North London, Holloway Rd, London N7 8DB, England
3. Robin Bradbeer, 01-607-2789
4. Gigo
5. Special interests: business, homebrew, and games workshops. PET users group.

1. Microtel—Club
2. 9, rue Huysmans 75006 Paris, France
3. M Perdrillat, 33 (1) 544 70 23
4. Microtel-Infos
5. This group is interested in microcomputers and telecommunications.

Bower-Stewart & Associates SOFTWARE AND HARDWARE DESIGN

\$GOLD DISK\$ CP/M® Compatible Z-80 Software

Available for all 8-5" SS-SD IBM format systems including TRS-80®, Northstar, SD Systems. Also available on 5" double density Superbrain.®

\$175.
ppd

Un-can your canned software!

Z-80 Disassembler Feel couped up with your canned software? Our Z-80 Disassembler recreates assembly language source files from absolute code enabling users to easily tailor programs to meet their specific needs. The Preconditioner works with the Disassembler to decode ASCII.

\$50.
ppd

Great looking letters & reports!

E-Z Text A unique word processor organized around user-created text files, embellished with simple control commands, which supports such 'BIG GUYS' features as Automatic Footnoting, Table Spacing, Heading, Paging, Left & Right Margins, Proportional Spacing and MORE, at a 'LITTLE GUYS' price tag.

Credit cards: Immediate service, free 24 hr phone—we will credit invoice. Checks, M.O.'s: Ten workday hold. CA res: Add tax.



State system & controller. Allow time for surface mail. Trademarks: Digital Research, Radlo Shack, Intertec.

POST OFFICE BOX 1389 HAWTHORNE, CALIFORNIA 90250 213 / 676-5055

The PRACTICAL MICROCOMPUTER PROGRAMMING™ books . . .

WHAT DO THE CRITICS SAY?

BYTE: "It was apparently Mr. Weller's goal from the beginning to present the fundamental concepts of assembly language programming in a completely nonthreatening way. He has accomplished this better than any other author to date. . . Practical Microcomputer Programming is a very powerful series. It is well written and full of essential techniques for the assembly language programmer. . . "The authors know the difference between a novice and a ninny. They never talk down. . . on every page the authors spot and clear up the small ambiguities of technical jargon that can block understanding."

Kilobaud: "A powerful plus for this book is the author's determination to demonstrate why and how to use each instruction, not merely to explain how it works. . . At no point do the authors resort to rehashing material available from the manufacturer. . . but instead choose a less theoretical, more practical approach."

Leventhal: ". . . large numbers of documented, well structured examples, and a clear readable style, a logical development of major topics."

Digital Design: "This book is the best and most lucid introduction to Z80 programming that we have seen."

CACHE: "This is an EXCELLENT book. . . dirt cheap for such great software and documentation."



IF YOU'VE TRIED THE "CHEAPIES" AND AREN'T SATISFIED WITH WHAT YOU GOT, IT'S TIME TO TRY THE REAL THING, THE ACKNOWLEDGED WORLD STANDARD OF TECHNICAL EXCELLENCE IN ASSEMBLY LANGUAGE PROGRAMMING INSTRUCTION—THE PRACTICAL MICROCOMPUTER PROGRAMMING BOOKS.

- FOR THE 6502 -

PRACTICAL MICROCOMPUTER PROGRAMMING: THE 6502 by W. J. Weller \$32.95
20 chapters, 6 appendices, 475 page Smythe sewn hardcover covering all fundamental assembly language techniques for the 6502 processor. The text explanation is re-enforced with 118 verified, real world programming examples that run on real computers. An extended 6502 language, supported by a new editor/assembler which comes with the book, circumvents many of the problems which have made the 6502 so difficult to program in the past. In addition to the fundamental technique chapters, there are special chapters covering simple graphics, elementary cryptography and random number generation and use. The source texts of both the editor/assembler and a powerful new debugging monitor for the Apple II and Apple II+ included in appendices. The object code for this software is supplied **FREE** to book purchasers on Apple cassette or for \$7.50 on disk when the licensing agreement from the book is returned to the publisher. The editor/assembler is also available on paper tape for users of other 6502 based systems.

- FOR THE Z80 -

PRACTICAL MICROCOMPUTER PROGRAMMING: THE Z80 by W.J. Weller \$32.95
18 chapters, 4 appendices, 481 page Smythe sewn hardcover which details assembly language technique as applied to the Z80 processor. The Z80 is treated as an 8080 superset in an 8080 extension language, which means that you don't have to discard your hard won 8080 knowledge to program the Z80. In addition to the fundamental chapters there are chapters on graphic output and full four function decimal arithmetic. The text explanation is re-enforced with 104 tested, verified programming examples. A powerful editor/assembler and debugging monitor, in source form, are provided to support the language used in the book. This software will run on any Z80 based computer with 10K RAM beginning at 0. Object code for both editor/assembler and debugging monitor is sent to book purchasers **FREE** on paper tape or, in modified form, on TRS-80 Level II cassette when the coupon from the book is returned to the publisher.

- FOR THE 8080 -

PRACTICAL MICROCOMPUTER PROGRAMMING: THE INTEL 8080 by Weller, Shatzel and Nice \$23.95
18 chapters, 3 appendices, 318 page Smythe sewn hardcover which applies fundamental assembly language technique to this most popular of processors. The text is supported by 84 separate programming examples. The book includes a special section on the handling of complex peripheral devices and exotic typefaces. Appendices give the source for an 8080 resident debugging monitor and a minicomputer cross assembler for the 8080. Also available (not shown above) are a workbook for use with this text (\$9.95) and **AN EDITOR/ASSEMBLER SYSTEM FOR 8080/8085 BASED COMPUTERS** (\$15.95) which supports the language used in the text. These three books together make a complete teaching package for the 8080.

- FOR THE 6800 -

PRACTICAL MICROCOMPUTER PROGRAMMING: THE M6800 by W.J. Weller \$23.95
16 chapters, 2 appendices, 299 page Smythe sewn hardcover text which details the application of fundamental assembly language technique to the 6800. 104 separate programming examples re-enforce the text explanation. Contains in addition special chapters on low precision trigonometry and random number generation and use. A resident debugging monitor for 6800 systems is included in an appendix.

NO GAMES, NO NONSENSE, NO REPRODUCTIONS OR REHASHES OF MANUFACTURER'S DATA SHEETS, JUST TESTED, ACCURATE, RELEVANT PROGRAMMING INFORMATION BACKED UP BY REAL EXAMPLES THAT RUN ON REAL COMPUTERS—THE PRACTICAL MICROCOMPUTER PROGRAMMING BOOKS. THERE IS NOTHING ELSE AS GOOD ANYWHERE, AT ANY PRICE.

Mail to: Northern Technology Books, Box 62, Evanston, IL 60204

- | | |
|---|---------|
| <input type="checkbox"/> Practical Microcomputer Programming: The 6502 | \$32.95 |
| <input type="checkbox"/> Practical Microcomputer Programming: The Z80 | \$32.95 |
| <input type="checkbox"/> Practical Microcomputer Programming: The Intel 8080 | \$23.95 |
| <input type="checkbox"/> Practical Microcomputer Programming: The M6800 | \$23.95 |
| <input type="checkbox"/> Workbook for Practical Microcomputer Programming: The Intel 8080 | \$ 9.95 |
| <input type="checkbox"/> An Editor/Assembler System for 8080/8085 Based Computers | \$15.95 |

Check enclosed (U.S. funds only)

Money order enclosed

Name _____

Street _____

City _____ State _____ Zip _____

Illinois residents add 5% sales tax

The time has come for computers to talk and listen



Introducing COGNIVOX series VIO, the affordable voice I/O peripherals

If you have a

PET — TRS-80 — APPLE II AIM-65 — SORCERER

or any Z-80 CPU based system with at least 16K of RAM, COGNIVOX will add a whole new dimension to your computer.

Imagine being able to use your voice for entry of commands and data and then listen to the computer talk back to you! This exciting possibility has now become a reality at a very affordable price.

COGNIVOX, series VIO, is a family of voice input and output peripherals especially designed for personal computers that are easy to use and have excellent software support. You need only plug in COGNIVOX, load one of the programs provided and you will be able to have a voice encounter with your computer!

COGNIVOX can be trained to recognize words or short phrases from a vocabulary of up to 32 entries of your choice, with an accuracy of up to 98%. The voice response vocabulary can also have up to 32 entries chosen by the user. COGNIVOX requires that your computer has at least 16K of RAM. If it has less memory or if you are only interested in recognition, ask us about our SR-100 series of voice input peripherals.

COGNIVOX comes complete with microphone, power supply, (as required), built-in amplifier/speaker and extensive user manual. What makes COGNIVOX truly unique, though, is the software that comes with it on cassette. Some of the programs included are: DIALOG, a program that lets you conduct a dialog with your computer (or translate from one language to the other); VDUMP, a vocal memory dump that reads the memory contents out loud; VOTH, a voice operated talking board game and VOICETRAP, a voice operated video game.

Adding voice I/O to your own programs can be done very easily too. All that is needed to have your computer recognize a word or say a word is a single USR statement in BASIC. No machine language programming is necessary.

With all these features, you'd expect COGNIVOX to cost a small fortune (after all, even talking chess games sell for over \$300), yet it only costs **\$149** (add \$4.50 for shipping in the U.S., 10% of order overseas, CA res. add 6% tax). This low price has been made possible by innovative hardware and a technological breakthrough in recognition algorithm design that uses powerful non-linear pattern matching techniques and adaptive learning.

COGNIVOX is simply the most fun, most exotic peripheral you can buy for your computer. Write or call (805) 685-1854 for more information, giving us the make and model of your computer. Or better yet, order a COGNIVOX today and bring your computer to life.

VOICETEK

Dept B, P.O. Box 388
Goleta, CA 93116

Clubs and Newsletters

- | | |
|---|---|
| <ol style="list-style-type: none"> 1. Japan Microcomputer Club 2. Rm 313, 3-5-8, Shibakoen, Minato-Ku, Tokyo 105, Japan 3. Keigo Aono, Director 03-438-1869 4. <i>Microcomputer Circular</i> 5. This is the largest, non-profit, nationwide group in Japan. An English-language version of the club's newsletter is available. | <ol style="list-style-type: none"> 1. HCC (Hobby Computer Club) 2. Christinastraat 171, 5 615 RK Eindhoven, Netherlands 4. <i>Hobby Computer Club Nieuwsbrief</i> 5. The goals of the HCC are to increase contacts between computer amateurs and to exchange ideas and experiences. |
| <ol style="list-style-type: none"> 1. Microcomputer Club 2. Fte de Quijote #5, Tecamachalco, Mexico 10-D F, Mexico 3. Alfredo Buzali, (905) 589-2279 4. Bulletin 5. Primarily concerned with the Apple computer. | <ol style="list-style-type: none"> 1. Club de Computación Lampas de Carabobo 2. Apartado 716, Valencia, Venezuela 2001A, Venezuela 5. Use of microcomputers in civil engineering, basic sciences, and administration. ■ |

Answers to MicroShakespeare Quiz

1 - m	6 - o	11 - i	16 - e
2 - j	7 - b	12 - c	17 - t
3 - a	8 - q	13 - r	18 - k
4 - f	9 - l	14 - g	19 - n
5 - h	10 - s	15 - p	20 - d

Number of Correct Matches

MicroShakespeare Rating

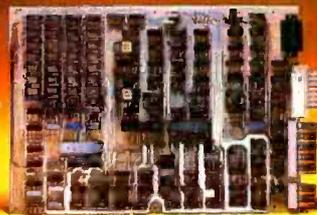
<p>20</p> <p>17 - 19</p> <p>13 - 16</p> <p>9 - 12</p> <p>5 - 8</p> <p>4 or fewer</p>	<p>Hit "START" with confidence.</p> <p>One short debug session and you're home free.</p> <p>Check your system monitor.</p> <p>Must have mixed up the pin-outs.</p> <p>Blame it on a power surge.</p> <p>Back to collecting stamps. ■</p>
--	--

SOLVE THE STORAGE SHORTAGE

with ten multi-user megabytes



CompuStar's 8-inch Winchester



Intertec's exclusive 255 User Controller



CompuStar Cable Assembly

If you could think of just one way to improve our phenomenally popular SuperBrain, what would it be? More disk storage? Well, we already thought about it. And for only a few thousand dollars for a whopping 10 megabytes of lightning-fast storage, it's nothing short of another major breakthrough! From the company that wrote the book on price/performance . . . Intertec.

Our New CompuStar™ 10 Megabyte Disk Storage System (called a DSS) features an 8 inch Winchester drive packaged in an attractive, compact desktop enclosure. Complete with disk, controller and power supply. Just plug it into the Z80 adaptor of your SuperBrain and turn it on. It's so quiet, you'll hardly know it's there. But, you'll quickly be astounded with its awesome power and amazing speed.

The secret behind our CompuStar DSS is its unique controller/multiplexor. It allows many terminals to "share" the resources of a single disk. So, not only can you use the DSS with your SuperBrain, you can configure multiple user stations using our new series of CompuStar™ terminals, called Video Processing Units or VPU's™.

Four CompuStar VPU's are available. At prices starting at less than \$2,500. Some models are designed to operate as stand-alone microcomputers, with internal disk storage. Just like your SuperBrain. Each model features its own 64K of RAM and can be "daisy-chained" into a powerful multi-user network. Just connect one VPU into the next. Using easy-to-install cable assemblies. Connect up to 255 users in a single system. One at a time. As you need them.

Whether you need an extra 10 megabytes for your SuperBrain or an enormous multi-user network, the CompuStar™ DSS solves your storage shortage problems. Sensibly. And economically. Plus, your investment is protected by a nationwide service network with outlets in most major U.S. cities. Providing efficient on-site or depot maintenance.

Get a demonstration of this extraordinary new system today. Call or write now for the name and address of your nearest CompuStar dealer.

**INTERTEC
DATA
SYSTEMS**

2300 Broad River Rd. Columbia, S.C. 29210
(803) 798-9100 TWX: 810-666-2115

THE HISTORY OF MICROCOMPUTERS

BY TOM SLOAN

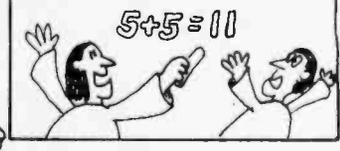
BACK IN PRE-HISTORIC TIMES, CAVEMEN DID ALL THEIR FIGURING ON THEIR FINGERS. BUT THE ONLY TROUBLE WAS 10 WAS AS HIGH AS THEY COULD COUNT.



LET'S SEE NOW... THE $\sqrt{144}$ IS... UH, HMM WELL, IT MUST BE 10.



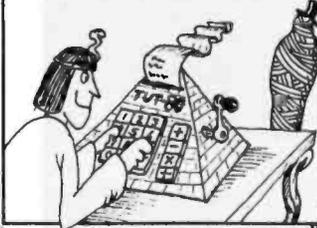
COUNTING REMAINED THAT WAY UNTIL SOME GREAT SUMERIAN DISCOVERED THAT NUMBERS CAN EXIST HIGHER THAN 10.



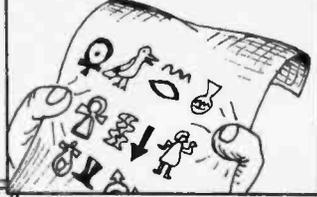
THE EGYPTIANS LOVED LARGE NUMBERS, AND...



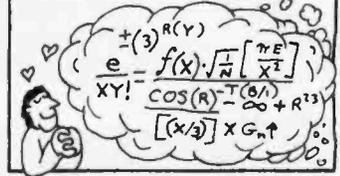
SO THEY INVENTED A CRUDE ADDING MACHINE



IT EVEN HAD ITS OWN SET OF GRAPHIC CHARACTERS.



AS TIME PROGRESSED SO DID MAN'S NEED FOR EVEN MORE COMPLICATED NUMBER WORK.



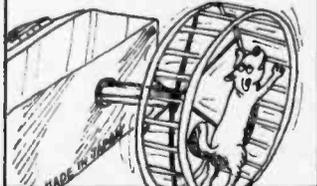
THE GREEKS CAME UP WITH A WHOLE SET OF VARIABLES: THE ALPHABET



THE CHINESE PUT IT TO IMMEDIATE USE.



THEN PASCAL INVENTED THE BUILT IN POWER SUPPLY.



GUTENBERG INVENTED THE FIRST MOVABLE PRINT HEAD.



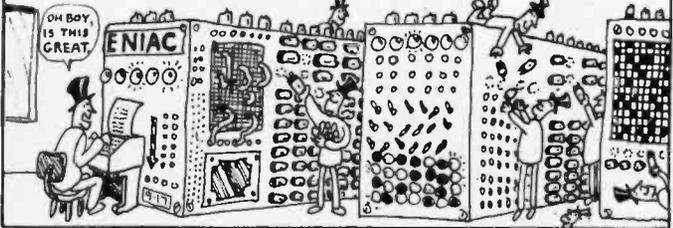
PEOPLE COULD NOW HAVE A HARD COPY OF ANYTHING. IT WAS EVEN USED BY OUR FOUNDING FATHERS.



ALONG CAME DeFORREST'S VACUUM TUBE, WHICH MEANT HEAVEN FOR MANY AN INVENTOR!



WITH THAT, THE FIRST TRUE DIGITAL COMPUTERS WERE BUILT. THEY WERE GIANT AND USED MILLIONS OF TUBES.



BUT WHEN REPLACING TUBES BECAME MORE COSTLY THAN THE FIGURING WAS WORTH, SOLID STATE TECHNOLOGY TOOK OVER. SO INSTEAD OF MASSIVE COMPUTERS FILLING UP AN ENTIRE FLOOR, THEY WERE BUILT TINY. ABOUT THE SIZE OF A REFRIGERATOR.



MAKE ME A SANDWICH.



INSTEAD OF PAPER, SOMEONE GOT THE IDEA TO ADD A T.V.



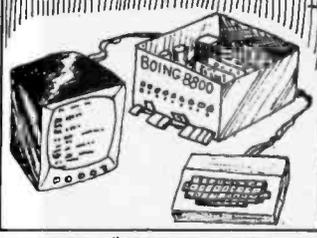
DESPITE THEIR SMALL SIZE, THEY STILL WERE NOT QUITE SMALL ENOUGH FOR HOME USE.



FINALLY CAME THE INVENTION OF THE MICRO-PROCESSOR!



WHICH MADE IT POSSIBLE FOR MICRO-SIZE COMPUTERS



AND NOW OUR SMALL, PORTABLE COMPUTERS ARE THOUSANDS OF TIMES MORE POWERFUL AND COST THOUSANDS OF TIMES LESS.



SO NOW IT IS EASIER THAN EVER TO WRITE A COMPLICATED PROGRAM.



* FACT: BEN FRANKLIN COINED THE ELECTRICAL TERMS "POSITIVE AND NEGATIVE."

Orange Micro

"SPECIALIZING IN PRINTERS
AND CRT'S"

CENTRONICS 737 (RADIO SHACK LINE PRINTER IV)

Word Processing Print Quality



- 18 x 9 dot matrix; suitable for word processing • Underlining • proportional spacing • right margin justification • serif typeface • 50/80 CPS • 9½" Pin Feed/Friction feed • Reverse Platen • 80/132 columns

CENTRONICS 737-1 (List \$995) \$765
CENTRONICS 737-3 (List \$1045) \$815

VISTA — C. ITOH

Daisy Wheel Letter Quality

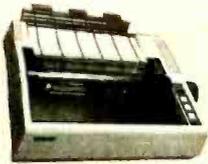


- 25 CPS (Optional 45 CPS) • Typewriter quality • Centronics parallel • RS 232 Serial (Optional) • Proportional spacing • Bidirectional • Programmable VFU • Self test • Diablo compatible • Friction feed (Optional tractors) • 136 printable columns • Manufactured by C. ITOH.

VISTA V300 (C. ITOH) (List \$1895) \$ Call

EPSON MX80

*Low-Priced
Professional Print Quality*



- 9 x 9 dot matrix • Lower case descenders • 80 CPS • Bidirectional, Logic seeking • 40, 66, 80, 132 columns per line • 64 special graphic characters: TRS-80 Compatible • Forms handling • Multi-pass printing • Adjustable tractors

EPSON MX80 (List \$645) \$Call
EPSON MX70 (List \$495) \$Call

ANACOM

Low Cost, High Speed, Wide Carriage

- 9 x 9 dot matrix • Lower case descenders • Wide carriage • Adjustable tractors to 16" • 150 CPS, Bidirectional, Logic Seeking

ANACOM 150 (List \$1350) \$ Call

ANADEX

Dot Graphics, Wide Carriage

- 11 x 9 dot matrix; lower case descenders • Dot resolution graphics • Bi-directional, logic seeking • Up to 200 CPS • RS 232 Serial & Parallel • Forms control • X-ON/X-OFF • Up to 6 part copy.

ANADEX 9501 (List \$1650) \$1450

OKIDATA MICROLINE SERIES

TRS-80 Graphics Compatibility



- 9 x 7 dot matrix • 80 CPS • 80, 132 columns — 64 shapes for charts, graphs & diagrams • Double wide characters • 6/8 lines per inch • Up to 3 part copy • Friction & pin feed • 200 M character head warranty

OKIDATA MICROLINE 80 (List \$800) \$520
OKIDATA M82 Bidirectional, Forms handling (List \$960) \$750
OKIDATA M83 Wide carriage, 9 x 9 dot matrix (List \$1260) \$Call

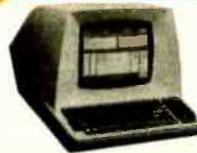
NEC SPINWRITER

High Speed Letter Quality

- 55 CPS • Typewriter quality • Bidirectional • Plotting • proportional spacing.

5510-5 RO, Serial, w/tractors (List \$2995) \$2625
5530-5 RO, Parallel, w/tractors (List \$2970) \$2599

TELEVIDEO CRT'S PRICES SLASHED!



TVI 912C } Please Call Toll Free
TVI 920C } Prices are too low to
TVI 950 } advertise

QUANTITY PRICING AVAILABLE

IDS PAPER TIGERS

Dot Resolution Graphics, quality print



- 7 wire printhead (445); 9 wire printhead (460) with lower case descenders • Over 150 CPS • bi-directional, logic seeking (460) • 8 character sizes; 80-132 columns • Adjustable tractors • High-resolution dot graphics • Proportional spacing & text justification (460).

IDS 445G 7 wire printhead, graphics (List \$895) \$ 795
IDS 460G 9 wire printhead, graphics (List \$1394) \$1150

PRINTERS

MALIBU 165 wide carriage, graphics, letter quality ... (List \$2495) \$ 1975
QUME 5/45 typewriter quality (List \$2905) \$ 2559

INTERFACE EQUIPMENT

CCS APPLE PARALLEL Interface & cable \$ 150
APPLE II - EPSON MX80
parallel graphics interface board & cable \$ 110
SSM AIO BOARD Apple Serial/parallel interface (List \$225) \$ 175
MICROTRONICS Atari parallel interface \$ 69
ATARI 850 Interface module, serial/parallel \$ 199
TRS-80 CABLES to keyboard or Exp. interface \$ Call
NOVATION D-CAT direct connect modem \$ Call

CALL FOR FREE CATALOG

(800) 854-8275
CA, AK, HI (714) 630-3322

At Orange Micro, we try to fit the right printer to your application.
Call our printer specialists for free consultation.

TELEPHONE ORDERS: Mon.-Fri. 8:30 - 5:00
The Orange Micro Printer Store (Retail):
Mon. -Fri. 10:00 - 6:00, Sat. till 4:00



Phone orders WELCOME; same day shipment. Free use of VISA & MASTERCARD. Personal checks require 2 weeks to clear. Manufacturer's warranty included on all equipment. Prices subject to revision.

**Orange
Micro, Inc.** 
3148 E. La Palma, Suite E
Anaheim, CA 92806

Three Versions of APL

Gregg Williams, Senior Editor
BYTE POB 372
Hancock NH 03449

When BYTE magazine published its APL language issue in August 1977, APL was far beyond the capabilities of any microcomputer. To show how rapidly things have evolved since then, the Digital Group, in that same issue, was advertising a 32 K-byte static-memory board for \$995, and another advertisement began, "Introducing Apple II...." Times have changed: 32 K bytes of dynamic memory, now commonly used in several major microcomputer lines, can be bought for less than \$120—and Apple is one of the oldest computer lines in the industry.

Times have changed for APL as well: several companies have announced software and hardware supporting this unique programming language. This review compares three versions of APL: Softronics APL, Ramware APL80 for the Radio Shack TRS-80, and Vanguard APL/V80. (For additional information, see the "At a Glance" boxes. Tables 1 thru 4 give timing comparisons and further information.)

Softronics APL: I/O Options and Documentation

Softronics APL runs on any Z80-based computer that supports at least 44 K bytes of memory and the CP/M operating system. It was written by Eric Mueller of Softronics, who, in 1977, authored a subset of APL called EMPL for 8080-based microcomputers. Softronics APL (Version 2.3C), which sells for \$350, has both good and bad features; a summary is given in table 2.

The most welcome feature of Softronics APL is the ability to use it with several types of keyboards and display devices. The default mode of operation is for the software to respond to a standard ASCII (American Standard Code for Information Interchange) terminal through standard CP/M input and output routines. Three other modes allow the user to use an assortment of APL-type devices.

For those of us who do not have several thousand extra dollars to spend on an APL-type I/O (input/output) device, the ASCII mode of Softronics APL is very welcome. In this mode, all APL characters that are not on a normal keyboard are replaced by either a single key (eg: an underline character to replace the APL assignment arrow) or a 3-character mnemonic (eg: \$TP for the transpose operator or \$RO for the Greek rho symbol). Although some users object to this arrangement, my reaction to running Xerox APL for an extended period, using such mnemonics, was one of gratitude—better this

APL than no APL at all.

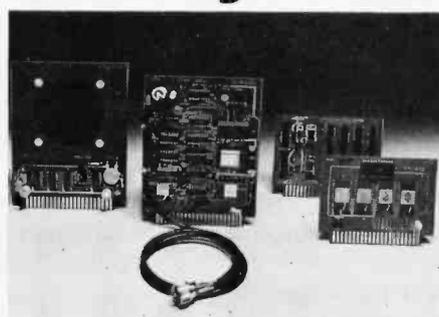
Listing 6 shows the output of the APL function CIRCLE. Listing 3a shows the output with slight changes in regular APL notation. I have also found that by changing the value of the system variable □CS, you can cause the APL mnemonics to be displayed *with angle brackets* around them instead of the preceding dollar signs—on printout only (ie: not input). For example, you will still have to type in \$RO for the APL reshape operator, but it will be displayed to the screen or printer as <RO>. This is a nice feature that adds to the readability of APL programs printed in ASCII mode.

Provisions are also made for using Softronics APL with the two most prevalent types of APL terminals (*bit-pairing* and *typewriter-pairing* terminals). Softronics APL begins executing in the ASCII mode but can be converted to APL terminal mode by assigning a new value to the system variable □CS, or it can be modified to begin executing in terminal mode by making a 1-byte patch to the APL.COM machine-language file. Nonstandard terminals or video boards can be interfaced by adding user-supplied input and output machine-language subroutines. The manual explains what routines need to be written and where they should be placed in memory.

Finally, the manual gives documentation on still another I/O option: the use of APL input and output through a video board with a programmable character generator. The documentation includes the software driver (which works with an Objective Design Inc character generator), a Kent-Moore Alpha-VDM-II video display board, and a listing that defines all APL special characters for a character generator as a series of hexadecimal numbers. All this code is included in the APL.COM file.

The ease with which I understood these four display options is an indication of the quality of the documentation. The Softronics APL documentation is the best of the three packages reviewed here. It includes a short tutorial on APL for the complete novice, a description of all functions, sample programs (including APL defined functions that simulate certain APL operators not defined in machine language), and several useful appendices. One section of the documentation, "Bugs and Common Perplexing Error Messages," is a great time saver. It is extremely helpful in explaining some quirks of Softronics APL and how to circumvent them. This section saves the user from

The VP-111 hobby computer: Start programming for only \$99.



New! VP-111 Microcomputer \$99. Assembled* and tested.

Features:

- RCA 1802 Microprocessor.
- 1K Bytes static RAM. Expandable on-board to 4K. Expandable to 32K Bytes total.
- 512 Byte ROM operating system.
- CHIP-8 interpretive language or machine language programmable.
- Hexidecimal keypad.
- Audio tone generator.
- Single 5-volt operation.
- Video output to monitor or modulator.
- Cassette interface—100 Bytes/sec.
- Instruction Manual with 5 video game listings, schematics, CHIP-8, much more!

Ideal for low-cost control applications. Expandable to full VP-711 capability with VP-114 Kit.

*User need only connect cables (included), a 5-volt power supply and speaker.

New low price! \$199. VP-711, only..... Completely assembled and tested.

All the features of the VP-111 plus:

- A total of 2K Bytes static RAM.
 - Power supply.
 - 8 Bit input port.
 - 8 Bit output port.
 - I/O port connector.
 - System expansion connector.
 - Built-in speaker.
 - Plastic cover.
- Three comprehensive manuals:
- Instruction Manual—20 video game listings, schematics, much more.
 - User's Guide—operating instructions and CHIP-8 for the beginner.
 - RCA 1802 User's Manual (MPM-201B)—complete 1802 reference guide.

Add computer power a board at a time.

With easy-to-buy options, the versatile RCA hobby computer means even more excitement. More challenges in graphics, games and control functions. For everyone, from youngster to serious hobbyist.

Built around an RCA COSMAC microprocessor, our hobby computer is easy to program and operate. Powerful CHIP-8 interpretive language gets you into programming the first evening. Complete documentation provided.

Send the coupon now...

Complete the coupon below and mail to: RCA MicroComputer Customer Service, New Holland Ave., Lancaster, PA 17604.

Or call toll free (800) 233-0094 to place your Master Charge or VISA credit card order. In Pennsylvania, call (717) 397-7661, extension 3179.



Please send me the items indicated.

- VP-111** New low cost Microcomputer (See description above) \$ 99
- VP-114** Expansion Kit for VP-111—Includes 3K RAM, I/O Port and connectors \$ 76
- VP-711** The original VIP Microcomputer (See description above) \$199
- VP-44** RAM On-Board Expansion Kit—Four 2114 RAM ICs. Expands VP-711 memory to 4K Bytes \$ 36
- VP-590** Color Board—Adds color. Four background and eight foreground colors \$ 69
- VP-595** Simple Sound Board—Provides 256 programmable frequencies. For simple music or sound effects. Includes speaker \$ 30
- VP-550** Super Sound Board—Turns VP-111/711 into a music synthesizer! Two independent sound channels. Outputs to audio \$ 49
- VP-551** 4-Channel Super Sound—Includes VP-576 and demo cassette. Requires VP-550 and 4K RAM \$ 74
- VP-570** Memory Expansion Board—Plug-in 4K RAM memory \$ 95
- VP-580** Auxillary Keypad—Adds two-player interactive capability. Connects to VP-590 or VP-585 \$ 20
- VP-585** Keypad Interface Board—Interfaces two VP-580 Auxillary Keypads to VP-111/711 \$ 15
- VP-560** EPROM Board—Interfaces two 2716 EPROMs to VP-111/711 .. \$ 34

- VP-565** EPROM Programmer Board—Programs 2716 EPROMs. With software \$ 99
- VP-575** Expansion Board—Provides 4 buffered and one unbuffered expansion sockets \$ 59
- VP-576** Two-Board Expander—Allows use of 2 Accessory Boards in either I/O or Expansion Socket \$ 20
- VP-700** Tiny BASIC ROM Board—BASIC code stored in 4K of ROM \$ 39
- VP-701** Floating point BASIC for VP-711 on cassette. Requires 16K Bytes RAM (avail. 7/80) \$ 49
- VP-710** Game Manual—Listing for 16 exciting games \$ 10
- VP-720** Game Manual-II—More games .. \$ 15

Keyboards & Terminals

- VP-601** Keyboard—128-character ASCII encoded alphanumeric 8-bit parallel output \$ 69
- VP-606** Keyboard—Same as VP-601. Asynchronous serial output \$ 99
- VP-611** Keyboard—Same as VP-601 plus 16-key numeric keypad \$ 89
- VP-616** Keyboard—Same as VP-606 plus 16-key numeric keypad \$119
- VP-620** Cable—Connects VP-601/611 to VP-111/711 \$ 20
- VP-623** Cable—Unterminated for VP-601/611 \$ 20
- VP-626** Connector—Male "D" mates to VP-606/616 \$ 7
- VP-3301** Interactive Data Terminal \$369
- VP-3303** Interactive Data Terminal with built-in RF output \$389

Enclosed is \$_____ for items checked plus shipping & handling charge of \$3.00.

Add your state and local taxes \$_____. Total enclosed \$_____

I enclose check or money order. Or charge my VISA Master Charge.

Credit card account No. _____

Master Charge Interbank No. _____ Expiration date _____

Signature (required for credit orders): _____

Name (please type or print): _____

Street address: _____ City: _____

State & Zip: _____ Telephone:() _____

Make checks payable to RCA Corp. Prices and specifications are subject to change without notice.

spending quite a bit of time swearing that the language "just doesn't work right."

Softronics APL: Some Problems

Despite its excellent performance in other areas, Softronics APL (Version 2.3C) has a number of deficiencies that range from minor annoyances to critical defects. The most serious defect is that Softronics APL does not notify the user of an error situation. Any computation that has a result over 9.2×10^{18} is replaced by a seemingly random value between 10^{16} and 10^{19} . The low limit on computation size is *not* what makes this error dangerous; rather, the danger lies in the language substituting an inaccurate answer and *not* stopping the computation with an error message.

A second problem with Softronics APL is that it responds with the message SYNTAX ERROR to any number over 7 digits long. I feel that the inability of this language to accept a longer number by rounding it off and, when necessary, putting it into scientific notation is a serious defect.

Many numeric operations that should come out "even" result in numbers ending in ...9999 or ...9997. For example, any variable assigned either the value 0.1 or 1/10 is printed as .099999. The dyadic power function has, for integral exponents, a cumulative round-off error that results in some incorrect answers. For example, 5^4 is calculated to be 390,622 (it is 390,625) and 3^{12} is calculated to be 531,436 (it is 531,441), with higher powers also being incorrect.

When using the power function for fractional powers, such as square roots, the results seem to be one or two units off in the least significant digit. Even though 6 significant digits are given in all calculations, I would recommend using only 5 significant digits when using the dyadic power function to calculate a root.

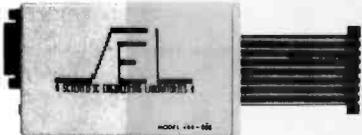
The trigonometric functions, such as sine, cosine, tangent, and arctangent, agree with the results found in the Chemical Rubber Company's *CRC Standard Mathematical Tables*. However, the arctangent function seems to work with a scalar (ie: a single value) but not with a vector (ie: a one-dimensional array of values).

Softronics APL still lacks several useful functions that are found in the more expensive Vanguard APL: arc-cosine, arctangent, and all hyperbolic trigonometric functions; rotation on three-dimensional and higher matrices; the grade-up and grade-down functions; and the deal (ie: dyadic question-mark) function. Other,

IEEE-488 TO TRS-80* INTERFACE

Everything needed to add *powerful* basic GPIB-488 controller capability to TRS-80 Model 1 or 3, Level 2 or DOS with a minimum of 16K.

MODEL 488-80B
For Model 1 Operation



MODEL 488-80C
For Model 3 Operation



Price of Model 488-80B or 488-80C \$225.
+ shipping, insurance & tax

Optional Relocatable Machine Level GPIB Driver for Assembler Level Programming-\$35.00

WHEN ORDERING SPECIFY DISK OR TAPE

SCIENTIFIC ENGINEERING LABORATORIES
11 Neil Drive • Old Bethpage, NY 11804
Telephone: (516) 694-3205

*Trademark of Tandy Corp.
There is no affiliation between Scientific Engineering Laboratories and Tandy Corp. or Radio Shack.

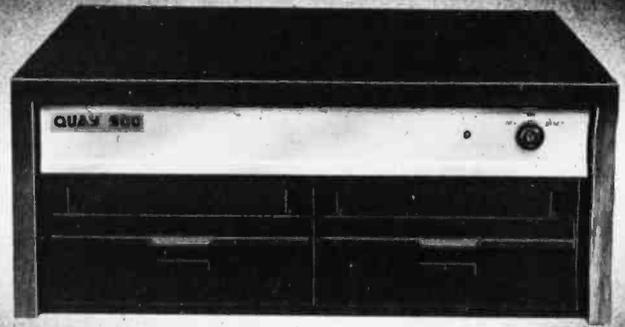
At a Glance

<p>Name Softronics APL, Version 2.3C</p> <p>Type of Software Package Version of APL programming language</p> <p>Manufacturer Softronics, 35 Homestead Ln, Roosevelt NJ 08555</p> <p>Price \$350</p> <p>Format 8-inch standard CP/M floppy disk</p>	<p>Language Used 8080 machine language</p> <p>Computer Needed An 8080-, 8085-, or Z80-based computer with at least 44 K bytes of programmable memory, running the CP/M operating system</p> <p>Documentation 112 pages, 22 by 28 cm (8½ by 11 inches)</p> <p>Audience APL users, programming language enthusiasts</p>
---	---

At a Glance

<p>Name APL80 (by Phelps Gates)</p> <p>Type of Software Package Version of APL programming language</p> <p>Manufacturer Ramware, 6 South St, Milford NH 03055 (603) 673-5144</p> <p>Price \$39.95</p> <p>Format 5-inch floppy disk</p> <p>Language Used Z80 machine language</p>	<p>Computer Needed Radio Shack TRS-80 Model I with one floppy-disk drive, Level II BASIC, and 32 K bytes of memory</p> <p>Documentation Twenty pages, 13 by 20 cm (5 by 7¾ inches)</p> <p>Audience APL users, programming language enthusiasts</p> <p>Comments Cassette-tape version with 25% fewer features available for 16 K TRS-80 at \$14.95</p>
--	---

RAM



standard on our 900 SERIES microcomputer system . . . under \$4,000.00*

Having so much disk capacity as standard in a low cost microcomputer system is reason enough to make the 900 Series your logical choice — but the fact is, it's only one of the reasons why this system offers the best price/performance value of any now on the market. There's also a simple modular design, a reliable single board computer, dual flexible disk drives, a versatile disk operating system, plenty of room for expansion, and attractive quantity discounts — plus a lot more.

Just check out these standard features and expansion capabilities.

STANDARD ON THE 900 SERIES:

- Single board microcomputer: Z80 based; 4 MHz. operation; DMA controlled disk access.
- Dual eight inch flexible disk drives: on-line formatted capacity of 2.5 megabytes expandable to 5 Mb; access time of 3 milliseconds track-to-track; 8000 hour MTBF reliability rating.
- IBM 3740 format compatible
- 48 kilobytes of dynamic RAM, expandable to 65 Kb.
- CP/M® Disk Operating System with assembler, editor and debug subsystems.
- RS232 or TTY serial port for system console.
- Parallel line printer port (Centronics-compatible).

OPTIONS FOR THE 900 SERIES:

- Disk expansion: up to 5 Mb formatted capacity.
- Serial I/O expansion: two additional RS232 ports (serial printer, modem, etc.)
- S100 bus adaptor for system expansion.
- Multi-user operation
- Hard disk subsystem OASIS operating system

AVAILABLE SOFTWARE FOR THE 900 SERIES:

- High level languages include: BASIC, FORTRAN, COBOL and PASCAL.
- Application packages include: Inventory, Word Processing, GL, AR, AP and Payroll.

the Quay 900 Microcomputer System offers the most complete package for the money



DESIGNED FOR OPTIMUM RELIABILITY AND EASY SERVICING

- Single board design
- Quad-density flexible disk drives
- Turn-key operation and security
- Expansion capabilities
- Industrial quality construction

*In OEM/Dealer quantities, please contact factory for pricing detail.

CP/M® is a registered trademark of Digital Research

QUAY CORPORATION

P.O. Box 386, Freehold, New Jersey 07728 ■ (201) 681-8700
Factory: Route 34, Wall Township, New Jersey 07719

DISTRIBUTOR AND REPRESENTATIVE INQUIRIES WELCOME

Circle 96 on inquiry card.

more advanced operators that are also missing are not mentioned here. See table 2 for a more complete definition of the language.

Ramware APL80

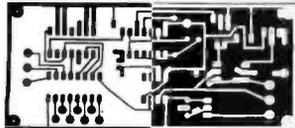
In its version of APL for the Radio Shack TRS-80 Model I, Ramware of Milford, New Hampshire, has made available a remarkable product. When I first saw the advertisements for the tape version of APL80, its low price (\$14.95) led me to dismiss it as some kind of toy, probably written in BASIC and too slow to be useful. Even though the tape version has about 25% fewer features than the more expensive disk version (\$39.95), it is still written in Z80 machine language and is a fairly usable version of the language. Author Phelps Gates has reason to be proud of this package.

Table 3 lists the operators available within APL80. The fullness of the language is due to the use of the ROM (read-only memory) modules implementing Level II BASIC. Because the author was able to use the numerical routines from Level II BASIC, much of the work of creating an entire programming language had been done for him, and he could concentrate on making it behave like APL. (APL80 has been tested and found to work on the newer TRS-80s that have Level II BASIC in two rather than three ROM devices. Until a correction can be made to the current version of APL80, however, the down-arrow symbol used for the APL drop and grade-down operations must be displayed by simultaneously

Text continued on page 196

FOOLPROOF P. C. BOARDS WITH RE-ZOLV[®]

PAT. PEND.



THE COVAL IMAGING PROCESS *Negative or Positive*

Coat your own p. c. board with this unique photo-resist. Environmentally safe. Develops in water. No toxic or corrosive chemicals. Work in room light. Temperature control is not critical. May be used either as a NEGATIVE OR POSITIVE IMAGING PROCESS with incandescent, fluorescent, or u. v. light.

Used worldwide by the experienced technician, hobbyist, and the beginner. Complete simplified instructions allow satisfaction and success. No more time consuming, frustrating, costly failures. Exposure latitude is phenomenal . . . plus or minus 50%. RE-ZOLV . . . it's simple, inexpensive, and easy to use. In an hour or less you can mix the emulsion, coat the board, dry it, expose the image (negative or positive), develop, and etch . . . a perfect board. Coat over 12 sq. ft. with the Starter Kit.

Unconditionally guaranteed, Coval Industries, Inc. invites you to try RE-ZOLV. COMPARE! You'll never again be without it. The Starter Kit (Emulsion, Sensitizer, and Steel Wool) only \$12.00 postpaid. Order yours TODAY! Call (217) 352-9336 or write to COVAL INDUSTRIES, INC.

COVAL INDUSTRIES, INC.
2706 W. Kirby, Champaign, IL 61820

At a Glance

Name of System
Vanguard APL/DTC
(desk-top computer)

Manufacturer
Vanguard Systems Corporation, 6812 San Pedro, San Antonio TX 78216 (512) 828-0554

Price
\$7995

Terminal Dimensions
32 by 45.5 by 53.5 cm
(12½ by 18 by 21 inches)

Computer Dimensions
19 by 51 by 43 cm (7½ by 20 by 17 inches)

Processor
Z80, 8-bit

System Clock Frequency
4 MHz

Memory
80 K bytes of static memory (34 K bytes left for APL workspace)

Mass Storage
Two quad-density 5-inch floppy-disk drives

Features
APL/ASCII keyboard and 12-inch APL/ASCII memory-mapped video display of twenty-four 80-character lines housed in separate video terminal enclosure; display of all APL characters

Software Included
CP/M operating system, APL/DTC software

Hardware Options
Communications option (Hayes Microcomputer Products Micromodem plus special software); high-resolution (256-by-240 black-and-white or 128-by-120 sixteen-gray-level) graphics; letter-quality APL/ASCII printer, real-time clock.

Software Options
APL * PLUS file system simulator

Audience
APL users, programming-language enthusiasts

At a Glance

Name
Vanguard APL/V80

Type of Software Package
Version of APL programming language

Manufacturer
Vanguard Systems Corporation, 6812 San Pedro, San Antonio TX 78216 (512) 828-0554

Price
\$500

Format
CP/M or CDOS operating system, 5-inch or 8-inch disk

Language Used
Z80 machine language

Computer Needed
Computers with at least 48 K bytes of program-

mable memory; a Z80 processor card; at least one floppy-disk drive

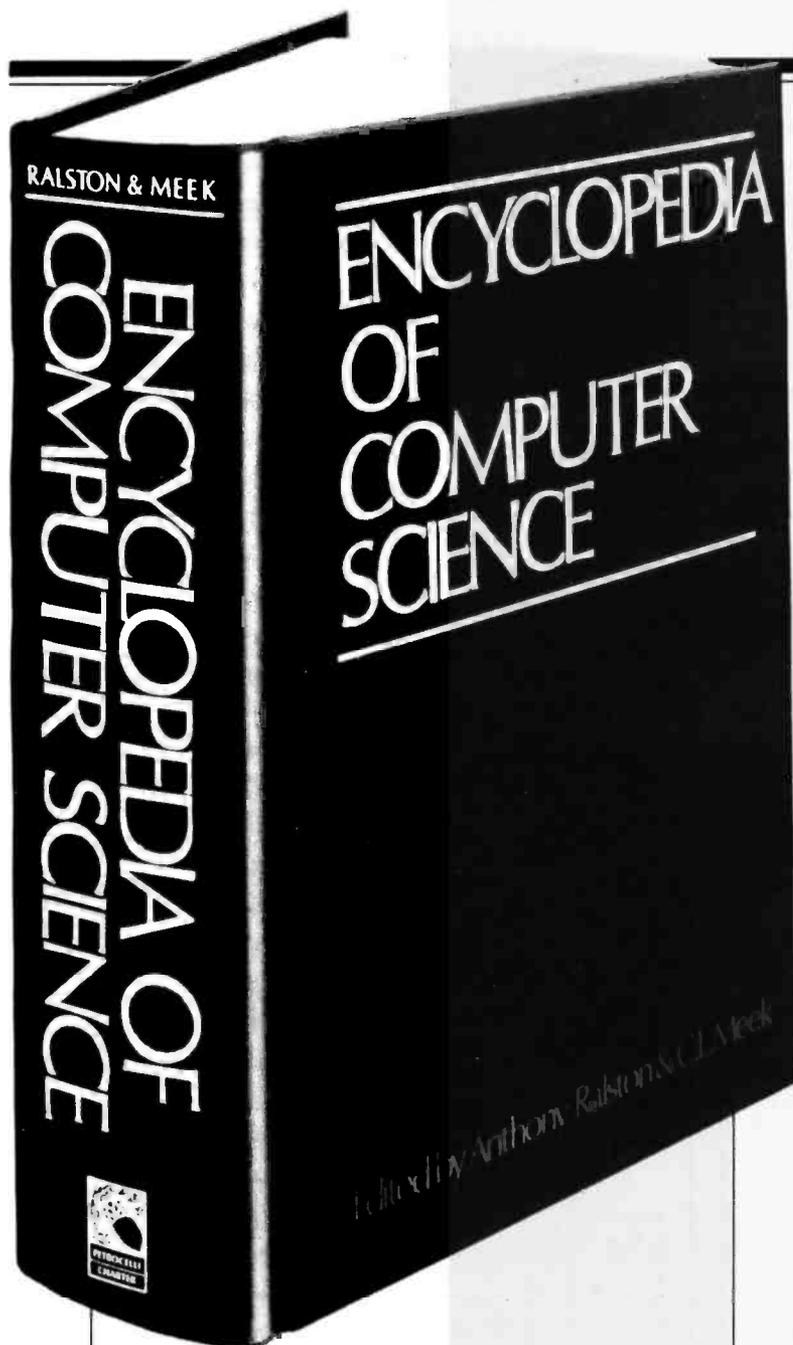
Documentation
Seventy-six pages, 22 by 28 cm (8½ by 11 inches)

Audience
APL users, programming language enthusiasts

Features
APL defined functions (programs) simulate some APL functions, APL * PLUS file system, and other functions

Comments
This version is identical to the software reported on for the APL/DTC computer, except for the reduced workspace size and the availability of the inner product function as a defined function.

The most comprehensive and useful
computer reference in the world.



- A mammoth volume covering everything from Access Methods to Working Set, in 1,523 pages, 470 articles and over 1,000 illustrations, tables and charts.
- Authoritatively compiled by over 200 internationally respected authorities.

If reply card has been removed, please write:
The Library of Computer and Information Sciences
Dept. 7-AL9, Riverside, N.J. 08075,
to obtain membership information and application.

Take the
**ENCYCLOPEDIA
OF
COMPUTER
SCIENCE**

—a \$60.00 value—
yours for only

\$295

when you join The Library of Computer and Information Sciences. You simply agree to buy three more books—at handsome discounts—within the next 12 months.

Find the answers to virtually all your data processing questions in the ENCYCLOPEDIA OF COMPUTER SCIENCE.

Thousands of photos, diagrams, graphs and charts completely illuminate the ENCYCLOPEDIA'S clear and thorough coverage of every area of the computer sciences—software, hardware, languages, programs, systems, mathematics, networks, applications, theory, history and terminology.

Appendices provide abbreviations, acronyms, special notations and many numerical tables. An additional highlight is a complete cross-reference system that assists the reader seeking in-depth information.

What is The Library of Computer and Information Sciences?

It's a book club especially designed for the computer professional. In the incredibly fast-moving world of data processing, where up-to-date knowledge is essential, we make it easy for you to keep totally informed on all areas of the information sciences. In addition, books are offered at discounts up to 30% off publishers' prices.

Begin enjoying the club's benefits by accepting the ENCYCLOPEDIA OF COMPUTER SCIENCE. It's the perfect reference for computer professionals . . . and it's a great bargain, too.

IN A HURRY?

SOFTWARE TO GO

(a division of C.T.G. Corp.)

presents

THE EVANS BUSINESS SYSTEM; a user-definable data-management system emphasizing rapid access to individual records for the APPLE II®. Creates indexed data files accessible to any sequential or random-access APPLE DOS read operation. Comes with fast search routine which can be incorporated in any Applesoft program. Requires 48K, 1 disk drive, ROM or RAM Applesoft.

THE EVANS BUSINESS SYSTEM. A single-disk data management system. All parameters (number of fields, record length, etc.) are user-definable. The system is specifically designed for microcomputer databases of 200-2000 records (maximum 9999) where fast access to individual records is required.

THE EVANS BUSINESS SYSTEM files can be accessed by any Apple DOS read command (sequential, record specified, byte specified).

- ★ Personal name converter; file by last name, but print first-name-first.
- ★ Print-select codes permit several files with the same format to be kept on one disk.
- ★ Print-to-disk creates sequential text files which can be input to word-processing or text-editing programs for customized report formatting.
- ★ Includes fast search routine which can be added to any Applesoft program.

Use the BUSINESS SYSTEM for

- ★ Rolodex Emulation
- ★ Financial records
- ★ Real Estate Locator
- ★ Grade books
- ★ Catalogs
- ★ Lab test results
- ★ Bibliographies
- ★ Names and addresses
- ★ Fantasy game characters
- ★ Any application requiring fast, cross-referenced random access to formatted information.

Not a stripped-down big-computer database system — THE BUSINESS SYSTEM was written especially for microcomputer applications.

RETRIEVAL TIME: Average less than 5 seconds for any of 1000 records. **NUMBER OF FIELDS:** defined by user. **RECORD LENGTH:** Defined by user. **FILE SIZE:** Determined by record length and disk capacity. **Keyfield(s):** Specified by user.

Soon to be released

PASCAL tutorial Insurance Rating Program
Client Information System Metric Education Program

INTRODUCTORY OFFER

You can get the **EVANS BUSINESS SYSTEM** software package for \$99.95 or an **EVANS BUSINESS SYSTEM** demo copy (free for your in-home inspection) at your nearest Software-To-Go dealer. If not yet available at your favorite computer store send: \$99.95 for the package, \$15.00 for the demo copy (creditable towards the package purchase).

SOFTWARE-TO-GO
2000 Guadalupe
Austin, Texas 78705
512-472-8926



★DEALER INQUIRIES INVITED★

Listing 1: Listing of the APL function *SETUP*. This routine defines certain variables used in the execution of benchmark programs.

```

▽ SETUP
[10] A←10 10p100
[20] B←QA
[30] C←10×10RA
[40] D←A×(02)÷100
[50] E←110
[60] F←1000 365 24 60 60
[70] RA←.A
[80] RB←.B
[90] M3D←2 5 10pRA ▽
    
```

Listing 2: Listing of the APL function *TIME*. When this routine is used as a benchmark program, the function to be tested replaces each occurrence of the phrase (EXP) on lines 10 thru 60. (See table 1.)

```

▽ TIME N;LP
[10] LP←0
[20] BGN:(EXP)
[30] (EXP)
[40] (EXP)
[50] (EXP)
[60] (EXP)
[70] →(N>LP+LP+1)/BGN
[80] 'DONE ' ;N×5; ' TIMES'
[90] 'UNIT TIME IS ' ; (÷N×5)×□;
    ' SECONDS PER ITERATION' ▽
    
```

Listing 3: Listing and sample execution of the APL function *CIRCLE*. Listing 3a shows the function, which has the purpose of adding a set value to all matrix elements that fall within an imaginary circle with a given center and radius. Listing 3b shows a 10 by 10 array filled with zeros and, below it, the same circle after execution of the statement *B←(6 5 4 8) CIRCLE A*. On one of the printers used to generate these listings, the backarrow character, ←, appears as an underscore, —.

```

VB←AR CIRCLE A;RD;ROW;COL
[10] AR CONTAINS: ROW COORD, COL COORD, RADIUS, VALUE ADDED
[20] B←A
[30] ROW←AR[1]-AR[3]+1
[40] NEXTROW: ROW←ROW+1
[50] COL←AR[2]-AR[3]+1
[60] NEXTCOL: COL←COL+1
[70] →(AR[3]≤(((ROW-AR[1])*2)+(COL-AR[2])*2)÷0.5)/ENDLP
[80] B[ROW;COL]←B[ROW;COL]+AR[4]
[90] ENDP:→(COL<AR[2]+AR[3])/NEXTCOL
[100] →(0,NEXTROW)[1+ROW<AR[1]+AR[3]]▽
    
```

```

A
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
    
```

```

B←(6 5 4 8) CIRCLE A
B
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 0 8 8 8 8 8 8 0 0
0 8 8 8 8 8 8 8 0 0
0 8 8 8 8 8 8 8 0 0
0 8 8 8 8 8 8 8 0 0
0 8 8 8 8 8 8 8 0 0
0 0 8 8 8 8 8 8 0 0
0 0 0 0 8 0 0 0 0 0
    
```

THE ORIGINAL MAGAZINE FOR OWNERS OF THE TRS-80™* MICROCOMPUTER

* TRS-80™ IS A TRADEMARK OF TANDY CORP.

SOFTWARE
FOR TRS-80™
OWNERS

H & E COMPUTRONICS INC.

MONTHLY
NEWSMAGAZINE
FOR TRS-80™
OWNERS

MONTHLY NEWSMAGAZINE Practical Support For Model I, II & III

NOW IN OUR 4th YEAR

- PRACTICAL APPLICATIONS
- BUSINESS
- GAMBLING • GAMES
- EDUCATION
- PERSONAL FINANCE
- BEGINNER'S CORNER
- NEW PRODUCTS
- SOFTWARE EXCHANGE
- MARKET PLACE
- QUESTIONS AND ANSWERS
- PROGRAM PRINTOUTS
- AND MORE

PROGRAMS AND ARTICLES PUBLISHED IN RECENT ISSUES
INCLUDE THE FOLLOWING:

- FINCALC - A COMPLETE FINANCIAL APPLICATIONS PACKAGE
- INFORMATION SYSTEM REVIEW
- STATISTICAL COMBINATIONS
- PASCAL'S TRIANGLE
- ASSEMBLY LANGUAGE FOR BEGINNERS
- DISK FILES
- MOD-III REVIEW
- KEYBOARD THUNDER AND LIGHTING EXPLAINED
- DOS COMMANDS IN LEVEL II
- PROBABILITY CURVE GENERATOR
- CALCULATOR SIMULATIONS
- THE MEGABYTE GAP
- STOCKS AND BONDS
- BUDGET ANALYSIS (FOR BUSINESS AND HOME)
- NEWDOS/80 REVIEW
- DUTCHING - THE HORSE SYSTEM THAT CAN'T LOSE
- A SIMULATED GOLF GAME
- CONTINUOUS FORM SOURCES
- TAX/SAVER REVIEW
- AND MORE

FREE* WITH
YOUR
SUBSCRIPTION
OR
RENEWAL

FINCALC

A Complete Financial Analysis Package Used
To Calculate Markup, Margin, Annuities, Compound Interest, Nominal
And Effective Rates, Sinking Funds, Mortgage Calculations, Future Value,
Savings and Insurance, Percentage Difference Between Two Numbers,
Amortization Schedule and More

SEND FOR OUR NEW 64 PAGE SOFTWARE CATALOG (INCLUDING LISTINGS OF HUNDREDS OF TRS-80™ PROGRAMS AVAILABLE ON CASSETTE AND DISKETTE). \$2.00 OR FREE WITH EACH SUBSCRIPTIONS OR SAMPLE ISSUE

* All programs are supplied on cassette (add \$3 for Diskette Version - add \$5 for modified Mod-II Version).

COMPUTRONICS
MATHEMATICAL APPLICATIONS SERVICE™

50 N. PASCACK ROAD
SPRING VALLEY, NEW YORK 10977

ONE YEAR SUBSCRIPTION \$24
TWO YEAR SUBSCRIPTION \$48
SAMPLE OF LATEST ISSUE \$ 4

START MY SUBSCRIPTION WITH ISSUE.....
(#1 - July 1978 • #12 - June 1979 • #24 - July 1980 • #30 - January 1981)

NEW SUBSCRIPTION..... RENEWAL.....

**NEW TOLL-FREE
ORDER LINE
(OUTSIDE OF N.Y. STATE)
(800) 431-2818**



**24 HOUR
ORDER
LINE
(914) 425-1535**



CREDIT CARD NUMBER _____ EXP. DATE _____

SIGNATURE _____ NAME _____

ADDRESS _____ CITY _____ STATE _____ ZIP _____

*** ADD \$12/YEAR (CANADA, MEXICO) - ADD \$24/YEAR AIR MAIL - OUTSIDE OF U.S.A., CANADA & MEXICO ***

Listing 4: Listing and sample execution of the APL function TRANS. Listing 4a shows the function, which translates a numeric array similar to the one in listing 3b to a character array that reflects the contents of the numeric array. Listing 4b shows the result of executing TRANS B, where B is the matrix in the lower half of listing 3b.

```

▽B←TRANS A;AA;MX;MN;MAXX;CHAR
[10] CHAR←'LMNOPQRSTUVWXYZ-123456789ABCDEF+*#'
[20] MN←L/AA+,A
[30] MX←I/AA
[40] MAXX←(MXI-MN)÷15
[50] AA←[0.5+16+AA+MAXX
[60] B←(ρA)ρCHAR[AA] ▽

```

```

TRANS B
-----
----F-----
--FFFFFF--
-FFFFFFF--
-FFFFFFF--
-FFFFFFF--
FFFFFFF---
-FFFFFFF--
-FFFFFFF--
-FFFFFFF--
-FFFFFFF--
-----F-----

```

Listing 5: Listing of the APL function IVER. This function, written by Kenneth Iverson (the inventor of APL), will generate a vector of all prime numbers up to and including the scalar A. (A must be greater than or equal to 7.)

```

▽ B←IVER A
B←(2÷+÷/0=(1A)0. | 1A)÷1A
▽

```

Listing 6: Listing of the APL function CIRCLE as generated by Softronics APL using a non-APL video terminal. APL functions can be printed on a standard printer through the use of mnemonic phrases, which begin with a \$ sign. The backarrow appears here as an underscore.

```

$DL B_AR CIRCLE A;RD;ROW;COL
[1] SLP
[2] SLP AR CONTAINS: ROW & COL COORD, RADIUS, VALUE ADDED
[3] SLP (EG: (6 5 4 9) CIRCLE A ADDS TO ARRAY A CIRCLE OF
[4] SLP VALUE 9 AND RADIUS 4, WITH CENTER AT (6,5))
[5] SLP
[6] B_A
[7] ROW_AR[1]-AR[3]+1
[8] NEXTROW:ROW_ROW+1
[9] COL_AR[2]-AR[3]+1
[10] NEXTCOL:COL_COL+1
[11] $GO ((AR[3]*2)<((ROW-AR[1])*2)+(COL-AR[2])*2)/ENDLP
[12] B[ROW;COL]_B[ROW;COL]+AR[4]
[13] ENDLP:$GO (COL$LE A:[2]+AR[3])/NEXTCOL
[14] $GO (0,NEXTROW)[1+ROW<AR[1]+AR[3]]
$DL

```

Text continued from page 192:

pressing three keys: the shift key, the down-arrow key, and the Z key.)

Because Ramware APL80 has almost all the capabilities of Level II Disk BASIC, it has some functions and features that the other versions reviewed here do not; several examples are: single-precision or double-precision variables, inverse trigonometric functions, exponents, logarithms, and character editing within a line. Even in the benchmarks (see table 1), this version does fairly well against the other two versions when you consider the differences in price (\$39.95 vs \$350 and \$500) and in processor speed (the TRS-80 is running at 1 MHz, while the other two are running the same type of Z80 processor, but at 4 MHz).

The method used to represent APL on an unmodified TRS-80 is odd, but it is probably the best way that could

Text continued on page 204

STOP PLAYING GAMES

TRS-80 (Level II)
APPLE
OTHERS

- Calculate odds on HORSE RACES with ANY COMPUTER using BASIC.
- SCIENTIFICALLY DERIVED SYSTEM really works. TV Station WKLV of Louisville, Kentucky used this system to predict the odds of the 1980 Kentucky Derby. See the Wall Street Journal (June 6, 1980) article on Horse-Handicapping. This system was written and used by computer experts and is now being made available to home computer owners. This method is based on storing data from a large number of races on a high speed, large scale computer. 23 factors taken from the "Daily Racing Form" were then analyzed by the computer to see how they influenced race results. From these 23 factors, ten were found to be the most vital in determining winners. NUMERICAL PROBABILITIES of each of these 10 factors were then computed and this forms the basis of this REVOLUTIONARY NEW PROGRAM
- SIMPLE TO USE: Obtain "Daily Racing Form" the day before the races and answer the 10 questions about each horse. Run the program and your computer will print out the odds for all horses in each race. COMPUTER POWER gives you the advantage!
- YOU GET: 1) TRS-80 (Level II) or Apple Cassette
2) Listing of BASIC program for use with any computer
3) Instructions on how to get the needed data from the "Daily Racing Form"
4) Tips on using the odds generated by the program
5) Sample form to simplify entering data for each race

MAIL COUPON OR CALL TODAY

3G COMPANY, INC. DEPT. BT
RT. 3, BOX 28A, GASTON, OR 97119

Yes, I want to use my computer for FUN and PROFIT. Please send me _____ programs at \$24.95 each.

I need a TRS-80 Cassette or Apple Cassette

Enclosed is: check or money order Master Charge Visa

Card No. _____ Exp. date _____

NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

(503) 357-9889

**START USING YOUR COMPUTER FOR
FUN and PROFIT!**

OPERATION	UNIT TIME TO PERFORM OPERATION, SECONDS		
	SOFTRONICS APL	RAMWARE APL80	VANGUARD APL/DTC SOFTWARE
Q ← A ÷ B	0.79	4.6	1.2
Q ← A > B	0.48	0.42	0.091
Q ← B	0.059	0.051	0.012
Q ← 2 ÷ 0	5.0	2.9	8.6
Q ← √ C	140.	11.	3.1
Q ← FT 100000000	NA	0.61	0.13
Q ← -50 I RA	0.086	0.18	0.014
Q ← [±] N1	180.	NA	66.
Q ← 4 ϕ [1] M3D	NA	0.74	1.8
Q ← E ° + E	0.41	0.31	0.082
Q ← + / C	0.25	0.25	0.19
CIRCLE	160. *	230. *	150.
TRANS	9.0 *	28. *	11.
IVER	28.	160. *	120.

Table 1: Timing results of APL benchmark programs. For details on this and tables 2 thru 4, see the "Notes on APL Benchmarks" text box on page 204.

H & E COMPUTRONICS INC.

● EVERYTHING FOR YOUR TRS-80* ● ATARI* ● APPLE* ● PET* ●

*TRS-80 is a trademark of the Radio Shack Division of Tandy Corp. - *ATARI is a trademark of Atari Inc. - *Apple is a trademark of Apple Corp. - *Pet is a trademark of Commodore



★ All orders processed within 24-Hours
★ 30-Day money back guarantee on all Software

BUSINESS PAC 100

100 Ready-To-Run

Business Programs

(ON CASSETTE OR DISKETTE).....Includes 110 Page Users Manual.....5 Cassettes (Or Diskettes)

Inventory Control.....Payroll.....Bookkeeping System.....Stock Calculations.....

Checkbook Maintenance.....Accounts Receivable.....Accounts Payable.....

BUSINESS 100 PROGRAM LIST

1 RULE78	Interest Apportionment by Rule of the 78's	59 WACC	Weighted average cost of capital
2 ANNU1	Annuity computation program	60 COMBPAL	True rate on loan with compensating bal. required
3 DATE	Time between dates	61 DISCBAL	True rate on discounted loan
4 DAYYEAR	Day of year a particular date falls on	62 MERGANAL	Merger analysis computations
5 LEASEINT	Interest rate on lease	63 FINRAT	Financial ratios for a firm
6 BREAKEVN	Breakeven analysis	64 NPV	Net present value of project
7 DEPRSL	Straightline depreciation	65 PRINDLAS	Laspeyres price index
8 DEPRSY	Sum of the digits depreciation	66 PRINDPA	Paasche price index
9 DEPRDB	Declining balance depreciation	67 SEASIND	Constructs seasonal quantity indices for company
10 DEPRDDB	Double declining balance depreciation	68 TIMETR	Time series analysis linear trend
11 TAXDEP	Cash flow vs. depreciation tables	69 TIMEMOV	Time series analysis moving average trend
12 CHECK2	Prints NEBS checks along with daily register	70 FUPRINF	Future price estimation with inflation
13 CHECKBK1	Checkbook maintenance program	71 MAILPAC	Mailing list system
14 MORTGAGE/A	Mortgage amortization table	72 LETWRT	Letter writing system-links with MAILPAC
15 MULTMON	Computes time needed for money to double, triple, etc.	73 SORT3	Sorts list of names
16 SALVAGE	Determines salvage value of an investment	74 LABEL1	Shipping label maker
17 RRVARIN	Rate of return on investment with variable inflows	75 LABEL2	Name label maker
18 RRCONST	Rate of return on investment with constant inflows	76 BUSBUD	DOME business bookkeeping system
19 EFFECT	Effective interest rate of a loan	77 TIMECLCK	Computes weeks total hours from timeclock info.
20 FVAL	Future value of an investment (compound interest)	78 ACCTPAY	In memory accounts payable system-storage permitted
21 PVAL	Present value of a future amount	79 INVOICE	Generate invoice on screen and print on printer
22 LOANPAY	Amount of payment on a loan	80 INVENT2	In memory inventory control system
23 REGWITH	Equal withdrawals from investment to leave 0 over	81 TELDIR	Computerized telephone directory
24 SIMPDISK	Simple discount analysis	82 TIMUSAN	Time use analysis
25 DATEVAL	Equivalent & nonequivalent dated values for oblig.	83 ASSIGN	Use of assignment algorithm for optimal job assign.
26 ANNUDEF	Present value of deferred annuities	84 ACCTREC	In memory accounts receivable system-storage ok
27 MARKUP	% Markup analysis for items	85 TERMSPAY	Compares 3 methods of repayment of loans
28 SINKFUND	Sinking fund amortization program	86 PAYNET	Computes gross pay required for given net
29 BONDVAL	Value of a bond	87 SELLPR	Computes selling price for given after tax amount
30 DEPLETE	Depletion analysis	88 ARBCOMP	Arbitrage computations
31 BLACKSH	Black Scholes options analysis	89 DEPRSF	Sinking fund depreciation
32 STOCVAL1	Expected return on stock via discounts dividends	90 UPSZONE	Finds UPS zones from zip code
33 WARVAL	Value of a warrant	91 ENVELOPE	Types envelope including return address
34 BONDVAL2	Value of a bond	92 AUTOEXP	Automobile expense analysis
35 EPSEST	Estimate of future earnings per share for company	93 INSFILE	Insurance policy file
36 BETAALPH	Computes alpha and beta variables for stock	94 PAYROLL2	In memory payroll system
37 SHARPE1	Portfolio selection model-i.e. what stocks to hold	95 DILANAL	Dilution analysis
38 OPTWRITE	Option writing computations	96 LOANAFFD	Loan amount a borrower can afford
39 RTVAL	Value of a right	97 RENTPRCH	Purchase price for rental property
40 EXPVAL	Expected value analysis	98 SALELEAS	Sale-leaseback analysis
41 BAYES	Bayesian decisions	99 RRCONVBD	Investor's rate of return on convertible bond
42 VALPRINF	Value of perfect information	100 PORTVAL9	Stock market portfolio storage-valuation program
43 VALADINF	Value of additional information		
44 UTILITY	Derives utility function		
45 SIMPLEX	Linear programming solution by simplex method		
46 TRANS	Transportation method for linear programming		
47 EOQ	Economic order quantity inventory model		
48 QUEUE1	Single server queueing (waiting line) model		
49 CVP	Cost-volume-profit analysis		
50 CONDPFROF	Conditional profit tables		
51 OPTLOSS	Opportunity loss tables		
52 FQOQ	Fixed quantity economic order quantity model		

NAME	DESCRIPTION
53 FQEOWSH	As above but with shortages permitted
54 FQEOQPB	As above but with quantity price breaks
55 QUEUECB	Cost-benefit waiting line analysis
56 NCFANAL	Net cash-flow analysis for simple investment
57 PROFIND	Profitability index of a project
58 CAPI	Cap. Asset Pr. Model analysis of project

CASSETTE VERSION \$99.95
 DISKETTE VERSION \$99.95
 TRS-80* MODEL II VERSION \$149.95

ADD \$3.00 FOR SHIPPING IN UPS AREAS
 ADD \$4.00 FOR C.O.D. OR NON-UPS AREAS
 ADD \$5.00 OUTSIDE U.S.A, CANADA & MEXICO

NEW TOLL-FREE ORDER LINE
 (OUTSIDE OF N.Y. STATE)
(800) 431-2818

COMPUTRONICS INC.

MATHEMATICAL APPLICATIONS SERVICE

50 N. PASCACK ROAD
SPRING VALLEY, NEW YORK 10977



24 HOUR ORDER LINE
(914) 425-1535



Circle 133 on inquiry card.

Scalar Dyadic Operators, Softronics APL

OPERATOR	NAME	MONADIC	DYADIC	COMMENTS	OPERATOR	NAME	MONADIC	DYADIC	COMMENTS
+	ADD	Y	Y			RESIDUE	Y	Y	
-	SUBTRACT	Y	Y		!	FACTORIAL	Y*	Y	Gamma function missing.
x	MULTIPLY	Y	Y		○	CIRCLE	Y	Y*	Only sin, cos, tan, arctan implemented.
÷	DIVIDE	Y	Y		^	LESS THAN, ETC.		Y	
*	EXPONENT	N	Y*	Dyadic version inaccurate in last decimal place; see text.	=	EQUAL TO, NOT EQUAL TO		Y	
⊗	LOGARITHM	Y	Y		∧∨	AND, OR		Y	
⌊	FLOOR	Y	Y		∧∨	NAND, NOR		Y	
⌈	CEILING	Y	Y						

Nondyadic Scalar and Mixed Operators, Softronics APL

OPERATOR	NAME	MONADIC	DYADIC	COMMENTS	OPERATOR	NAME	MONADIC	DYADIC	COMMENTS
~	NOT	Y			⊖	TRANPOSE	Y	Y*	Dyadic "diagonal" transpose missing.
?	ROLL	Y	N*	Dyadic available as defined function only.	⊕	ROTATE OR REVERSE	Y	N*	Dyadic function available for vectors and two-dimensional matrices only available as defined function.
i	IOTA (INDEX)	Y	Y		⊖	ROTATE	Y	N	
ρ	RHO (RESHAPE)	Y	Y		/	COMPRESS		Y	
,	RAVEL	Y	Y*	Catenation for vectors only; no lamination.	⌢	COMPRESS		N*	Available as / [1] only.
⌊ T	DECODE, ENCODE		N		\	EXPAND		N	
↑ ↓	TAKE, DROP		Y		⌢	EXPAND		N	
ε	MEMBERSHIP		Y		⊖	EXECUTE		Y	
↑ ↓	GRADE-UP, GRADE-DOWN	N*		Available as defined function only.	⊖	FORMAT		Y*	Converts a vector or array to a character string (with embedded carriage return) for printing.
⊕	MATRIX DIVIDE OR INVERSE	N*	N*	Both available as defined function only.					

Composite Operators, Softronics APL

OPERATOR	NAME	AVAILABLE P	OPERATOR	NAME	AVAILABLE P
r/	REDUCTION	Y	f.g	INNER PRODUCT	Y
r⌢	REDUCTION	Y	o.f	OUTER PRODUCT	Y

Notes:

"Y" and "N" mean that a given operator is either present in all its forms or totally absent from this version of APL. "Y*" means that the operator is only partially present in this version. "N*" means that the operator is not present in this version but that part or all of it is available through an APL defined function supplied with this version. Further information explaining "Y*" and "N*" is given in the "Comments" column.

A scalar is an object (number or character) with no dimension. A vector is a string of objects that have one dimension. An array is a matrix of objects that have two or more dimensions.

Other features: standard APL commands, system functions, and system variables; line editing only of defined functions; PEEK and POKE functions; 8080-type port IN and OUT functions; shared variable mechanism for interaction with disk files (sequential read and write only, in standard CP/M format); mixing of APL data structures (arrays, vectors, scalars) in records of same file; user choice of standard terminal, APL terminal, or video board with programmable character generator; and good documentation.

Other limitations: several much-needed operators are missing (see body of this table) and there is no random access to disk files' character-editing of defined functions.

Table 2: Summary of Softronics APL features.

COMPUTRONICS INC.

●● EVERYTHING FOR YOUR TRS-80™ ●● MODEL III

★ All orders processed within 24-Hours
 ★ 30-Day money back guarantee on all TRSDOS Software
 ★ Add \$2.00 for shipping in UPS Areas
 ★ Add \$4.00 for C.O.D. or NON-UPS Areas
 ★ Add \$5.00 outside U.S.A., Canada & Mexico
 ★ We will match any bonafide advertised price in any of the Major Computer Magazines

TRS-80 is a trademark of Tandy Corp.

GENERAL LEDGER, ACCOUNTS RECEIVABLE, ACCOUNTS PAYABLE, PAYROLL, INVENTORY CONTROL AND INVOICING (Small Business Group).....an extensive business system for the serious user.....can be used one module at a time or as a coordinated system.....
\$199.95 per module.....\$1199.95 for the complete system.*

MASTER PAC 100.....100 essential programs.....BUSINESS.....PERSONAL FINANCE..... STATISTICS.....MATH.....GAMBLING.....GAMES.....includes 125 page manual and 5 diskettes
\$59.95

BUSINESS PAC 100.....100 essential business programs.....INVENTORY CONTROL.....PAY-ROLL.....BOOKKEEPING SYSTEM.....STOCK CALCULATIONS.....CHECKBOOK MAINTENANCE.....ACCOUNTS RECEIVABLE.....ACCOUNTS PAYABLE.....Includes 125 page manual and five diskettes
\$99.95

INFORMATION SYSTEM (The Bottom Shelf).....An in-memory information system for small mailing lists, inventories (i.e. books, articles, records, program reference files).....Can be used for anything that you would use rolodex or index card files.....Up to ten user define fields..... Programmable printouts for rolodex cards, mailing labels, etc.....Will identify all records that contain a group of characters you've entered even if that group is in the middle of a line.....Sorts data base by any field
\$49.50*

DATA MANAGER II (The Bottom Shelf).....RANDOM ACCESS Disk based DATA MANAGEMENT SYSTEM (Similar to INFORMATION SYSTEM above.....but RANDOM ACCESS STORAGE expands the amount of storage space available).....Used to replace index cards for medium sized mail lists, inventories, personnel records, sales prospects, etc.....Uses up to four disk drives on line.....Up to twenty user defined fields, programmable printouts for rolodex cards, etc.....will identify all records that contain a group of characters you've entered even if that group is in the middle of a line.....maintain up to 5 changeable presorted "key" files..... variable length random records (the smaller the record you define, the more records you can store)
\$99.95*

BUSINESS MAIL SYSTEM (The Bottom Shelf).....Handles large mailing lists (up to 150,000 names).....supports 3 or 4 line addresses.....files automatically in zip code order, alphabetical within zip code.....formats for 1 to 4 across mailing labels.....supports quick disk location of single or multiple names.....meets all industry and postal standards.....numeric code fields included for printing selected records
\$125.00*

ANALYSIS PAD (The Bottom Shelf).....A Columnar Calculator for financial analysis, line item budgeting, cost analysis, sales analysis and almost any financial function (and many statistical functions).....create matrices of 29 x 39.....make all entries at one time either by row or column..... add, delete, move or switch columns and rows.....edit any data from full screen display.....add, subtract, multiply and divide one column by another and put results in designated column (up to six calculations can be made and placed in designated column).....define columns as constants.....save calculations and formulas on disk.....results can be printed in a variety of report formats
\$99.95*

CHECKBOOK II (The Bottom Shelf).....A complete in memory checkbook balancing and reconciliation program.....five column keyboard input with 5 characters for check number, 16 for payee, 4 for code.....numerical sort routine
\$49.50*

CHECK REGISTER ACCOUNTING SYSTEM (The Bottom Shelf).....A complete random access checkbook system.....set and define up to 60 accounts with as many income accounts as you choose.....complete checkbook balancing and reconciliation.....single entry input where transaction can be dispersed over several accounts.....enables user to make a 64-character note on each transaction.....print out your own check after data entry.....prints monthly summaries of each account with month and year-to-date totals.....create a suspense file to remind you of coming expenses.....Reports generated included Check Register (for any month), notes to Check Register, Income/Expense Distribution Report, Statement of Selected Accounts, Bank Reconcile Statement, Suspense File and Full Account Distribution Statement
\$74.95*

LIBRARY 100 (The Bottom Shelf).....100 Programs on a broad range of topics.....Finance..... Education.....Graphics.....Home.....Games.....CASSETTE VERSION
\$49.50
 DISK VERSION
\$74.95

ADVENTURE (by Scott Adams).....A series of games (for ages 10-99).....wander through enchanted worlds seeking treasures..... 1. Adventureland.....2. Pirate's Adventure.....3. Mission Impossible Adventure.....4. Voodoo Castle.....5. The Count.....6. Strange Odyssey.....7. Mystery Fun House.....8. Pyramid of Doom.....9. Ghost Town.....(#1 and #2 recommended for the movie adventure)..... Each adventure **\$14.95** (jon cassette).....Diskette versions sold in groups of three at **\$39.95** per three programs (#1 - #3, #4 - #6, #7 - #9).

HORSE SELECTOR II (Dr. Hal Davis).....New simplified version of the original Horse Selector (for flats).....The first Horse Selection System to actually calculate the estimated odds for each horse.....easy to follow rules.....uses 4 factors (speed rating, track variant, distance of the present race, distance of the last race).....calculated estimated odds.....FREE DUTCHING TABLES allows betting on 2 or more horses with a guaranteed profit
\$50.00

MON-3 and MON-4 (Howe Software).....Powerful utility programs enabling you to interact directly with your TRS-80 in MACHINE LANGUAGE.....The monitor comes with complete 40-page instruction manual making it useful for both the beginner and advanced programmer..... simple commands make it easy to use.....functions include DISPLAY, DISASSEMBLE, MOVE and COMPARE, SEARCH, MODIFY, RELOCATE, PRINT, READ and WRITE, UNLOAD, SAVE and READ, INPUT and OUTPUT, SEND and RECEIVE.....MON-3 **\$39.95** (for cassette)..... MON-4 **\$49.95** (for disk).

(14) SMART TERMINAL (Howe Software).....enables your TRS-80 to be used as a remote terminal to a time sharing computer system
\$69.95

(15) FAST SORT (Howe Software).....a series of machine-language subroutines to sort data from BASIC programs.....data may be alphabetic (string) or numeric.....easily interfaced with your BASIC programs (no machine language knowledge is necessary)
\$9.95

(16) MAILING LIST (Howe Software).....maintains mailing lists of over 1000 names.....commands allow adding, changing, deleting, and finding names. Sorting is done in machine language subroutine.....labels printed in 1, 2 or 3 columns
\$69.95

(17) HOME BUDGET (Howe Software).....combines the maintenance of your checkbook with analysis of your income, expenses and monthly bills. Handles data including bills, income, deposits, checks and debits to your checking account, and cash expenses. Computes checkbook balance, list of unpaid bills, monthly and year-to-date summaries of income and expenses showing income tax deductions.....All output printed on video display or line printer.....comes with complete instructions manual
\$49.95*

(18) SMALL BUSINESS ACCOUNTING (Howe Software).....Based on the DOME BOOKKEEPING SYSTEM.....keeps track of all income, expenditures and payroll for a small business of up to 16 employees.....income and expenditures can be entered on a daily, weekly or monthly basis..... computes monthly and year to date totals.....manual contains complete instructions for customization
 Cassette version **\$29.95**.....Diskette version **\$49.95**

(19) REMODEL-PROLOAD (Racet Computes).....Renum program files.....move statements from one part of a program to another
\$34.95

(20) GSF (Racet Computes).....Lightning fast in-memory machine language sort utility that can be made part of your BASIC programs without any machine language knowledge.....Includes several other utilities to speed up your BASIC programs.....no machine knowledge necessary to use GSF in your BASIC programs
\$30.00

(21) DOSORT (Racet Computes).....includes GSF (above).....extends the in memory sort to sorts on multiple disk drives
\$45.00

(22) COPSYS (Racet Computes).....allows the user to make copies of machines language cassettes without any knowledge of machine language
\$20.00

(23) COMRPOC (Racet Computes).....an auto load program for disk users.....allows the user to insert a diskette into their MOD-III and have the computer take over all loading.....load a machine language program, BASIC, RUN a certain program all without pressing a single button.....allows your computer to perform 10, 20, 30 or more functions without pressing a single button
\$30.00*

(24) INFINE BASIC (Racet Computes).....adds a variety of machine language subroutines to your BASIC programs (without any machine language knowledge).....fast sorts.....matrix operations.....compress and uncompress data.....and more
\$60.00

(25) INFINITE BUSINESS (Racet Computes).....an add on package to INFINITE BASIC.....adds a variety of routines important to the businessman (increase accuracy of calculations and more)
\$30.00

(28) DMS (Racet Computes).....lightning fast machine language sort.....sorts up to 4 disk drives of information
\$90.00*

(27) BLINK (Racet Computes).....allows you to RUN new programs without losing the variables stored in your previous program.....line many programs together without losing important variables
\$30.00*

(28) KFS-80 (Racet Computes).....now you can use ISAM (Index Sequential Access Files) in your MOD-III.....using ISAM in your BASIC programs allows instant access of your items in your data files.....use with mail programs.....inventory programs.....etc.
\$100.00*

(29) MAIL LIST (Racet Computes).....all routines are in machine language allowing for quick access
\$75.00

* FOR DISK ONLY

Circle 134 on inquiry card.

COMPUTRONICS

MATHEMATICAL APPLICATIONS SERIES™

50 N. PASCACK ROAD
 SPRING VALLEY, NEW YORK 10977

NEW TOLL-FREE
 ORDER LINE
 (OUTSIDE OF N.Y. STATE)
(800) 431-2818



24 HOUR
 ORDER LINE



(914) 425-1535

Scalar Dyadic Operators, Ramware APL80

OPERATOR	NAME	MONADIC	DYADIC	OPERATOR	NAME	MONADIC	DYADIC	COMMENTS
+	ADD	Y	Y		RESIDUE	Y	Y	
-	SUBTRACT	Y	Y	!	FACTORIAL	Y*	Y	Gamma function missing.
x	MULTIPLY	Y	Y	○	CIRCLE	Y	Y*	Hyperbolic and hyperbolic inverse not defined.
÷	DIVIDE	Y	Y	[^] _v _v _v	LESS THAN, ETC.		Y	
*	EXPONENT	N	Y*	= ≠	EQUAL TO, NOT EQUAL TO		Y	
⊗	LOGARITHM	Y	Y	∧∨	AND, OR		Y	Assumes nonzero values are equivalent to 1 or true (non-standard).
⌊	FLOOR	Y	Y	⋈	NAND, NOR		Y	
⌈	CEILING	Y	Y					

Nondyadic Scalar and Mixed Operators, Ramware APL80

OPERATOR	NAME	MONADIC	DYADIC	COMMENTS	OPERATOR	NAME	MONADIC	DYADIC	COMMENTS
~	NOT	Y			⊖	TRANSPOSE	Y*	Y*	Monadic transpose is nonstandard for 3-dimensional or larger arrays; dyadic "diagonal" transpose missing.
?	ROLL	Y	Y		⊕	ROTATE OR REVERSE	Y	Y	
i	IOTA (INDEX)	Y	Y		⊖	ROTATE	N*	N*	Available as ϕ [1] only.
ρ	RHO (RESHAPE)	Y	Y		/	COMPRESS	Y		
,	RAVEL	Y	Y*	Catenation for arrays, vectors, along last coordinate only; no lamination.	⊢	COMPRESS	N*		Available as / [1] only.
⊥ T	DECODE, ENCODE		Y*	Right argument of encode limited to scalars only.	\	EXPAND		Y	
↑ ↓	TAKE, DROP		Y		⊢	EXPAND		N*	Available as \ [1].
ε	MEMBERSHIP		Y		⊖	EXECUTE	N		
↑ ↓	GRADE-UP GRADE-DOWN	Y			⊖	FORMAT	Y*		Sets field width and number of decimal places for future output.
⊕	MATRIX DIVIDE OR INVERSE	N	N						

Composite Operators, Ramware APL80

OPERATOR	NAME	AVAILABLE ?	COMMENTS	OPERATOR	NAME	AVAILABLE ?	COMMENTS
f/	REDUCTION	Y		f.g	INNER PRODUCT	Y	
f⊢	REDUCTION	N*	Available as f[1]	o.f	OUTER PRODUCT	Y	

Notes:

"Y" and "N" mean that a given operator is either present in all its forms or totally absent from this version of APL. "Y*" means that the operator is only partially present in this version. "N*" means that the operator is not present in this version but that part or all of it is available through an APL defined function supplied with this version. Further information explaining "Y*" and "N*" is given in the "Comments" column.

A scalar is an object (number or character) with no dimension. A vector is a string of objects that have one dimension. An array is a matrix of objects that have two or more dimensions.

Other features: five tutorial programs on APL included in package; standard APL commands, automatic execution of latent expression; tracing of function execution; choice of single (6-digit) or double (15-digit) precision in output; real-time clock, line and character editing of defined functions; print formatting and system control variables (APL I-bar functions); positioning of screen output (equivalent to PRINT @ in BASIC); use of periods and dashes in variable names; PEEK, POKE, and CALL functions; random or sequential access of file records; updating of file records; and mixing of APL data structures (ie: arrays, vectors, scalars) in records of same disk file.

Other limitations: only one assignment operator per line; maximum of thirty-two functions per workspace and 255 lines per defined function; arrays limited to sixty-three dimensions; uses one-letter substitutions for APL operators (but these substitutions are differentiated from normal text).

Table 3: Summary of Ramware APL80 features.

The Hard Facts About Software

1. THREADED INTERPRETIVE LANGUAGES

by Ronald Loeliger

Threaded languages (such as FORTH) are compact, giving the speed of assembly language with the programming ease of BASIC. They combine features found in no other programming languages. This book develops an interactive, extensible language with specific routines for the Zilog Z80 microprocessor. With the core interpreter, assembler, and data type defining words covered in the text, it is possible to design and implement programs for almost any application and equivalent routines for different processors.



272 pages
hardcover
illustrated ISBN 0-07-038360-X

2. BASIC SCIENTIFIC SUBROUTINES, VOLUME I

by Fred Ruckdeschel

Designed for the engineer, scientist, experimenter, and student, this book presents a complete scientific subroutine package in BASIC. Volume I covers plotting, complex variables, vector and matrix operation, random number generation, and series approximations. This volume features routines written in both standard Microsoft and North Star BASIC, extensive appendices, and subroutine cross-references.



VOLUME I
336 pages
hardcover
illustrated ISBN 0-07-054201-5

3. BEYOND GAMES: System's Software For Your 6502 Personal Computer

by Kenneth Skier

At last, a complete programming guidebook for owners of personal computers utilizing the 6502 microprocessor. A self-contained course in structures programming and top-down design, this book presents a powerful set of tools for building an extended monitor, disassembler, hexadecimal dump routine, and text editor programs. Programs are thoroughly explained, with clear instructions for modifications.

ISBN 0-07-057860-5
440 pages
softcover
illustrated



Circle 135 on inquiry card.

Toll Free # 1-800-258-5420

Please remit in U.S. funds or draw on a U.S. Bank

- Please send
- _____ copies of Threaded Interpretive Languages 18.95
 - _____ copies of Basic Scientific Subroutines Volume I 19.95
 - _____ copies of Beyond Games 14.95

Name Title Company

Street City State/Province Code

- Check enclosed in the amount of \$ _____
- Bill Visa Bill Master Charge
- Card No. _____
- Exp. Date _____
- Add 75¢ per book to cover postage and handling.

Circle 135 on inquiry card.



70 Main Street
Peterborough, New Hampshire 03458

Scalar Dyadic Operators, Vanguard APL

OPERATOR	NAME	MONADIC	DYADIC	COMMENTS
+	ADD	Y	Y	
-	SUBTRACT	Y	Y	
×	MULTIPLY	Y	Y	
÷	DIVIDE	Y	Y	
*	EXPONENT	Y	Y	
⊗	LOGARITHM	Y	Y	
⌊	FLOOR	Y	Y	
⌈	CEILING	Y	Y	
	RESIDUE	Y	Y	
!	FACTORIAL	Y*	Y	Gamma available as a defined function.
○	CIRCLE	Y	Y*	Hyperbolic, inverse $\sqrt{B^2 - 1}$, $\sqrt{B^2 + 1}$ not defined.
<	LESS THAN, ETC.		Y	
=	EQUAL TO, NOT EQUAL TO		Y	
∧	AND, OR		Y	
∧∨	NAND, NOR		Y	

Nondyadic Scalar and Mixed Operators, Vanguard APL

OPERATOR	NAME	MONADIC	DYADIC	COMMENTS
~	NOT	Y		
?	ROLL	Y	Y	
i	IOTA (INDEX)	Y	Y	
ρ	RHO (RESHAPE)	Y	Y	
.	RAVEL	Y	Y*	Catenation for arrays, vectors, along all coordinates; lamination available as defined function.
⌊ T	DECODE, ENCODE	Y	Y	Right argument of encode limited to scalars only.
↑ ↓	TAKE, DROP		Y	
ε	MEMBERSHIP		Y	
↑ ↓	GRADE-UP GRADE-DOWN	Y		
⊕	MATRIX DIVIDE OR INVERSE	N*	N*	Both available as defined function only.
⊖	TRANPOSE	Y*	N	Monadic transpose for arrays available as defined function only.
⊕	ROTATE OR REVERSE	Y*	Y*	Both forms work for vectors only; for all arrays, available as defined functions only.
⊖	ROTATE	N*	N*	
/	COMPRESS		Y	
/	COMPRESS		N*	Available as / [1] only.
\	EXPAND		Y	
\	EXPAND		N*	Available as \ [1] only.
⊕	EXECUTE	Y		
⊕	FORMAT		Y	Left argument is print width and number of decimal places; right argument is vector or array to be formatted.

Composite Operators, Vanguard APL

OPERATOR	NAME	AVAILABLE ?	COMMENTS
f/	REDUCTION	Y	
f/	REDUCTION	N*	Available as f/[1] only.
f.g	INNER PRODUCT	Y	
o.f	OUTER PRODUCT	Y	

Notes:

"Y" and "N" mean that a given operator is either present in all its forms or totally absent from this version of APL. "Y*" means that the operator is only partially present in this version. "N*" means that the operator is not present in this version but that part or all of it is available through an APL defined function supplied with this version. Further information explaining "Y*" and "N*" is given in the "Comments" column.

A scalar is an object (number or character) with no dimension. A vector is a string of objects that have one dimension. An array is a matrix of objects that have two or more dimensions.

Other features: standard APL commands, system functions, and system variables; line editing only of defined functions; shared variable mechanism for interaction with disk files (sequential and random access); mixing of APL data structures (arrays, vectors, scalars) in records of same disk file; the ability to share with any Z80 I/O port.

Other limitations: only way to use this software with a non-APL terminal or video board uses one-letter substitutions of a standard ASCII character for APL operators (plus these substitutions are not differentiated from normal text); documentation is adequate but terse; no character editing of defined functions.

Table 4: Summary of Vanguard APL/DTC software features.

"WITH THE UCSD p-SYSTEM,TM WE CAN WRITE ONE APPLICATION THAT GOES FROM APPLE TO ZENITH."

HARRY BLAKESLEE, President, Denver Software



UCSD p-System and UCSD Pascal are trademarks of the Regents of the University of California.

Our business is bigger and better than ever. A lot of the credit for that goes to the UCSD p-System software from SofTech Microsystems. It's given us ten times the market we used to have.

We can write a single, sophisticated applications program with the UCSD p-System—like our financial management package—and it just keeps on running. On Apple, Commodore, Ohio Scientific, Texas Instruments, Zenith, and more. That's the real beauty of the UCSD p-System. Any program you write for one microcomputer runs on others, both today and tomorrow. You protect your software investment, without restricting your hardware options.

And with the UCSD p-System, you can use the language of your choice—UCSD Pascal,TM FORTRAN-77, BASIC, or assembly language. All are backed by SofTech Microsystems, a leading system software company who's been around for over a decade, who knows how to develop professional quality software, and who's committed to delivering it.

Get a head start on tomorrow. With the microcomputer software that goes from "A" to "Z." Distribution licensing and single copies available. Write or call for details, so you can start going places, too.

SOFTech
MICROSYSTEMS
A SUBSIDIARY OF SOFTECH

For the software that's going places.

9494 Black Mountain Road, San Diego,
CA 92126. (714) 578-6105
TWX: 910-335-1594

Notes on APL Benchmarks

The following information specifies the tests that are run on all versions of APL that are examined at *BYTE* magazine. Defined function *SETUP*, shown in listing 1, creates the APL variables that will be used in the tests shown in table 1. *A* and *B* are 10 by 10 matrices used in tests like $A \div B$ to perform an operation 100 times with one statement. *C* is a ten-element vector giving the values from π to 10π . *D* is a 10 by 10 matrix of trigonometric values. *E* is a ten-element vector of the values from 1 to 10 (used to test the outer product operator). *F* is a vector used to convert seconds to years, days, hours, minutes, and seconds in the test $F \uparrow 100000000$, using the encode (\uparrow) operator. *RA* and *RB* are 100-element vectors made from the elements of matrices *A* and *B*. Finally, *M3D* is a three-dimensional array used to test rotation around a non-default axis.

The function *TIME* in listing 2 was used in timing the performance of a function. Statements 20 thru 60 are performed *N* times, with the (*exp*) in each line replaced by the function being tested (for example, $Q \leftarrow A \div B$). Statement 80 displays the total number of times the function has been performed, while statement 90 requests the number of seconds used in the test (timed by a stopwatch) and displays the time used to perform the function once. Each function is per-

formed five times within *TIME* to maximize the time spent executing the function when compared to the time spent executing statement 10 and repeatedly executing line 70 *N* times. In addition, the *TIME* function was performed with increasing values of *N* until the unit time agreed to three significant places. The timing values in table 1 are rounded to two significant places.

Three short APL functions, *CIRCLE*, *TRANS*, and *IVER*, are used as benchmarks to grade the performance of an APL implementation in less abstract terms. (See listings 3, 4, and 5.) *CIRCLE* takes a numeric matrix and adds a set value to all matrix elements in an imaginary circle with a given center and radius. (This function was used to set up a "picture" matrix of geometric shapes in a pattern-recognition algorithm.) The *TRANS* function transforms a matrix of numbers into a matrix of symbols, with the individual symbols used to reflect the value of the corresponding numeric matrix entry. The *IVER* function was presented by Dr Kenneth Iverson in the article "Understanding APL" (August 1977 *BYTE*, page 36). When given a right argument of seven or larger, it returns a vector containing all the prime numbers up to and including that number. (For example, *IVER* 11 returns the vector 2 3 5 7 11.)

Notes:

- All of the above tests are performed on either 10 by 10 matrices or 100-element vectors; in addition, the tests were carried out to minimize the amount of time outside the operation being timed.
- In some cases, a version of APL could not operate on a given size matrix. An asterisk denotes an estimated entry made by adjusting the time an operation took for a smaller matrix.
- *CIRCLE*, *TRANS*, and *IVER* (shown in listings 3 thru 5) are APL defined functions used to compare the versions of APL in a working environment.
- All numbers here are given to 2 significant digits.
- In the cases where a version of APL gives the user an APL defined function (a short program written in APL) to use when the operation is not in the machine-code version of APL, the defined function is used in the above timing tests. For example, none of the above

versions of APL incorporate matrix divide in their versions, but Softronic and Vanguard supply an APL defined function to do the same operation.

- *NA* means the function is not available in a given version of APL.
- The Ramware APL80 was run on an unmodified Radio Shack TRS-80 Model I with one disk drive and 48 K bytes of memory. The TRS-80 runs at 1 MHz; all timing figures should be halved for users running modified TRS-80s at 2 MHz.
- The Softronic APL was run on a Cromemco Z2D with 56 K bytes of memory, running at 4 MHz.
- The Vanguard APL/DTC software was run on an APL/DTC computer with 80 K bytes of memory, running at 4 MHz. Users buying the Vanguard APL/V80 software should expect slightly decreased performance varying with the amount of memory in the system.

Text continued from page 196:

be devised. APL operators that normally do not appear on the keyboard have a 1-character substitution. For example, the character % replaces the APL division operator \div , and parentheses () replace the square brackets [] used in APL to denote subscripts. Other characters are represented by a shifted keyboard letter; for example, shift-q is used for the APL character □ (a quad), and shift-i is used for the APL *iota* operator ι . On the TRS-80 video screen, these characters are displayed as their uppercase alphabetic equivalents (because an unmodified TRS-80 has no lowercase letters) with a little graphic dot just below and to the left of the uppercase let-

ter. This, plus one space on the left of the single letter substitution, makes this system more readable. (See photo 1 for the APL80 equivalent of the *CIRCLE* function of listing 3a).

Many other Level II-related features make Ramware APL80 a usable product and certainly the best buy dollar-for-dollar. Several other features that must be mentioned are sequential and random access of APL disk files and access to the real-time clock; other features are listed in table 3.

Vanguard APL/DTC Computer and Software

Two of the "At a Glance" boxes describe the last ver-

logo

computer
systems inc.

368 Congress Street

Boston, Mass.

USA 02210

(617) 451-2646

87 Haut-Bois Blvd Suite 4

Ste-Julie, Québec

Canada J0L 2S0

(514) 649-6185

on inquiry card.

MEGABYTER

8"
IBM
Diskette

ZVX4 FOUR TIMES THE BYTE

The ZVX4 MEGABYTER is for the APPLE II user who wants to DOUBLE file size, expand the capability of existing business software, and make other SERIOUS applications more viable.

Now you can have compatibility with IBM, INTEL, CP/M*, Z80 Softcard*, UCSD Pascal, and others.

Look what the MEGABYTER dual density 8" floppy disk controller, with its LSI circuitry and reliable industry standard IBM 3740 format, means to you:

INCREASED STORAGE

- Increase online storage to 2 Mega bytes
- Double your maximum accounts and file size
- Add high capacity efficient hard disk backup
- Control up to 4 Shugart SA800/SA850 drives

IMPROVED COMPATIBILITY

- Operate APPLE DOS 3.1/3.2/3.3, mini disks
- Preserve existing software investment
- Interchange data with other computers

SIMPLIFIED OPERATION

- Reduce disk handling and I/O slot usage
- Gain automatic single/double density operation
- Change to double sided drives with one switch

Available at your Apple dealer. Call or write today!!



SORRENTO VALLEY ASSOCIATES
11722 SORRENTO VALLEY ROAD
SAN DIEGO, CA 92121
(714) 452-0101

* CP/M trademark of Digital Research, Inc.
Z80 Softcard trademark of Microsoft, Inc.

```
01  DIMR CIRCLE A FROM FROM TOOL
02  DIMR CONTAINS FROM A COL COORD ,RADIUS ,VALUE ADDED
03  DIMR (( 6 5 4 9)CIRCLE A ADDS TO THE ARRAY A CIRCLE
04  DIMR CIRCLE A FROM FROM TOOL
05  DIMR C
06  DIMR C
07  DIMR ROM +AR ( 1)AR ( 3)+ 1
08  DIMR NEXTRON :ROM +ROM + 1
09  DIMR COL +AR ( 2)AR ( 3)+ 1
10  DIMR NEXTCOL :COL +COL + 1
11  DIMR DIST +((ROM _AR ( 1))% 2)+(COL _AR ( 2))% 2)% .5
12  DIMR +AR ( 3)DIST )EMULP
13  DIMR ROM _COL +B (ROM _COL )AR ( 4)
14  DIMR EMULP +COL (AR ( 2)+AR ( 3))NEXTCOL
15  DIMR +( ROM NEXTRON )( 1+ROM (AR ( 1)+AR ( 3))
16  DIMR
```

Photo 1: The APL function CIRCLE as presented by Ramware APL80. In this version of APL for the TRS-80 Model I, nonstandard APL characters are replaced by either a 1-character substitution or by a single letter marked by a graphics dot below and to the left of the letter.

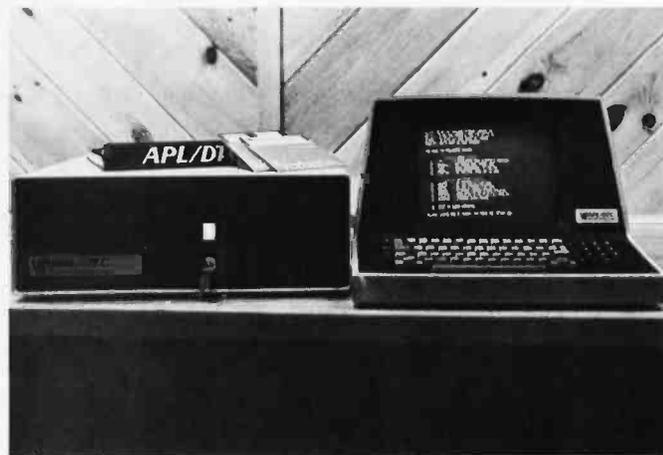


Photo 2: The Vanguard Systems Corporation APL/DTC. The system includes: the APL/DTC (desk-top) computer, on the left; its associated APL terminal, on the right; and, on top of the computer, documentation and two floppy disks of software—customized CP/M and Vanguard APL.

sion of APL, which was reviewed as a computer/software combination called APL/DTC. The computer and software have been optimized for each other, creating a version of APL that is slightly more powerful than its stand-alone software counterpart, APL/V80.

The APL/DTC system, which carries a label of the same name (see photo 2), is actually a Vector Graphics microcomputer with modifications made at Vanguard Systems Corp. (One modification results in the computer holding 80 K bytes of memory.) Its associated terminal, which displays all APL characters (as shown in photo 3) has an APL keyboard and is a Vector Graphics "Mindless Terminal" (a keyboard and video display that connects to a memory-mapped video board inside the computer proper). Its associated video board has a PROM (programmable read-only memory device) that generates the APL character set. The APL/DTC computer runs CP/M as customized by Lifeboat Associates and Vanguard. The

Start learning and computing for only **\$129.95** with a **Netronics 8085-based computer kit**. Then expand it in low-cost steps to a business/development system with 64k or more RAM, 8" floppy disk drives, hard disks and multi-terminal I/O.

THE NEW EXPLORER/85 SYSTEM

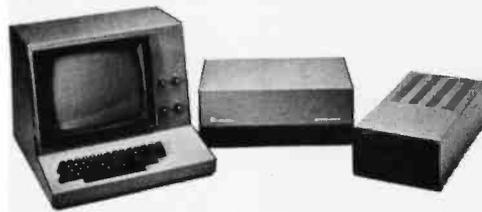
Special! Full 8" floppy, 64k system for less than the price of a mini! Only **\$1499.95!**

(Also available wired & tested, \$1799.95)

Imagine — for only \$129.95 you can own the starting level of Explorer/85, a computer that's expandable into full business/development capabilities — a computer that can be your beginner system, an OEM controller, or an IBM-formatted 8" disk small business system. From the first day you own Explorer/85, you begin computing on a significant level, and applying principles discussed in leading computer magazines. Explorer/85 features the advanced Intel 8085 cpu, which is 100% compatible with the older 8080A. It offers on-board S-100 bus expansion, Microsoft BASIC in ROM, plus instant conversion to mass storage disk memory with standard IBM-formatted 8" disks. All for only \$129.95, plus the cost of power supply, keyboard/terminal and RF modulator if you don't have them (see our remarkable prices below for these and other accessories). With a Hex Keypad/display front panel, Level "A" can be programmed with no need for a terminal, ideal for a controller, OEM, or a real low-cost start.



Level "A" is a complete operating system, perfect for beginners, hobbyists, industrial controller use. \$129.95



Full 8" disk system for less than the price of a mini (shown with Netronics Explorer/85 computer and new terminal). System features floppy drive from Control Data Corp., world's largest maker of memory storage systems (not a hobby brand!)



Level "A" With Hex Keypad/Display.

LEVEL "A" SPECIFICATIONS

Explorer/85's Level "A" system features the advanced Intel 8085 cpu, an 8355 ROM with 2k deluxe monitor/operating system, and an advanced 8155 RAM I/O ... all on a single motherboard with room for RAM/ROM/PROM/EPROM and S-100 expansion, plus generous prototyping space.

PC Board: Glass epoxy, plated through holes with solder mask. • I/O: Provisions for 25-pin (DB25) connector for terminal serial I/O, which can also support a paper tape reader. • cassette tape recorder input and output. • cassette tape control output. • LED output indicator on SOD (serial output) line. • printer interface (less drivers) ... total of four 8-bit plus one 6-bit I/O ports. • Crystal Frequency: 6.144 MHz. • Control Switches: Reset and user (RST 7.5) interrupt. • additional provisions for RST 5.6, 6.5 and TRAP interrupts on-board. • Counter/Timer: Programmable, 14-bit binary. • System RAM: 256 bytes located at F800, ideal for smaller systems and for use as an isolated stack area in expanded systems. • RAM expandable to 64k via S-100 bus or 4k on motherboard.

System Monitor (Terminal Version): 2k bytes of deluxe system monitor ROM located at F800, leaving 6000 free for user RAM/ROM. Features include tape load with labeling ... examine/change contents of memory ... insert data ... warm start ... examine and change all registers ... single step with register display at each break point, a debugging/training feature ... go to execution address ... move blocks of memory from one location to another ... fill blocks of memory with a constant ... display blocks of memory ... automatic baud rate selection to 9600 baud ... variable display line length control (1-255 characters/line) ... channelized I/O monitor routine with 8-bit parallel output for high-speed printer ... serial console in and console out channel so that monitor can communicate with I/O ports.

System Monitor (Hex Keypad/Display Version): Tape load with labeling ... tape dump with labeling ... examine/change contents of memory ... insert data ... warm start ... examine and change all registers ...

single step with register display at each break point ... go to execution address. Level "A" in this version makes a perfect controller for industrial applications, and is programmed using the Netronics Hex Keypad/Display. It is low cost, perfect for beginners.

HEX KEYPAD/DISPLAY SPECIFICATIONS

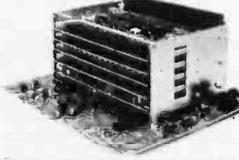
Calculator type keypad with 24 system-defined and 16 user-defined keys. Six digit calculator-type display, that displays full address plus data as well as register and status information.

LEVEL "B" SPECIFICATIONS

Level "B" provides the S-100 signals plus buffers/drivers to support up to six S-100 bus boards, and includes: address decoding for on-board 4k RAM expansion selectable in 4k blocks ... address decoding for on-board 8k EPROM expansion selectable in 8k blocks ... address and data bus drivers for on-board expansion ... wait state generator (jumper selectable), to allow the use of slower memories ... two separate 5 volt regulators.

LEVEL "C" SPECIFICATIONS

Level "C" expands Explorer/85's motherboard with a card cage, allowing you to plug up to six S-100 cards directly into the motherboard. Both cage and card are neatly contained inside Explorer's deluxe steel cabinet. Level "C" includes a sheet metal superstructure, a 5-card, gold plated S-100 extension PC board that plugs into the motherboard. Just add required number of S-100 connectors.



Explorer/85 With Level "C" Card Cage.

LEVEL "D" SPECIFICATIONS

Level "D" provides 4k of RAM, power supply regulation, filtering decoupling components and sockets to expand your Explorer/85 memory to 4k (plus the origi-

nal 256 bytes located in the 8155A). The static RAM can be located anywhere from 0000 to EFFF in 4k blocks.

LEVEL "E" SPECIFICATIONS

Level "E" adds sockets for 8k of EPROM to use the popular Intel 2716 or the TI 2516. It includes all sockets, power supply regulator, heat sink, filtering and decoupling components. Sockets may also be used for 2k x 8 RAM IC's (allowing for up to 12k of on-board RAM).

DISK DRIVE SPECIFICATIONS

- 8" CONTROL DATA CORP. professional drive.
- LSI controller.
- Write protect.
- Single or double density.
- Data capacity: 401,016 bytes (SD), 802,032 bytes (DD), unformatted.
- Access time: 25ms (one track).

DISK CONTROLLER/I/O BOARD SPECIFICATIONS

- Controls up to four 8" drives.
- 1771A LSI (SD) floppy disk controller.
- Onboard data separator (IBM compatible).
- 2 Serial I/O ports
- Autoboot to disk system when system reset.
- 2716 PROM socket included for use in custom applications.
- Onboard crystal controlled.
- Onboard I/O baud rate generators to 9600 baud.
- Double-sided PC board (glass epoxy.)

DISK DRIVE CABINET/POWER SUPPLY

- Deluxe steel cabinet with individual power supply for maximum reliability and stability.

ORDER A COORDINATED EXPLORER/85 APPLICATIONS PAK!

Beginner's Pak (Save \$26.00!) — Buy Level "A" (Terminal Version) with Monitor Source Listing and AP-1 5-amp Power Supply; (regular price \$199.95), now at SPECIAL PRICE: \$169.95 plus post. & insur.
Experimenter's Pak II (Save \$53.40!) — Buy Level "A" (Hex Keypad/Display Version) with Hex Keypad/Display, Intel 8085 User Manual, Level "A" Hex Monitor Source Listing, and AP-1 5-amp Power Supply; (regular price \$279.35), all at SPECIAL PRICE: \$219.95 plus post. & insur.
Special Microsoft BASIC Pak (Save \$103.00!) — Includes Level "A" (Terminal Version), Level "B", Level "D" (4k RAM), Level "E", 8k Microsoft in ROM, Intel 8085 User Manual, Level "A" Monitor Source Listing, and AP-1 5-amp Power Supply; (regular price \$439.70), now yours at SPECIAL PRICE: \$329.95 plus post. & insur.

ADD A TERMINAL WITH CABINET, GET A FREE RF MODULATOR; Save over \$114 at this SPECIAL PRICE: \$499.95 plus post. & insur.

Special 8" Disk Edition Explorer/85 (Save over \$104!) — Includes disk-version Level "A", Level "B", two S-100 connectors and brackets, disk controller, 64k RAM, AP-1 5-amp power supply, Explorer/85 deluxe steel cabinet, cabinet fan, 8" SD/DD disk drive from famous CONTROL DATA CORP. (not a hobby brand!), drive cabinet with power supply, and drive cable set-up for two drives. This package includes everything but terminal and printers (see coupon for them). Regular price \$1630.30, all yours in kit at SPECIAL PRICE: \$1499.95 plus post. & insur. Wired and tested, only \$1799.95.

Special! Complete Business Software Pak (Save \$625.00!) — Includes CPM 2.0, Microsoft BASIC, General Ledger, Accounts Receivable, Accounts Payable, Payroll Package; (regular price \$1325), yours now at SPECIAL PRICE: \$699.95.

Please send the items checked below:

- Explorer/85 Level "A" Kit (Terminal Version) ... \$129.95 plus \$3 post. & insur.
- Explorer/85 Level "A" Kit (Hex Keypad/Display Version) ... \$129.95 plus \$3 post. & insur.
- 8k Microsoft BASIC on cassette tape. \$64.95 postpaid.
- 8k Microsoft BASIC in ROM kit (requires Levels "B", "D" and "E") ... \$99.95 plus \$2 post. & insur.
- Level "B" (S-100) kit ... \$49.95 plus \$2 post. & insur.
- Level "C" (S-100 6-card expansion) kit ... \$39.95 plus \$2 post. & insur.
- Level "D" (4k RAM) kit ... \$69.95 plus \$2 post. & insur.
- Level "E" (EPROM/ROM) kit ... \$5.95 plus \$6 p&h.
- Deluxe Steel Cabinet for Explorer/85 ... \$49.95 plus \$3 post. & insur.
- Fan For Cabinet ... \$15.00 plus \$1.50 post. & insur.
- ASCII Keyboard/Computer Terminal kit: features a full 128 character set, u&l case; full cursor control; 75 ohm video output; convertible to baudot output; selectable: baud rate, RS232-C or 20 ma. I/O, 32 or 64 character by 16 line formats, and can be used with either a CRT monitor or a TV set (if you have an RF modulator) ... \$149.95 plus \$3.00 post. & insur. \$19.95 plus \$2.50 post. & insur.
- Deluxe Steel Cabinet for ASCII keyboard/terminal ... \$19.95 plus \$2.50 post. & insur.
- New! Terminal/Monitor: (See photo) Same features as above, except 12" monitor with keyboard and terminal is in deluxe single cabinet; kit ... \$399.95 plus \$7 post. & insur.
- Hazeltine terminals; Our prices low to quote — CALL US
- Lear-Sigler terminals/printers; Our prices low to quote; CALL US
- Hex Keypad/Display kit ... \$69.95 plus \$2 post. & insur.

- AP-1 Power Supply Kit ±8V @ 5 amps) in deluxe steel cabinet ... \$39.95 plus \$2 post. & insur.
- Gold Plated S-100 Bus Connectors ... \$4.85 each, postpaid.
- RF Modulator kit (allows you to use your TV set as a monitor) ... \$4.95 postpaid.
- 16k RAM kit (S-100 board expands to 64k) ... \$199.95 plus \$2 post. & insur.
- 32k RAM kit ... \$299.95 plus \$2 post. & insur.
- 48k RAM kit ... \$399.95 plus \$2 post. & insur.
- 64k RAM kit ... \$499.95 plus \$2 post. & insur.
- 16k RAM Expansion kit (to expand any of the above in 16k blocks up to 64k) ... \$99.95 plus \$2 post. & insur. each.
- Intel 8085 cpu Users' Manual ... \$7.50 postpaid.
- 12" Video Monitor (10MHz bandwidth) ... \$139.95 plus \$5 post. & insur.
- Beginner's Pak (see above) \$169.95 plus \$4 post. & insur.
- Experimenter's Pak (see above) ... \$219.95 plus \$6 post. & insur.
- Special Microsoft BASIC Pak without Terminal (see above) ... \$329.95 plus \$7 post. & insur.
- Same as above, plus ASCII Keyboard Terminal With Cabinet, Get Free RF Modulator (see above) ... \$499.95 plus \$10 post. & insur.
- Special 8" Disk Edition Explorer/85 (see above) ... \$1499.95 plus \$26 post. & insur.
- Wired & Tested ... \$1799.95 plus \$26 post. & insur.
- Extra 8" CDC Floppy Drives ... \$499.95 plus \$12 post. & insur.
- Cabinet & Power Supply For Drive ... \$69.95 plus \$3 post. & insur.
- Drive Cable Set-up For Two Drives ... \$25 plus \$1.50 post. & insur.

- Disk Controller Board With I/O Ports ... \$199.95 plus \$2 post. & insur.
- Special! Complete Business Software Pak (see above) ... \$699.95 postpaid.
- SOLD SEPARATELY:**
- CPM 1.4 ... \$100 postpaid.
- CPM 2.0 ... \$150 postpaid.
- Microsoft BASIC ... \$325 postpaid.
- Intel 8085 cpu User Manual ... \$7.50 postpaid.
- Level "A" Monitor Source Listing ... \$25 postpaid.

Continental U.S.A. Credit Card Buyers Outside Connecticut

CALL TOLL FREE: 800-243-7428

To Order From Connecticut Or For Technical Assistance, call (203) 354-9375

Total Enclosed (Conn res. add sales tax) \$ _____
 Paid By:
 Personal Check Cashier's Check/Money Order
 VISA Master Charge (Bank No. _____)
 Acct. No. _____ Exp. Date _____
 Signature _____
 Print Name _____
 Address _____
 City _____
 State _____ Zip _____

NETRONICS Research & Development Ltd.
 333 Litchfield Road, New Milford, CT 06776



Photo 3: Listing of the APL function CIRCLE on the APL/DTC terminal screen and, below, a listing of special APL characters as they appear on the APL/DTC terminal. The last row is composed of characters that are created using an overstrike.

price tag of \$7995 is rather steep for an APL machine, but a large body of CP/M software, including other computer languages, is available for the machine, somewhat mitigating the expense.

The language itself, called APL/V80 and available for \$500 in a variety of formats, is the undisputed winner in every category except cost and documentation. The fact that it is more expensive is reasonable; after all, it does offer a faster APL that implements more operators. However, its weakness in the documentation, though slight, is disturbing.

Because its documentation is not of the same caliber as the rest of the package, the software must stand on its own merits. (Fortunately, it does.) The documentation is terse, sometimes cryptic. Much of the language is defined in charts that give only the name of the operation being performed. Only one or two examples are given for each operator, far too few to be able to generalize. Comparing the Vanguard documentation to the Softronics documentation (which takes up to a half page to describe an operator and includes examples), I can summarize by saying that the Softronics documentation is much more "friendly" and much more useful as both a tutorial and a reference.

On the positive side, APL/V80 includes information on customizing the software and on building and using auxiliary processors (software) that allow the language to interface to custom external devices through Z80 I/O ports. In addition, Vanguard provides a set of APL defined functions (in both printed and disk file form) that implements almost all of the functions not in its APL. Data files can be accessed either sequentially or randomly through a mechanism called *shared variables*; this method is used by the IBM 5100 computer and other computers to provide an APL-like mechanism for interacting with disk files.

Vanguard has solved the problem of using its APL/V80 on an unmodified ASCII computer. According to Dr John Howland of Vanguard Systems Corporation, a defined function is included in the APL/V80 package that, when executed, allows the user to edit and list APL functions using mnemonic substitutes of any length for the APL characters that are not on a regular ASCII keyboard. Although I have not seen this system at work, it sounds like a viable solution.

Several notes are in order in relation to tables 1 and 4. The information in these tables is based on the APL software supplied with the APL/DTC computer, not the APL/V80 software. Again, according to Dr Howland, the APL/V80 software should run at the same speed as the software running on the APL/DTC computer (assuming that the Z80 board of the host computer runs at 4 MHz, the system clock frequency of the APL/DTC). This means that the timing figures of table 1 are valid for the APL/V80. In addition, the software features in table 4, listed as available on the APL/DTC, are also in the APL/V80 software, with the exception of the inner product function (available as a defined function in APL/V80). The APL/DTC allows an APL workspace of 34 K bytes, while the APL/V80 software allows a workspace of about 27 K bytes when running on a 64 K-byte CP/M system. The additional memory space used by the APL/DTC software is devoted to the implementation of hardware-related features (such as access to the real-time clock and a machine-related security function).

Conclusions

Versions of APL are available to fit every budget. The Ramware APL80 is a usable version of APL for the TRS-80, and it is quite a bargain at \$39.95. Softronics APL, although it does have some serious limitations, is in a medium price range at \$350. Vanguard APL/V80, at \$500, is the fullest and fastest APL. Your needs and the amount of money you can spend will determine which version is best for you. ■

POCKET ASCII TERMINAL

MIDGET DUPLEX UNIT WITH MAN-SIZED CAPABILITIES

Here's \$395 worth of convenience for anyone working with digital systems. Carry it anywhere in a pocket, valise or toolkit to enter and retrieve data, run diagnostics, change constants, test data links, etc.



Look at its facilities:

- Transmits 128 ASCII codes
- Can display last 30 characters received
- Displays full 64-character ASCII set on clear 16-segment LEDs
- 25-line RS232/c compatible interface
- Single 5V supply required at 400mA typical
- 110 or 300 baud transmission selectable
- Parity codes, stop bits settable to your standard
- Obeys bell, cursor and data format control codes

Phone or write us for more details now:

GR ELECTRONICS
1640 Fifth Street,
Santa Monica, CA 90401.
Telephone: (213) 395-4774.
Telex: 65-2337 (BT Smedley SNM).

Let onComputing be your guide to personal computing.



Finally, there is a magazine that speaks to the beginner.

onComputing is the new McGraw-Hill quarterly that tells what's ahead — without talking over your head — in the 1980's with personal computers.

onComputing puts you on target with all the applications that go beyond your imagination.

- Personal computers in the home.
- Classrooms.
- They bring computer music.
- Electronic mail.
- Robots.
- They manage your personalized investment.
- The list goes on and on in **onComputing**.

If you're a beginner with personal computers, get the most understood magazine on computers, **onComputing**. And even if you're an experienced computer user, **onComputing** has the information you need in today's fast-growing personal computer market.

onComputingTM



Get onto onComputing. Call 800-258-5485.

onComputing Subscription Dept. P.O. Box 307, Martinsville, NJ 08836 7B41

DOMESTIC subscription rate:
 U.S. 1 yr. (4 issues) @ \$8.50 Canada & Mexico, 1 yr. (4 issues) @ \$10.00
 FOREIGN (to expedite service, please remit in U.S. funds drawn on a U.S. bank)
 Europe (and all other countries, except above), 1 Yr. @ \$12.00 — surface delivery.
 Bill Visa Bill Master Charge Bill me (North America only)

Card Number _____ Expiration _____
 Signature _____ Name (please print) _____
 Street/Apartment Number _____
 City _____ State/Province/Country Code _____

Please allow 6-8 weeks for processing.

64K STATIC



RAM 17

- the memory that took 18 months to hatch!

18 months ago, we designed RAM 17 around a brand new 16K static RAM from Hitachi that not only had the reliability and speed of static memory, but also consumed less power than dynamics.

Unfortunately, pricing on this VLSI chip back then was such that we didn't feel RAM 17 would meet our tough standards for cost-effectiveness. In the past few months, however, volume production has lowered chip prices to where RAM 17 now represents an exceptional value in S-100 memory.

Features include a stunningly low 250 mA typical power consumption, guaranteed operation (no wait states) at 6 MHz with CPU Z and 10 MHz with CPU 8085/8088, full compliance with all IEEE 696/S-100 specifications (including 24 bit addressing and standard board size), four optional 2K windows to accommodate memory mapped disk controllers, pinout compatibility with 2716 EPROM (allows RAM/ROM mix on a single board), plus all the other features that make CompuPro memory the first choice of system designers world-wide.

\$1595 CSC (2 year limited warranty), \$1395 A/T (1 year limited warranty), \$1095 UnkIt.

These features may appear to be those of a dream memory of the future. . .
but CompuPro is delivering RAM 17 now at finer computer stores near you.

CompuProTM

OAKLAND AIRPORT, CA 94614

division of

GODBOUT
ELECTRONICS

(415) 562-0636



CompuPro computers don't JUST work: they WORK, and WORK, and WORK, and WORK, and

If there's anything more important than throughput, it's reliability: that's why CompuPro System Components are painstakingly engineered not just to work, but to keep on working. Say goodbye to unexplained system hardware glitches - CompuPro products conform to all IEEE 696/S-100 specifications, thereby ensuring well integrated (and predictable) system performance. Also, should a system malfunction ever occur, the bus oriented nature of S-100 machines allows you to simply pull out the bad board and plug in a replacement. . .and when you depend on a computer, you know what it means to minimize down time.

All CompuPro products meet the most demanding mechanical and electrical standards, and are backed with one of the best warranties in the business (1 year limited warranty on all products, 2 year limited warranty with exchange program for products qualified under the Certified System Component program).

Sure, computers can be great intelligent toys; but for scientific, industrial, and commercial applications, toys aren't good enough. You need a computer that works, works right, and keeps on working: you need CompuPro system components.

NEW! DISK 1: THE ULTIMATE DISK CONTROLLER.

A/T \$495, CSC \$595

Finally, a disk controller worthy of the CompuPro name. This state of the art design uses properly implemented DMA with **arbitration**, meaning that Disk 1 can co-exist - without any conflict whatsoever - on the same bus as other DMA devices. And because Disk 1 has 24 bit DMA addressing (not memory mapped), you have access to a full 16 megabyte memory map.

What about speed? Disk 1 transfers data independently of CPU speed, allowing operation with 6 MHz Z80s*. Versatility? Disk 1 handles up to four 8" or 5.25" floppy disk drives (including 96 track high density minifloppies), single or double sided, single or double density (soft sector). Convenience? Disk 1 includes BIOS for CP/M-80*, as well as on-board boot for automatic startup and on-board serial port for system initialization startup. Compatibility? Disk 1 is compatible with MP/M*, OASIS, CP/M-80, and CP/M-86. Reliability? Uses industry-standard, third generation controller chips and the same design excellence that is a part of every CompuPro product.

We weren't going to put out another me-too disk controller... and we didn't. The CompuPro Disk Controller is here.

SYSTEM SUPPORT 1 MULTIFUNCTION BOARD

\$295 Unkit, \$395 A/T, \$495 CSC

This multi-purpose S-100 board provides sockets for 4K of extended address EPROM or RAM (2716 pinout) with one battery backup socket; battery backup month/day/year/time crystal clock with BCD outputs; optional math processor (9511 or 9512); full RS-232 serial port; three 16 bit interval timers (cascade or use independently); two interrupt controllers service 15 levels of interrupts; power fail indicator; and comprehensive owner's manual with numerous software examples. Conforms fully to all IEEE 696/S-100 standards. (Add \$195 to the above prices for the optional 9512 math processor.)

SOFTWARE

8088/8086 MONITOR-DEBUGGER: Supplied on single sided, single density soft-sector 8" disk. CP/M* compatible. Great development tool; mnemonics used in debug conform as closely as possible to current CP/M* DDT mnemonics. \$35.

PASCAL/M* FROM SORCIM: PASCAL - easy to learn, easy to apply - can give a microcomputer with CP/M* more power than many minis. We supply a totally standard Wirth PASCAL/M* 8" diskette and comprehensive manual. Specify Z-80* or 8080/8085 version. \$175.

Most CompuPro products are available in Unkit form, Assembled/Tested, or qualified under the high-reliability Certified System Component (CSC) program (200 hour burn-in, more). Note: Unkits are not intended for novices, as de-bugging may be required due to problems such as IC infant mortality. Factory service is available for Unkits at a flat service charge.

COMPUTER ENCLOSURE 2

Introductory price: \$795 (specify rack mount or desk top version)

Includes fused, constant voltage power supply (+8V at 25 Amps, ±16V at up to 6 Amps); 20 slot shielded/active terminated motherboard; and deluxe enclosure with dual AC outlets on rear, heavy-duty line filter, circuit breaker, quiet ventilation fan, and reset switch. Rack mount version includes slides for easy pull-out from rack frame.

Also available: **COMPUTER ENCLOSURE 1.** Same as above, but less power supply and motherboard. \$289 desktop, \$329 rack mount.

PRICE BREAKTHROUGH ON 16K MEMORY EXPANSION - 8 RAMS/\$29

These top quality, low power, high speed (200 ns) 16K dynamic RAMs expand memory in TRS-80* -I, -II, and -III computers (color model too) as well as machines made by Apple, Exidy, Heath H89, newer PETs, etc. Backed by 1 year limited warranty. Add \$3 for two dip shunts plus TRS-80* conversion instructions. Limited quantity.

S-100 MEMORIES FROM THE MEMORY LEADER

CompuPro memories feature fully static design to eliminate dynamic timing problems, full conformance to all IEEE 696/S-100 specifications, high speed operation (4/5 MHz Unkit, 10 MHz A/T and CSC), low power consumption, extensive bypassing, and careful thermal design.

	Unkit	A/T	CSC
8K RAM 2A.....	\$159	\$189	\$239
16K RAM 14 (extended addressing).....	\$279	\$349	\$429
16K RAM 20-16 (extended addressing and bank select).....	\$319	\$399	\$479
24K RAM 20-24 (extended addressing and bank select).....	\$429	\$539	\$629
32K RAM 20-32 (extended addressing and bank select).....	\$559	\$699	\$799

NEW! 64K STATIC RAM 17. Amazingly low power in a 64K fully static RAM board: less than 500 mA maximum, 250 mA typical! It's fast, too; runs with 6 MHz Z-80* CPUs, or 10 MHz 8080-family CPUs (8085, 8088, etc.). Uses IEEE extended addressing protocol, and may optionally turn off 2K windows from E000 to FFFF in order to accommodate North Star or Morrow disk controllers (the CompuPro disk controller can use the full 64K since it employs properly implemented DMA techniques). \$1095 Unkit, \$1395 A/T, \$1595 CSC.

TERMS: Prices shown do not include dealer installation and support services. Cal res add tax. Allow at least 5% shipping; excess refunded. Orders under \$15 add \$2 handling. VISA® and Mastercard® orders (\$25 min) call our 24 hour order desk at (415) 562-0636. Include street address for UPS delivery. Prices are subject to change without notice.

FREE CATALOG: Want more information? Then send for our free catalog. For fast 1st class delivery, add 41 cents in stamps; foreign orders add \$2 (refundable with order).

*LEGAL CORNER: Z80A is a registered trademark of Zilog; TRS-80 is a trademark of the Tandy Corporation. PASCAL/M is a trademark of Sorcim; CP/M and MP/M are registered trademarks of Digital Research.

**COMPUPRO PRODUCTS ARE AVAILABLE AT FINER COMPUTER STORES
WORLD-WIDE. . .CALL (415) 562-0636 FOR THE STORE NEAREST YOU.**

CompuPro™

Circle 140 on inquiry card.

division of

**GODBOUT
ELECTRONICS**

OAKLAND AIRPORT, CA 94614

(415) 562-0636

News and Speculation About Personal Computing

Conducted by Sol Libes

Sony Enters Word-Processing Arena:

The Sony Corporation is a real innovator. First, it decided to enter the word-processing market. Then it introduced a new concept in word processing that's surely a winner. Called the Typecorder, it consists of a small keyboard/microcassette unit [about the size of two issues of *BYTE*. ...GW] that has a microcomputer and 1-line LCD display; it costs \$1400. Small enough to fit into your briefcase, it permits you to create text, edit it, and store it on tape. The tape can be run off on a companion printer, available for \$800, or through a word-processor system due later this year. You can transmit the text over telephone lines via an optional acoustic-coupler modem, or you can process the text through a non-Sony system. Typecorder lets you mix audio and digital information on cassette, so you might devise some interesting computer-assisted software.

I have no doubt that Sony's concept, features, and low price will be popular and will lead to applications beyond word processing.

A Close Look At The IBM Displaywriter:

IBM is now delivering its new low-cost Displaywriter word-processing system; it's only \$1000 more than the Radio Shack TRS-80 Model II, and it's really a general-purpose microcomputer that uses the Intel 8088 microprocessor.

IBM rents word-processing software for \$50 per month, which sounds rather steep; however, consider the TRS-80 owner who uses WordStar. WordStar costs \$500, plus another \$150 for the CP/M operating system.

Further, MicroPro International issues WordStar updates about four times a year at \$25 to \$40 apiece. Hence, WordStar can cost a user about \$850 for the first year of operation.

My point is that the price difference between a word-processing system using an IBM (or Wang, Lanier, etc) and a Radio Shack system is really not that great. Add to this IBM's terrific service and its promises of extended I/O, communications, and applications packages for the Displaywriter, and you'll see that IBM is competing aggressively in the microcomputer marketplace.

Word-Processing Prices Dropping:

Word-processing-system prices are dropping. Following on the heels of IBM's new low-cost word-processing system, Wang Laboratories has introduced a new stand-alone system for \$7500, with discounts offered on multiple units. Lanier Business Systems is expected to introduce an inexpensive system. A B Dick is planning a \$7500 system that includes software (the others do not), and is drawing up plans for a local-network system that shares a printer, which will further reduce costs.

Computer Hobbyists Gather For Huge Flea Market:

On Saturday and Sunday, April 25th and 26th, several thousand computer hobbyists will flock to Trenton State College, Trenton, New Jersey, for the Trenton Computer Festival, the world's largest personal-computer-equipment flea market. This annual outdoor event is now in its sixth year. A multitude of swap and seller tables covering more than 5

acres of real estate feature everything from complete computer systems to tiny electronic parts. There will be speakers, user-group meetings, an indoor exhibition area, and a banquet on Saturday night.

The Festival is sponsored by the Amateur Computer Group of New Jersey, the Philadelphia Area Computer Society, and the Trenton State Computer Society. The funds raised help support these nonprofit organizations and their activities. For information, call (609) 771-2487, or write to TCF-81, Trenton State College, Trenton NJ 08625.

Credit Cards With Intelligence?

The Battelle Memorial Institute is studying the feasibility of a credit card with a built-in microprocessor. Such a card has already been developed in Europe and will soon be tested. It is expected that intelligent credit cards will provide added security without requiring large computer networks.

Home-Information Market Takes Shape:

Several tests are underway to determine the best way to capture the lucrative home-information market. In the meantime, there's a battle brewing for control of the market, and the major contestants are the telephone companies, principally AT&T (American Telephone and Telegraph) and the cable-television companies.

By 1983, AT&T is expected to launch its home-information systems. A user will probably have to buy a special video-display terminal, about \$250, plus pay a monthly service fee in the \$4 to \$8 range.

The cable-television companies plan to provide the same two-way services. Companies such as Westinghouse, General Electric, and American Express are snatching up cable-television outfits. Several cable-television home-information systems are already in operation. However, the real battle is at least two years away when AT&T actually enters the market.

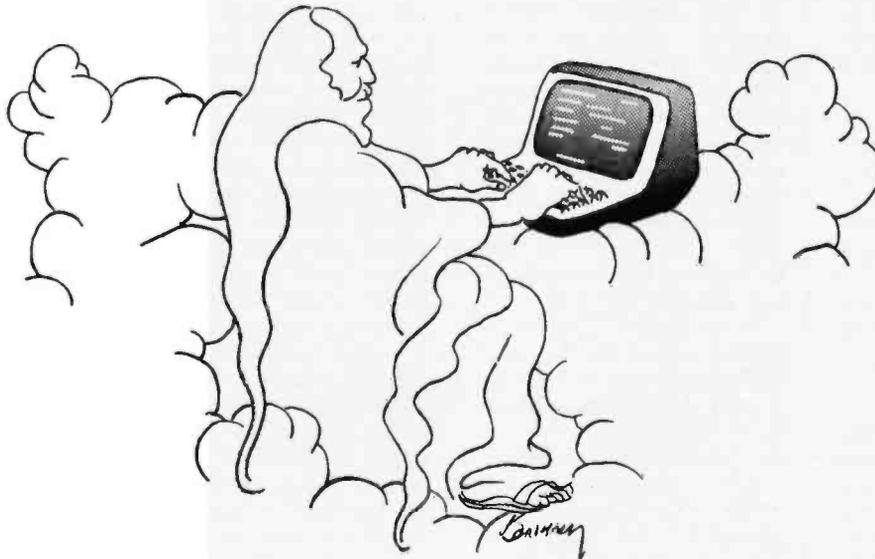
The Terminal You May Have Been Waiting For:

Hewlett-Packard has introduced a super-intelligent terminal, called the Model 2626A. It displays 119 lines with 160 characters per line; moreover, the display can be divided into four windows. There are two independent I/O ports, so that you can simultaneously communicate through separate windows with two different computers. There are user-programmable keys, and the bell has fifteen pitches, sixteen intensities, and two volumes—which means that you can play decent-sounding music on it.

Microsoft And DEC Join Forces:

Microsoft's first software product was a 4 K-byte BASIC interpreter, which used keywords similar to DEC's (Digital Equipment Corporation's) BASIC-Plus. It launched Microsoft on the road to success with expanded BASICs and other language packages. DEC has now adopted Microsoft BASIC for its GIGI (general imaging generator and interpreter) color-graphics system. Microsoft's BASIC is contained in ROM (read-only memory) in a microprocessor-based unit. GIGI is used with the PDP-11 and VAX-11 systems.

Whether the job is building a home or a world MILESTONE^{T.M.} helps...



With today's concerns about increasing costs and declining productivity it is true more than ever that any project worth doing deserves careful planning. Whether you're planning a construction project or the opening of a new retail store, you must carefully schedule your manpower, dollars and time in order to maximize productivity.

MILESTONE is a critical-path-network-analysis program. It runs on a desktop microcomputer, is inexpensive and simple enough for anyone to use.

MILESTONE's design is a product of many years of experience in the "real world" of small-project management. In such an environment the primary purpose of planning is to help the project leader clarify the task at hand and to help him communicate his ideas to his subordinates and superiors. For these two reasons the designers of **MILESTONE** stressed its *interactivity* and comprehensive reporting.

Most of the design effort was put into eliminating unnecessary or redundant operator input and to checking all entries for validity. By organizing the project data for you, you can interactively modify your project plan leaving **MILESTONE** to perform the tedious calculations and to display the results.

Internally, **MILESTONE** treats your project as a series of activities. Each activity has a name, duration, capital cost, mix of manpower, and an associated list of other activities that must be completed first. The list of associated activities (or prerequisites) provides a thread that **MILESTONE** uses to link all the jobs together into an overall project schedule. Every time you add a new activity or make a change to an existing one, the entire schedule is recomputed and the results are immediately redisplayed on the screen.

For **MILESTONE** a project is simply any task made up of steps that must be performed in sequence. After dividing a project into its composite steps, **MILESTONE** can help you plan, schedule and control the project.

Specifically here are some of the things you can do,

- Find out which activities are time critical and can't be delayed
- Discover which activities have slack time and can be delayed without delaying the entire project
- Prepare a detailed cost estimate based upon a summation of each activity's individual equipment and manpower expenses
- Change an activity and instantly see the impact on the overall project schedule
- Investigate tradeoffs between manpower, dollars, and time
- Keep track of your project's progress by periodically updating the schedule to reflect changes in the plan and completed activities

MILESTONE requires 54K RAM and CP/M, Apple Pascal, or UCSD Pascal. CP/M versions need no support language. All Apple II versions require 24 x 80 video card. Formats: 8" single density IBM soft-sectored, NorthStar DD, Micropolis Mod II, Superbrain 3.0, Apple II. Price is \$295. Manual alone - \$30. Add \$7.00 for shipping.

SOFTWARE
SOFTWARE
DIGITAL MARKETING
DIGITAL MARKETING

2670 CHERRY LANE
WALNUT CREEK • CALIFORNIA 94596 • (415) 938-2880

MILESTONE trademark Organic Software CP/M trademark
Digital Research Apple Pascal Trademark Apple Computer
UCSD Pascal trademark Regents University California

D **Diagnostic Disk Troubleshoots Your Disk Drive:**

Dysan Corporation will introduce a floppy disk that checks disk-drive operation. It contains software and geometric patterns that test radial positioning, linearity, hysteresis, eccentricity, index timing, skew, relative head positioning, azimuth, drive rpm (revolutions per minute), head load, access time, and head/media compliance. The first model to be introduced will be a \$40 IBM 3740-compatible 8-inch disk.

W **Word-Processor Dictionary Introduced:**

IBM's new Displaywriter word-processor system features an optional dictionary-software package that checks the spelling of up to 70,000 words. Similar packages will soon be available for other systems. The first is Microspell, to be distributed by Lifeboat Associates. It checks the spelling of any ASCII-text file stored on disk under CP/M. Thus, the program can be used with files created by WordStar, WordMaster, Magic Wand, and other word-processing packages.

I **BM Status Report:**

Many critics want you to believe that IBM's dominance in the data-processing market is eroding rapidly. Don't believe it, because more than a third of the \$60 billion 1980 computer market was IBM's. In all industry, IBM's \$23 billion in sales ranked eighth, and its \$3 billion in total profits was third. By contrast, the second largest computer maker, Burroughs, had \$2.83 billion sales and \$305.5 million in profits.

IBM is not always the technological leader. Rather, it has used marketing clout to establish dominance in any market it enters. For example, IBM sells 70% of the large mainframe computers in the USA.

However, during the last few years, DEC (Digital

Equipment Corporation), Data General, Wang Laboratories, and Amdahl have grabbed an increasing share of the computer market. Several Japanese companies, such as Fujitsu, Hitachi, and NEC (Nippon Electric Company), are also moving in on IBM's territory. On the horizon, IBM faces strong competition from AT&T, Xerox, and Exxon, as they move into local and interoffice data-communication network markets.

These factors have had a serious impact on the value of IBM's stock. In the 1960s, it sold for as much as 66 times earnings; it now sells for 15 to 20 times earnings.

IBM's strategy for the 1980s is based on a coming generation of mainframes that will set new levels in price versus performance and emphasize telecommunication networks. In addition, IBM has opened retail stores and is entering several new markets via joint ventures, such as a videodisk project and satellite communications. However, it is likely that these projects will be a minor part in the whole IBM strategy for the 80s. Although IBM will become more involved in data networking, its focus will continue to be large central data-processing operations.

N **ew 8-Inch Winchester Has 136 Megabytes:**

Ontrax Corporation has unveiled the largest capacity 8-inch Winchester-type disk drive to date. It stores 136 megabytes on five platters using sixteen read/write heads. With a controller, the drive sells for \$5000 in quantity. That's 0.004 cents per byte, compared to about 0.2 cents per byte for a typical single-density floppy-disk drive.

R **andom News Bits:**

Computerland, High Technology, and The Computer Store plan to stock at least one Japanese-made personal computer. Japanese sup-

pliers currently being considered are NEC, Casio, Canon, Sharp, and Panasonic. ...Tandy Corporation and the Professional Farmers of America (PFA) have introduced Instant Update, a data-base service that uses TRS-80 videotext terminals (actually TRS-80 Model II). Via telephone connections, the service provides information affecting commodity prices and crop yields and gives access to *Washington Watch News*. Commodity prices are updated every 10 minutes. The service costs \$95 per month. ...Sony has introduced a 3½-inch micro-floppy-disk drive. (**Editor's note:** See *this month's editorial*.) It is currently being marketed to OEMs and systems houses; its capacity is reputed to be over 800 K bytes (unformatted) per disk. ...Two teenagers have been charged with masterminding a scheme that shut down DePaul University's computer during enrollment week. The shutdown cost DePaul \$22,252 in computer time, repairs, and manpower. The teenagers said they did it to disprove the school's claim that it couldn't be done. ...Intel Corporation announced its figures on net income and revenues for the year that ended December 31, 1980. Net income was \$96.7 million, up 24% from the previous year, and revenues were \$855 million, up 29% from 1979. Most of the growth occurred in the first half of the year....

R **andom Rumors:**

Informed sources say that Tandy will lower the price of its Videotext terminal to compete with AT&T's projected home-information terminal. ...Apple Computer is developing a new microcomputer using the 16-bit Motorola 68000 microprocessor. ...At least one software-development house has leaked that it is seriously negotiating with Apple on a disk operating system for a machine called the Apple IV. ...Look for a lower-priced version of Hewlett-Packard's HP-85

desk-top computer—maybe less than \$2000—to be called the HP-83. It lacks some of the HP-85's features, but it has a plug-in disk-drive option. ...Exxon's Kylex division is developing a 40-row by 80-character LCD (liquid-crystal display) for computer-display terminals. ...Sony might be developing a personal-computer system for this year's market. Sony may include an interface for its new Typecorder word-processor terminal. ...Digital Equipment Corporation is developing a new line of personal-computer products with extensive software support, including an operating system based on RT-11 with VAX-compatible BASIC....

C **OBOL For The 8086 Announced:**

The software picture for 8086-based 16-bit microcomputer systems keeps improving. Seattle Computer Products has announced an 8086 version of Microsoft BASIC. Now Microsoft has COBOL-86, which runs under the CP/M-86 operating system.

The projected execution time of these packages is three times as fast as the 8080/Z80 versions. As a result of the 8086's multitasking capabilities, the packages will be better suited for multiple-user systems than the 8-bit versions.

MAIL: I receive a large number of letters each month as a result of this column. If you write to me and wish a response, please include a stamped, self-addressed envelope.

Sol Libes
POB 1992
Mountainside NJ 07092

ALL THESE FEATURES... IN THIS SMALL SPACE... AT THIS LOW PRICE!

4,695

Greater computer power . . . fewer separate components . . . larger capability . . . simpler to operate . . . modular maintenance . . .

These are the unique benefits of the Quasar Data QPD-100 Floppy Disk Computer . . . plus unsurpassed reliability...plus 12-month warranty on all PC boards.

Its highly reliable, industry-standard MFE drive is compact. Accepts both single AND double-sided disks.

Upgradeable from the Z-80™ microprocessor-based system to our Z8000™ microprocessor-based system by simply plugging in extra PC cards. Hard disk and multi-user systems available.

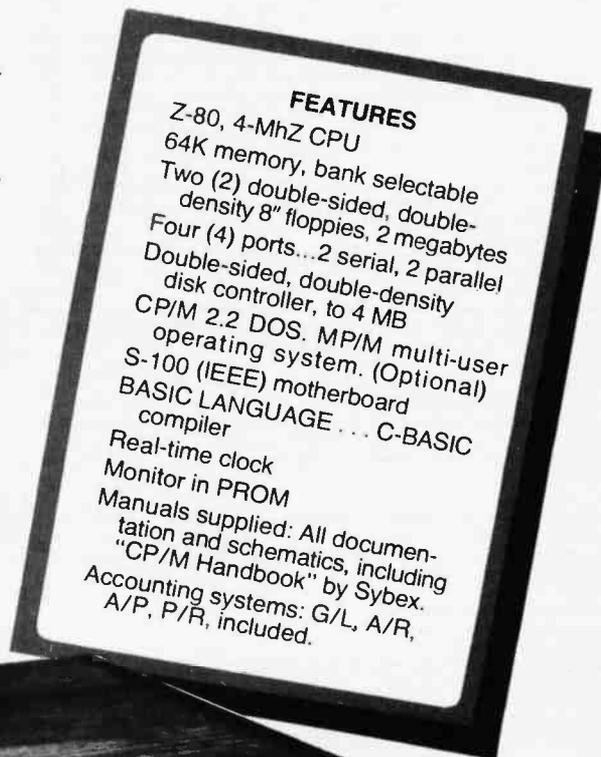
As your requirements grow, your QDP-100 can grow to fit them.

The Quasar Data QDP-100H is a larger version with 6-megabyte capacity; includes one double-sided floppy and one 5¼ microwinchester hard disk.

Both the Quasar Data QDP-100 and QDP-100H are fully compatible with all standard terminals.

Phone or write for descriptive bulletin and specifications. And ask for a demonstration. Dealer inquiries invited.

QUASAR DATA'S QDP-100 COMPUTER SYSTEM.



18" wide
16 7/8" deep
11" high

Complete systems available

* Z-80 and Z-8000 are trademarks of Zilog Corporation

** CP/M and MP/M are trademarks of Digital Research Corp.

Quasar Data Products

10330 Brecksville Road, Brecksville (Cleveland), Ohio 44141
Phone: 216/526-0838 / 526-0839
Telex: 241596



SuperSoft's Gallery of CP/M Masterworks

SUPER-M-LIST: A complete, easy to use mailing list program package. Allows for two names, two addresses, city, state, zip and a three digit code field for added flexibility. Super-M-List can sort on any field and produce mailing labels direct to printer or disk file for later printing or use by other programs. Super-M-List is the perfect companion to TFS. Handles 1981 Zip Codes!

Requires: 48K CP/M
Supplied with complete user manual: \$75.00 manual alone: \$10.00

TFS-Text Formatting System: An extremely powerful formatter. More than 50 commands. Supports all major features including:

- left & right margin justification
- user defined macros
- dynamic insertion from disk file
- underlining and backspace

TFS lets you make multiple copies of any text. For example: Personalized form letters complete with name, address & other insertions from a disk file. Text is not limited to the size of RAM making TFS perfect for reports or any big job. Text is entered using CP/M standard editor or most any CP/M compatible editor.

Requires: 24K CP/M
Supplied with extensive user manual: \$85.00 manual alone: \$20.00
Source to TFS in 8080 assembler (can be assembled using standard CP/M assembler) plus user manual: \$250.00.

TEXT PROCESSING

DIAGNOSTICS I: Easily the most comprehensive set of CP/M compatible system check-out programs ever assembled.

Tests:

- Memory
- CPU (8080/8085/Z80)
- Terminal
- Disk
- Printer

To our knowledge the CPU test is the first of its kind anywhere. Diagnostics I can help you find problems before they become serious. A good set of diagnostic routines are a must in any program library. Minimal requirements: 32K CP/M. Supplied with complete user manual: \$75.00 Manual alone: \$15.00

DIAGNOSTICS II: Includes all of Diagnostics I, plus:

- Every test is "submit"-able
- A complete Spinwriter/Diablo/Qume test has been added (Serial Interface only)
- Output may be logged to disk
- Expanded memory test
- Expanded terminal test
- Expanded disk test

Diagnostics II provides the next level in system maintenance.

Requires: 32K CP/M
Price: \$100.00 Manual only: \$15.00

SYSTEM MAINTENANCE

UTILITIES I: A collection of programs that you will find useful and maybe even necessary in your daily work (we did!).

Includes:

- GREP: Searches files for a specified string
- SORT: In core sort of variable length records
- CMP: Compare two files for equality
- PRINT: Formatted listings to printer
- PG: Lists files to CRT a page at a time

... plus more ...

Requires: 24K CP/M
Supplied with manual on discette: \$60.00

UTILITIES II: Many new programs not available elsewhere. Includes these

"file" utilities:

- DIFF: Source comparator
- PR: Powerful multicolumn output formatter
- CAT: Concatenate files
- RPL: Substitute strings in files

... plus more ...

Requires: 24K CP/M \$60.00
Supplied with manual on discette

UTILITIES

ANALIZA: An amazingly accurate simulation of a session with a psychiatrist. Better than the famous "ELIZA" program. Enlightening as well as fun. An excellent example of Artificial Intelligence.

Requires: 48K CP/M, CBASIC2
Cost: \$35.00

ENTERTAINMENT

Z8000CROSSASSEMBLER: Supports: full Z8000 syntax, segmented and unsegmented mode, full 32-bit arithmetic, hex output, listing output, "downloader".

Requires: 56K CP/M \$500.00
1 year maintenance \$300.00
manual alone \$ 50.00

Z8000 too!

'TINY' PASCAL II: We still call it 'Tiny' but it's bigger and better than ever! This is the famous Chung-Yuen 'Tiny' Pascal with more features added. Features include:

- recursive procedures/functions
- integer arithmetic
- CASE
- FOR (loop)
- sequential disk I/O
- 1 dimensional arrays
- IF...THEN...ELSE
- WHILE
- PEAK & POKE
- READ & WRITE
- REPEAT...UNTIL
- more

'Tiny' Pascal is fast. Programs execute up to ten times faster than similar BASIC programs. SOURCE TOO! We still distribute source, in 'Tiny' Pascal, on each discette sold. You can even recompile the compiler, add features or just gain insight into compiler construction.

Requires: 36K CP/M. Supplied with complete user manual and source on discette: \$85.00. Manual alone: \$10.00

STACKWORK'S FORTH: A full, extended Forth interpreter/compiler produces COMPACT, ROMABLE code. As fast as compiled FORTRAN, as easy to use as interactive BASIC.

SELF COMPILING: Includes every line of source code necessary to recompile itself.

EXTENSIBLE: Add functions at will. Z80 or 8080 ASSEMBLER included.

Single license, OEM licensing available.

Please specify CPU type: Z80 or 8080
Supplied with extensive user manual and tutorial: \$175.00
Documentation alone: \$25.00

SSS FORTRAN: The SSS FORTRAN compiler is fast, efficient, and complete (full 1966 ANSI standard with extensions). The RATFOR compiler compiles into FORTRAN allowing the user to write structured code while retaining the benefits of FORTRAN. The FORTRAN supports many advanced features not found in less complete implementations. Including: complex arithmetic, character variables, and functions. Complete sequential and random disk I/O are supported. SSS FORTRAN will compile up to 600 lines per minute! Recursive subroutines with static variables are supported. ROMABLE ".COM" files may be generated. SSS RATFOR allows the use of contemporary loop control and structured programming techniques. SSS RATFOR is similar to FORTRAN '77 in that it supports such things as:

- REPEAT...UNTIL
- WHILE
- IF...THEN...ELSE

SSS RATFOR is supplied with source code in FORTRAN and RATFOR.

System Requirements & Prices:

SSS FORTRAN requires a 32K CP/M system.

SSS FORTRAN with RATFOR: \$325.00

SS FORTRAN alone: \$250.00

RATFOR alone: \$100.00

(Sold only with valid SSS FORTRAN license)

PROGRAMMING LANGUAGES

TERM: A complete intercommunications package for linking your computer to other computers. Link either to other CP/M computers or to large timesharing systems. TERM is comparable to other systems but costs less, delivers more and source is provided on discette! With TERM you can send and receive ASCII and Hex files (COM too, with included conversion program) with any other real time communication between users on separate systems as well as acting as timesharing terminal.

- Engage/disengage printer
- error checking and auto retry
- terminal mode for timesharing between systems
- conversational mode
- send files
- receive files

Requires: 32K CP/M

Supplied with user manual and 8080 source code: \$150.00
Manual alone: \$15.00

INTERCOMPUTER COMMUNICATIONS

ENCODE/DECODE: A complete software security system for CP/M. Encode/Decode is a sophisticated coding program package which transforms data stored on disk into coded text which is completely unrecognizable. Encode/Decode supports multiple security levels and passwords. A user defined combination (One billion possible) is used to code and decode a file. Uses are unlimited. Below are a few examples:

- data bases
- payroll files
- programs
- tax records

Encode/Decode is available in two versions:

Encode/Decode I provides a level of security suitable for normal use.

Encode/Decode II provides enhanced security for the most demanding needs.

Encode/Decode I: \$50.00 Encode/Decode II: \$100.00 manual alone: \$15.00

SOFTWARE SECURITY

CP/M Formats: 8" soft sectored, 5" Northstar, 5" Micropolis Mod II, Vector MZ, Superbrain DD/QD



All Orders and General Information:

SUPERSOFT ASSOCIATES

P.O. BOX 1628

CHAMPAIGN, IL 61820

(217) 359-2112

Technical Hot Line: (217) 359-2691

(answered only when technician is available)

On line "Help" system provided with every program package.

SuperSoft

First in Software Technology

SuperSoft's DIAGNOSTICS I & II for CP/M

Since the beginning, programs have been written to verify the correctness of computer systems. This task has usually fallen on the manufacturers of computer equipment. However in the case of microcomputers, the manufacturers have been reluctant to supply such programs along with their hardware. First, because they often are not the ones called on to fix that hardware, and second, because the low cost of such systems often does not allow for such a large programming effort. The tremendous number of CP/M systems have made it possible for us to offer both **DIAGNOSTICS—I & II** at an affordable price, since we do not have to deal with a myriad number of console devices and disk systems; we simply use the standardized system calls.

Both packages perform tests on the five critical areas of your computer system:

- Memory
- CPU
- Printer
- Terminal
- Disk drive

DIAGNOSTICS—I provides an excellent level of testing. **DIAGNOSTICS—II** is simply the finest set of system maintenance routines ever written for microcomputers. **DIAGNOSTICS—II** includes all of **DIAGNOSTICS—I**, but goes much further in providing the user with even more checks, tests, and reports.

DIAGNOSTICS—I Features

The **MEMORY TEST** allows every byte of user memory to be tested. Both a quick test as well as a 'walking bit' test are included. Error reports summarize errors by bit as well as address.

The **CPU TEST** interprets a program that is designed to execute all single instruction sequences and many multiple instruction sequences. After each instruction sequence, the program tests all of the CPU registers to see that the proper registers changed correctly, *and* only those registers changed. This will detect, for instance, if storing into the A register affects the B register. The CPU test will automatically recognize the type of CPU you have. To the best of our knowledge, nothing as powerful as the CPU test is available anywhere else.

The **PRINTER TEST** prints a one line pattern, then rotates the pattern one character and prints again. This 'barber pole' scheme is simple, yet elegant, since it checks that every printable character can be printed in every printer column, and does so in a manner that makes any error obvious at a glance.

The **TERMINAL TEST** prints a 'barber pole' and then exercises cursor positioning, foreground, background, erase-all, erase-to-end-of-line, erase-foreground, and erase-background. If some of these features are not available on your terminal, they can be skipped. The test can be used with any terminal; many standard types are supplied pre-patched, any other can be patched by the user.

The **DISK TEST** writes a unique pattern in each sector, and then does a pseudo-random seek/read test within the file area.

DIAGNOSTICS—II Features

Every test is "submit"-able. In fact, a sample submit file is provided with each disk. This means that the user can run a series of tests without operator interaction. To further decrease the need for the user to "baby sit" the tests, the output of tests may be logged to disk for later review. This makes overnight testing very easy yet informative.

We started with **DIAGNOSTICS—I** and added all the features that users wanted as well as some of our own. Below is a description of some of the enhancements.

MEMORY TEST:

- Default to size of CP/M TPA
- Bank select (a necessity for more than 64k)
- Memory map of system displayed
- Memory speed test
- Burn in test

PRINTER TEST:

- Spinwriter, Diablo, Qume test which checks all head and carriage motions as well as ASCII printing features. (This is a very thorough test!)

DISK TEST:

- Writes a unique pattern to each sector on disk, verifying as it runs.
- User defined seek patterns allowed. (This is great for drive alignment and testing!)
- Tests user specific user defined sectors.

The **TERMINAL TEST** is the same as for **DIAGNOSTICS—I** except that it is "submit"-able.

The **CPU TEST** is the same except that it is "submit"-able and output may be logged to disk.

Also, a **QUICK TEST** has been added which will check the memory, disk drives, and CPU in your system in less than four minutes! The test is, of course, not as thorough as the ones described above, but provides a measure of confidence. It is particularly useful if used every time the system is powered up.

DIAGNOSTICS I: \$75.00
DIAGNOSTICS II: \$100.00
(manual only): \$15.00
Both require 32K CP/M

SuperSoft
First in Software Technology



All Orders and General Information:

SUPERSOFT ASSOCIATES

P.O. BOX 1628

CHAMPAIGN, IL 61820

(217) 359-2112

Technical Hot Line: (217) 359-2691

(answered only when technician is available)

CP/M Formats: 8" soft sector, 5" Northstar, 5" Micropolis Mod II, Vector MZ, Superbrain DD/QD

*CP/M REGISTERED TRADEMARK DIGITAL RESEARCH

An Introduction to Data Compression

Harold Corbin
11704 Ibsen Dr
Rockville MD 20852

Even though the cost of data storage continues to decrease fairly rapidly, there are still a number of situations where it is desirable to squeeze more data into a physical storage device. Often the typical microcomputer has limited memory, small disks, or slow cassettes. With any of these storage limitations, data compression may offer a method of using the existing device to store larger quantities of data or to provide improved access time to the data. The use of data compression can also provide significant improvement in the transmission of data over communication networks since there are fewer bits to send in order to convey the information.

ASCII code does not consider that the frequency of the characters in the file is not uniform.

The basic idea in data compression is to use more efficient codes to represent the information in a file or to remove redundant and unnecessary information from the file. With data compression in effect, the system stores or sends only the minimum data necessary to convey the original information.

In a typical file, the individual characters are represented by fixed-length codes such as ASCII (American Standard Code for Information Interchange). This representation does not consider that the frequency of occurrence of the characters in the file is not uniform. In typical English text, E is the most common letter and Z is the least frequently used letter. Table 1 presents a frequency analysis for letters in English text. Using a code such as ASCII for storing or transmitting text means that

the same number of bits is used for the most frequently occurring letter as well as for the least frequently occurring letter. This method of encoding data uses more bits to represent the information in the file than is necessary. In this article, I will illustrate ways to store data more efficiently.

Encoding the data in a more efficient form is called *data compression*. There are a variety of methods that have been used to compress data, but all of them attempt to reduce the redundancy of the original data. Most large data-processing systems provide some form of file compression, since storage costs money. Also, it is often less expensive to pay for the computer time to compress and expand the data than to pay for mass storage. The user of a large system usually has PACK and UNPACK commands available to allow compression and expansion of his files.

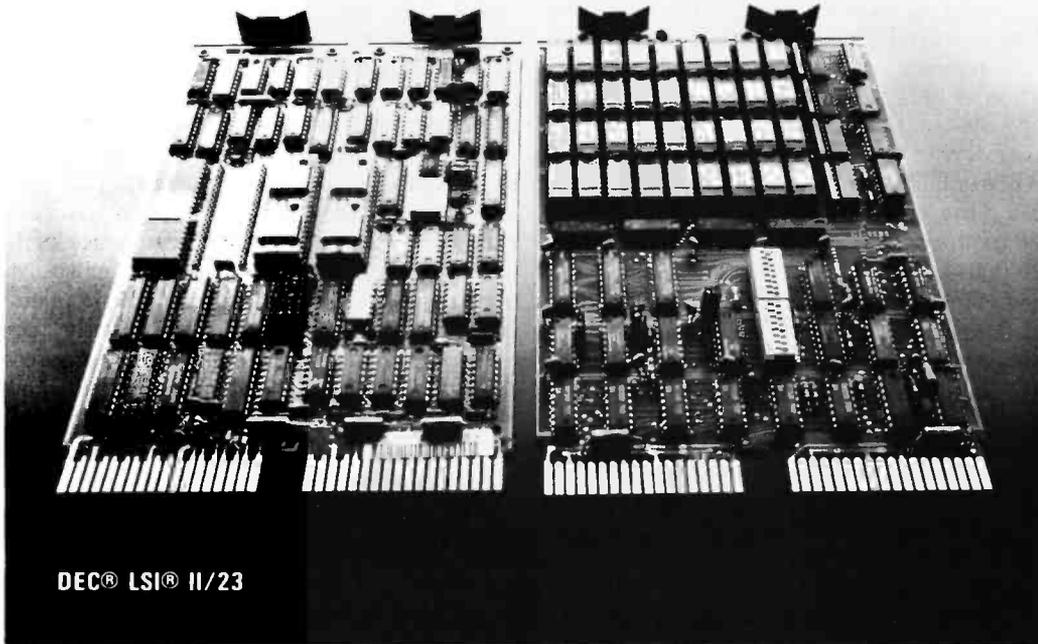
Typical data-processing systems use some form of zero or space suppression to do their data compression. This method is easy to implement and not very expensive to run, and produces fairly good compression for many types of data. The efficiency of this compression method is dependent upon how many spaces or zeros occur in the file. Typically, a source file of assembly-language statements is a good candidate for data compression. Fifteen to twenty percent compression of an assembly-language source file is not uncommon.

Data-Compression Methods

A space-compression capability can be implemented in several ways. Two common ones are *bit mapping* and *recurrence coding*. In the bit-mapping scheme, a bit map exists that is long enough to match one bit of the bit map to each byte of data in the original file. In the map, a 0 is stored for each byte in the data that is a space, and a 1 is

THE PERFECT MARRIAGE

CHRISLIN 256KB MEMORY



NOW AVAILABLE! 256KB memory on a dual height board only **\$1925**. CHRISLIN INDUSTRIES now offers state-of-the-art 64K RAM Memory system designs. Like our recently introduced 512KB MULTIBUS® compatible single card memory our 256KB LSI 11/23 memory is an industry first.

Free up critical and expensive backplane space. Saves you 3 dual slots.

Addressable in 4K increments up to 4 Megabytes.

On board parity generator checker totally DEC hardware and software compatible.

Single 5 volt power requirement.

Battery back-up capability. 256KB unit draws less than 300 ma at 5 volts in battery back-up mode.

Tested and burned in. Full year warranty.

DON'T ASK WHY WE CHARGE SO LITTLE, ASK WHY THEY CHARGE SO MUCH.



Chrislin Industries, Inc.

Computer Products Division

31352 Via Colinas • Westlake Village, CA 91362 • 213-991-2254

stored in the map for each corresponding byte in the data that is not a space. This way, the data can be stored with all spaces removed and still be easily reconstructed by first examining the bit map to determine where the expanded file needs to have a space or spaces inserted as the next data byte.

Recurrence coding takes a string of more than two repetitive characters and replaces the string with a special character. It is then followed by the count of how many occurrences of the repeated character are being compressed. A variation of this method is used in the IBM VM/370 Operating System with the PACK option of the COPYFILE command.

If the string "ABbbbbCD" (where *b* is a space) were to be compressed using the bit-mapping technique, 5 bytes would be required to store the data and the bit map. The map would be 11000011 (1 byte) and the data would be "ABCD" (4 bytes). Since only 5 bytes are required to store the original data in compressed form instead of 8 bytes, the data is compressed to 62.5% of its original length. Storing the same string using recurrence coding would result in a compressed string of "AB*4CD", where "*4" replaces the four spaces. In this case, the data is compressed to 75% of its original length. You can see that the efficiency of a given method is dependent upon both the method itself and the characteristics of the data's redundancy.

Another method of compression is known as *pattern substitution*. In this method, each occurrence of a specific pattern is replaced by a unique code. For example, in the above text, the pattern "compression is" could be replaced by a single 8-bit byte — say, 11111001. This would compress each occurrence of the 14 ASCII bytes in the pattern to a single byte. Obviously, if there were more than 256 patterns, the code pattern would have to be bigger than 8 bits to maintain uniqueness.

Variations of this method could mix the ASCII code and the pattern code. One scheme would place a unique code — for example, the ASCII ESC (escape) character — ahead of the pattern code. When the PACK routine encounters the ESC character, the next byte is replaced with its equivalent pattern.

Another scheme that would permit ASCII and pattern codes to be mixed would tag the pattern codes by setting the high-order bit to 1. This would restrict the ASCII to 128 codes and the patterns to 128 codes.

The efficiency of the pattern-substitution compression methods can be very useful if the pattern is long and its number of recurrences is high. Some compression systems based upon this method have sophisticated programs that search the data for patterns and assign codes to the patterns in an optimal manner.

Some compression methods are data-value dependent. One of these methods is *difference compression*. For example, if succeeding records had a field with the following values:

1,732,517
1,732,217
1,732,200
1,732,190

either the difference between succeeding fields or the difference from a base value could be stored as the com-

pressed data. In the first case, the values

1,732,517
300
17
10

would be stored. Obviously, if the field is of fixed length, nothing is gained by compression. However, if a variable field-length capability exists in the system, some space savings can be achieved with this compression method. Again, the amount of compression is highly dependent upon the data and its characteristics.

Another compression method makes use of the statistical properties of the occurrence of the data to be compressed. In this method, shorter codes are used for the more frequently occurring data elements. Longer codes are used for less frequently occurring data elements. One code used in data compression that optimizes the encoding values is the Huffman code. There

Letter	Frequency (%)
E	13.0
T	10.5
A	8.1
O	7.9
N	7.1
R	6.8
I	6.3
S	6.1
H	5.2
D	3.8
L	3.4
F	2.9
C	2.7
M	2.5
U	2.4
G	2.0
Y	1.9
P	1.9
W	1.5
B	1.4
V	0.9
K	0.4
X	0.15
J	0.13
Q	0.11
Z	0.07

Table 1: Relative frequency of the alphabet in the English language. In most character codes (including the common 7-bit ASCII), every letter is represented by the same number of bits. But one method of data compression assigns shorter codes to the frequently used letters (ie: E, T, and A) and longer codes to seldom used letters (ie: Q and Z). A message stored in this kind of code should be significantly shorter in bits than the same message stored in ASCII.

Letter	Huffman Code
E	100
T	001
A	1111
O	1110
N	1100
R	1011
I	1010
S	0110
H	0101
D	11011
L	01111
F	01001
C	01000
M	00011
U	00010
G	00001
Y	00000
P	110101
W	011101
B	011100
V	1101001
K	110100011
X	110100001
J	110100000
Q	1101000101
Z	1101000100

Table 2: A Huffman code. There are many Huffman codes; this is the one that is used in figure 2 and listings 1 thru 4. Note that the shorter codes are used for frequently occurring letters, and that no code is a beginning substring of a longer code.

The average number of digits used to represent a letter can be reduced toward the entropy limit *H* if the Huffman technique is used to encode blocks of letters rather than individual ones.

A FUNNY THING HAPPENED ON OUR WAY TO GROWTH.

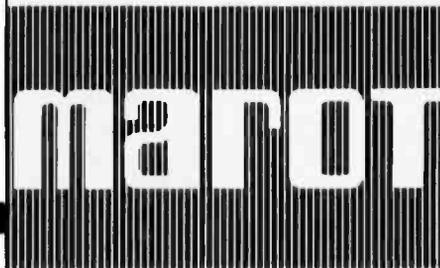
A year ago, the course for Marot Software Systems, Inc. was clear. We were on our way to becoming the world's best source for software. And we were going to accomplish that by distributing only the operating system and the application software that brought out the best in micro-computers. That was our course... and, in all modesty, we were most successful.

That's when something funny happened. The dealers, consultants and computer users with whom we had relationships began asking—and then demanding—that we at Marot apply our expertise and follow-through to the supply of reliable, quality-oriented hardware and complete computer systems. Systems that could solve specific problems in data-based management and analysis for business, law, medicine, science and government.

Here's the hardware we now distribute:

ONYX—Extremely powerful and reliable 5-user Z80-based micro, with 10 or 20 Mb hard disk and integral tape subsystem. Also available: 16 bit Z8000 operating UNIX™ Version 7, with up to 1 Mb RAM for as many as 8 users. 10 or 18 Mb hard disk with integral tape subsystem and additional storage available.

ALTOS—Cost-effective floppy disk system, 208 K RAM for up to 4 users. Expansion to 58 Mb hard disk with tape backup available.



MAROT SYSTEMS YOUR EASTERN SOURCE

The marketplace told us of the need for support, too. Of the gap that existed in matching hardware, operating systems and software to application requirements. And of the need for assistance in evaluating options available to meet those requirements.

So, we thoroughly searched and found the best hardware we could distribute.

As a result, Marot Software Systems, Inc. has become Marot Systems, Inc. It's the one company you can rely on to handle total computer needs: from hardware, software, operating systems and support to total computer solutions.

If you're a computer dealer or a computer consultant, Marot's total backup and support could be the special something you need to make your operation grow. Call or write us today.

Here are the products distributed by Marot Systems, Inc. Please check items of interest and return this coupon to:

Marot Systems, Inc.
310 Madison Avenue, Suite 408
New York, New York 10017
(212) 661-8550

Please send me more information on the following:

Operating System

- OASIS® — The mini-like single and multi-user machine-independent operating system for Z80 commercial applications and serious programmers.

Software

- MAGIC WAND™ — The most usable full-feature word processing system with extremely powerful text-formatting features.
- MAROT'S MAILING LIST PROGRAM — Maintains up to 65,000 entries in zip and name order, by ISAM files.
- COMPLETE BUSINESS PACKAGES — In standard ANSI '74 COBOL. Five module accounts receivable, accounts payable, general ledger, payroll, order entry/inventory plus financial modeling and job costing.
- ESQ-1™ — Time and billing system for the legal profession.
- MAROT'S OFFICE APPOINTMENT SCHEDULER — Maintains complete office diary, with ability to compare schedules.

Hardware

- ONYX
- ALTOS
- CORVUS HARD DISKS — 10 or 20 Mb, available for many computers including Tandy's TRS-80® Mod II
- PERKIN-ELMER TERMINALS
- TELEVIDEO® TERMINALS
- XEROX® PRINTERS

I am a computer dealer
 computer consultant
 computer user

Name _____ Title _____

Company _____

Address _____

City/State/Zip _____ Phone () _____

ESQ-1 is a trademark of Micro Information Systems, Inc.
TRS-80 is a trademark of Tandy Corp.
OASIS is a product of Phase One Systems.
MAGIC WAND is a trademark of Small Business Applications Inc.

are actually many Huffman codes, but they are similar in structure.

Before explaining how to construct a Huffman code, I will describe a typical Huffman code and how it works. The code that is used in the two compression programs in this article is given in table 2.

To compress the word "compression", the appropriate

binary code is assigned to each letter, which produces the binary string:

01000111000011110101101110001100110101011101100
 C O M P R E S S I O N

A quick count shows that 47 bits were required to encode the word "compression" with Huffman coding as compared to the 88 bits required with ASCII code. This gives a compressed text that is 53.4% of its original length. This level of compression is not too surprising since it is well known that the English language is highly redundant.

Of course the above example is a very short one. A larger piece of data should be used to find a more exact value of the amount of compression that can be expected from using Huffman coding. The actual efficiency can also be determined mathematically, but an explanation of that method is beyond the scope of this article. Using the program code described above with English text, approximately 4.18 bits would be required for each letter. Compared to 8-bit ASCII code, the compressed text is compressed to 52.2% of its original length.

Earlier in this article I mentioned that Huffman codes are optimized based upon the probability of the occurrence (ie: frequency) of the data element being encoded. In the program-code table (table 2), the more frequently occurring letters have the shorter codes, (eg: an E is coded with 3 bits). The number of bits, *b*, needed to encode a letter can be determined by the following formula:

$$b = f(-\log_2 p)$$

where *p* is the probability of occurrence of the letter, and *f(x)* is the closest integer greater than or equal to *x*.

From table 1, the probability of occurrence of an E in English text is 0.13; since $-\log_2 0.13 = 2.94$, the integer length is 3. If you were to continue to compute the code lengths from the probabilities in table 1, the lengths would differ from the code lengths used in the programs. This is because the program code lengths were determined from text that differs slightly in frequency from the text used to prepare table 1.

There are several ways the actual codes can be constructed. One method is shown in figure 1. To use the algorithm in figure 1, the letters must be arranged by

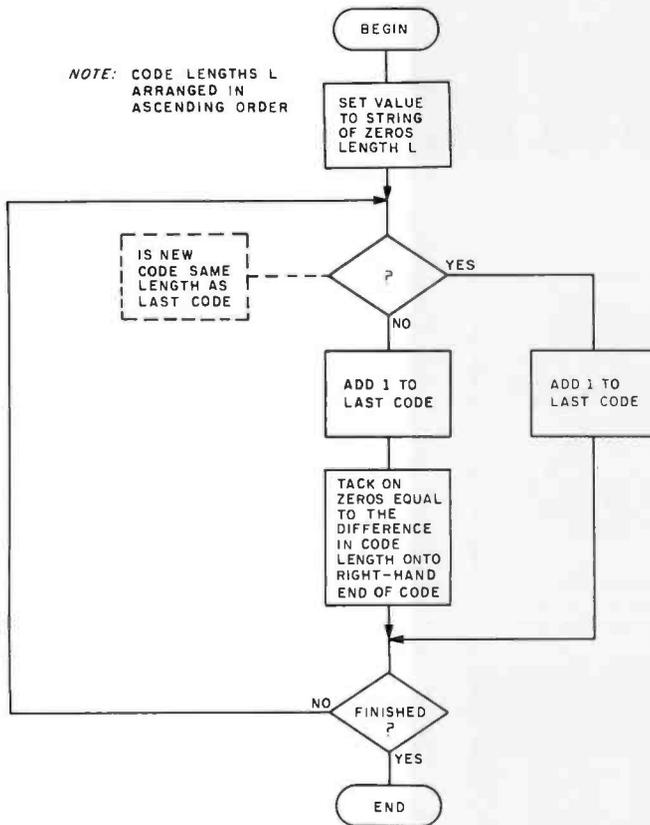


Figure 1: Flowchart for assignment of Huffman codes. This algorithm will produce a series of codes (Huffman codes) with the following two characteristics: the length of the code (in bits) is inversely proportional to the relative frequency of the symbol being encoded; and no code is a beginning substring of the Huffman code of another symbol. Together, these properties define a code with a unique decoding that uses the smallest number of bits to encode an average message.



***\$449**
 SPECIAL OFFER
 REGULAR PRICE \$489

VM-13

COLOR MONITOR/RECEIVER

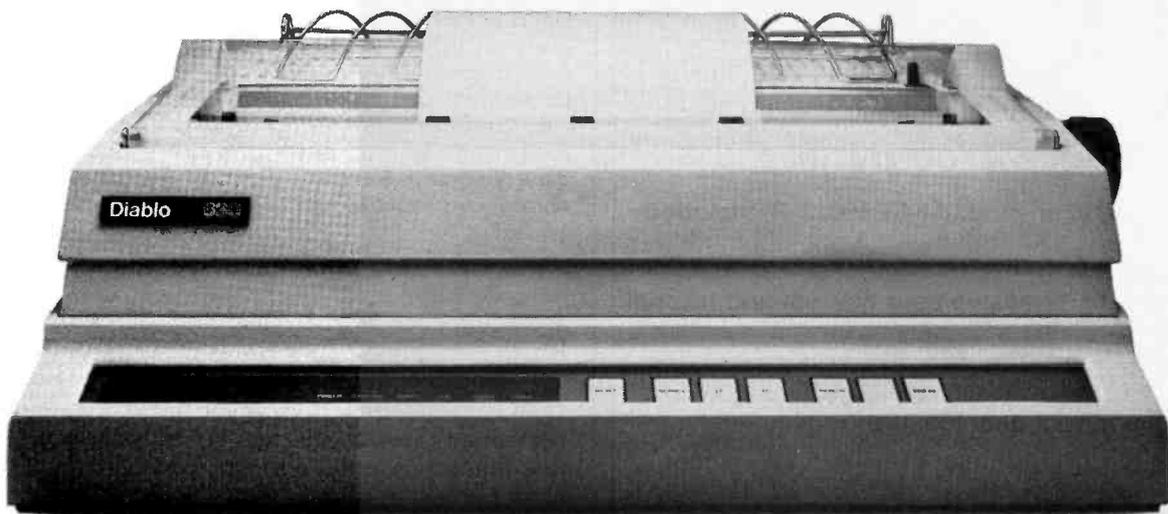
Two Modes of Operation for The Price of One

- Standard composite video/ 75 ohm term.
- Transformer isolated for safety.
- External audio input with control.
- Power Requirements: 117 VAC 60 Hz.
- VM-19, 19" diagonal screen, \$575.00.
- For professional, industrial, home video applications.

V.A.M.P. Inc.

P.O. BOX 29315 • LOS ANGELES, CA 90029 • (213) 466-5533

If you want a choice in print wheels, there's only one choice in printers.



The Diablo 630.

It's the only printer that lets you use either metal or plastic print wheels. So you can choose the print wheel that's just right for the job.

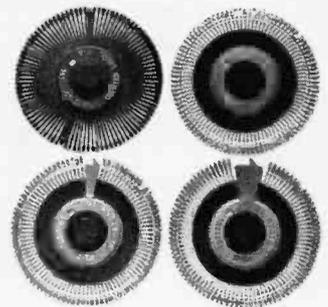
The 630 works as well with a 96-character plastic daisy print wheel as it does with an 88-, 92-, or 96-character metal daisy print wheel. In over 100 different type styles.

Every 630 has fewer moving parts than competitive printers, which makes it more reliable. And it offers unsurpassed print quality. Compatibility with Diablo supplies. And bi-directional printing capability.

The 630 is the only printer in the world that uses both metal and plastic wheels.

So if you want to change your print wheels, you'll just have to change your printer.

To a Diablo 630 printer.



Diablo Systems

XEROX

Diablo® and XEROX® are trademarks of XEROX CORPORATION.

Circle 146 on inquiry card.

BYTE April 1981 223

StackWork's

FORTH

A full, extended FORTH interpreter/compiler produces COMPACT, ROMABLE code. As fast as compiled FORTRAN, as easy to use as interactive BASIC.

SELF COMPILING

Includes every line of source necessary to recompile itself.

EXTENSIBLE

Add functions at will.

CP/M* COMPATIBLE

Z80 or 8080 ASSEMBLER included

Single license

Supplied with extensive user manual and tutorial:
\$175.00

Documentation alone: \$25.00

OEM's, we have a deal for you!

CP/M Formats: 8" soft sectored,
5" Northstar, 5" Micropolis Mod II,
Vector MZ, TRS-80 Mod II

Please specify CPU type.
Z80 or 8080

All Orders and General Information:

SUPERSOFT ASSOCIATES

P.O. BOX 1628

CHAMPAIGN, IL 61820

(217) 359-2112

Technical Hot Line: (217) 359-2691

(answered only when technician is available)



SuperSoft

First in Software Technology

*CP/M registered trademark Digital Research

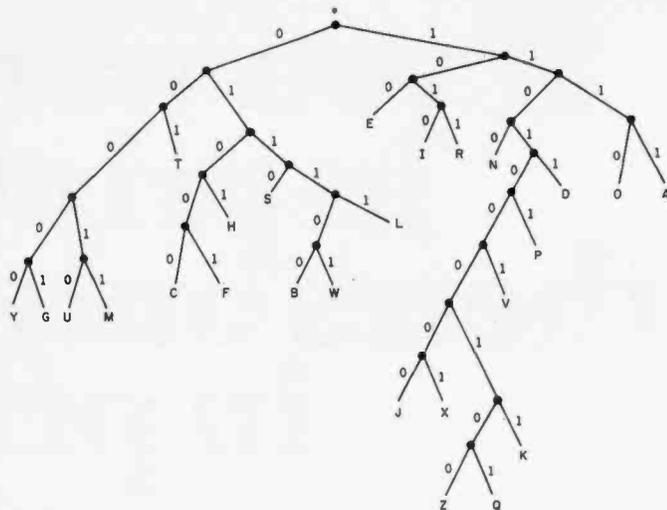


Figure 2: Binary tree for a Huffman code. The Huffman code for a letter is defined as the sequence of binary digits encountered when tracing the path from the root node, *, to the letter. Thus, the code for G is 00001, and the code for E is 100. This is the code used in the programs of listings 1 thru 4. Although this code cannot be produced by the algorithm of figure 1, it is a valid Huffman code (there are many) that can be validly used to illustrate the structure and implementation of Huffman codes in general.

ascending code length. Then the letter with the shortest length is assigned a code consisting of all 0s. Execution of the algorithm will result in the assignment of a unique code to each letter.

With any set of codes that are constructed, it is important that no code has a shorter code as part of its beginning. For example, if E is 100, then 10010 cannot be the code for another letter. This is because in scanning the bit stream from left to right, the decoding algorithm would think that 10010 is E (100) followed by 10 and not the different letter that was intended.

Regardless of the method used to construct the codes, the full set of binary Huffman codes can be represented as a binary tree. Figure 2 shows the binary tree that is equivalent to the Huffman code used in the programs of listings 1 thru 4. (These codes were not produced by the algorithm of figure 1.) This code structure allows the code to be uniquely decoded by simply starting at the top of the tree and walking down the tree, taking each branch that corresponds to the bit value, 1 or 0, as the coded data stream is scanned from left to right. This is the way the expansion program recreates the original data.

It is possible to combine various compression methods to increase the storage efficiency even more than when working with single letters. For example, Huffman codes could be assigned to patterns. Instead of working with the frequency of letters, you would use the frequency of the patterns. Thus, the pattern "code" might be represented by 010 and the pattern "data compression" might be represented by 10110. Obviously, a lot of compression could be achieved, particularly if single-letter and pattern methods are combined and certain patterns have a high frequency of occurrence.

Sample Programs

Two versions of both the compression and the expansion

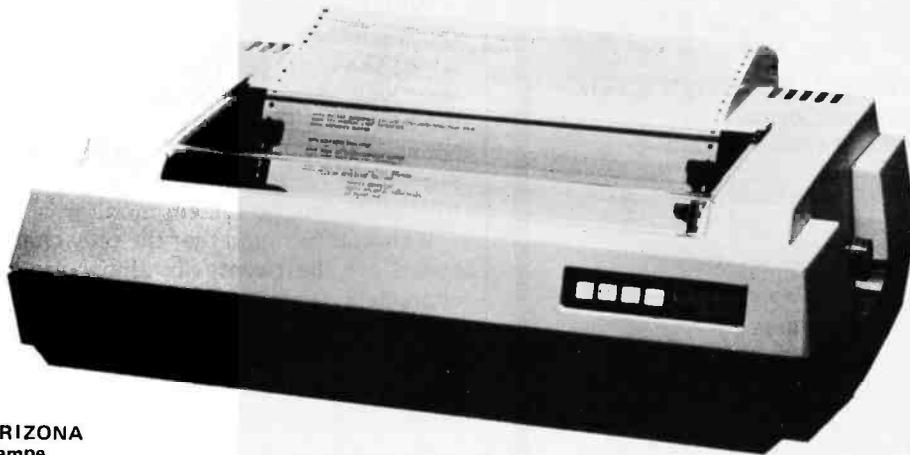
MORE BANG

Qantex Impact Printers 150 Characters Per Second 136 Columns Per Line

The microprocessor controlled Series 6000 is packed with standard features. True lower case descenders and underlining. Bidirectional logic seeking. Built-in test capability. Rugged 400 million character print head. Beautiful 96 character set in a 9 x 9 matrix. Parallel, or up to 19,200 baud serial interfaces supporting RS-232, X-ON, X-OFF or Current Loop. Full operator controls. Quietized, sleek enclosure to enhance your system. Delivery from stock.

Qantex Division of North Atlantic Industries

60 Plant Avenue, Hauppauge, N.Y. 11787
(516) 582-6060 TWX 510-227-9660
(800) 645-5292



For more information
call your local distributor:

ARKANSAS
Little Rock
Hemco Electronics
501-663-0375

ARIZONA
Tempe
PGI Wholesale
1-800-528-1415

ARIZONA
Tempe
Qualtech
602-967-4655

CALIFORNIA
Inglewood
Basic Systems
213-673-4300

CALIFORNIA
San Diego
Basic Systems
714-268-8000

CALIFORNIA
Santa Clara
Basic Systems
408-727-1800

ILLINOIS
Addison
Engineered Sales
312-832-8425

INDIANA
So. Bend
Audio Specialists
219-234-5001

LOUISIANA
New Orleans
Micro Computer
Of New Orleans
504-885-5883

MINNESOTA
Edina
Integrated Peripherals
612-831-0349

MINNESOTA
St. Paul
Vikeland Sales
612-645-4647

MISSOURI
Independence
Computer Dataco
816-254-3600

MISSOURI
St. Louis
ESC Sales & Leasing
314-997-1515

NEW MEXICO
Albuquerque
Qualtech
505-255-6100

AUSTRALIA
Sydney
Mitsui Computer Systems
02-9299921

BELGIUM
Brussels
Computata Belgium
7205066

CANADA
Toronto
Computer Markets
416-445-1978

FAR EAST
Hong Kong
Equipment
5-453870

FRANCE
Paris
Gepsi
1-554-9742

GERMANY
Munich
Technitron
49(89)692-4141

THE NETHERLANDS
Computata
Benelux B.V.
73-215700

Distributor inquiries welcome!

sion programs have been prepared to demonstrate two different uses of data compression. The compression program, COMP1, demonstrates the basic concept. (See listing 1.) Characters are entered from the keyboard and the output of the program is a serial bit stream that could be sent to a cassette for storage of the compressed data. Such a scheme could result in reduced writing time and faster access to the data. The tradeoff involved is the usual one in many data-processing situations; namely, storage space saved versus computer time used to encode and decode the data.

The amount of compression is highly dependent upon the data and its characteristics.

Since COMP1 is for demonstration purposes only, the program is simplified somewhat by storing the serial data 1 bit per byte of memory. This is just a convenience that simplifies the expansion program, EXP1. (See listing 2.) If the data were actually being sent to a serial output port, only minor changes in the code would be required.

The second compression program, COMP2, uses the same basic compression method as COMP1. (See listing 3.) However, the resulting serial bit stream is broken into 8-bit bytes for use by a parallel storage medium such as programmable memory. This provides maximum compression in a fixed-word-length computer. The program

EXP2 expands the compressed text created by COMP2. (See listing 4.) The description of the compression and expansion programs emphasizes the table structure, since both programs use tables to facilitate changing codes.

COMP1 Description

This program takes characters entered via the keyboard, checks for a legal character, finds the Huffman code corresponding to the entered character, and stores the bit stream sequentially in memory. Each bit is stored in the lowest-order bit of a byte for demonstration convenience and for interfacing with EXP1. The first two words of the output buffer contain a count of the number of bits that are stored in the remainder of the buffer. This information is used by EXP1 to stop the decoding process on the bit stream. The input need not come from the keyboard and could be from another buffer, simply by changing a few lines of code related to the input function.

The heart of the program's operation is the table lookup and the shifting function. Based upon a letter's ASCII code, an index is computed that is then added to the base address of the encoding table. This table has the following format: two 8-bit words are required for each letter to be encoded; the low-order 4 bits of the first word in memory contain a count of the number of bits required to encode the letter. The remaining 12 bits, 8 in the second byte followed by 4 in the top half of the first byte, are used to store the compressed code. (Note that the word order in the source statement and in memory is reversed because of the assembler's treatment of the DW (Define Word) instruction. The code is stored left-justified in the 12-bit area. This format makes processing simple when the two words are loaded into the D and E register pair for shifting.

With the compressing code located, it is serialized by shifting left according to the count in the 4-bit part of the table. The DAD (add register pair to H and L) instruction effectively shifts the DE register pair's high-order bit into the carry register. As each bit is shifted out, the total bit count in the buffer is updated. The processing of the input stream continues until a period is detected, and control returns to the system monitor.

It should be noted that the only characters that are encoded are the twenty-six alphabetic letters. Any other characters (including blanks) are ignored. In a non-demonstration environment, spaces, punctuation, and other symbols would have to be included; this would require enlarging the lookup table to include the representation of the new symbols.

EXP1 Description

The expansion program, EXP1, operates on the bit stream prepared by COMP1. (See listing 2.) It expects this data to be in the buffer defined by COMP1, with the bit count in the first two words and the data bit in the lowest bit of each byte. This program is also table-driven; but the table is more complex than the encoding table and the processing is more involved. Basically, the program searches a binary tree to decode the bit stream. The binary tree shown in figure 2 is converted to a table. The program then steps through the table, selecting the appropriate branch in the tree structure depending upon the value of each bit in the data stream. The data in the table

Text continued on page 246

H/Z-89, S-100

CP/M*, Data Base, & Peripherals

Small Systems Consulting Customized Data Base Design

ST506 5MB μ W/Inchester,
2 Drive Controller, CP/M \$2500
Additional Drives \$1400

NEW! IDS Tiger 560 Printer,
14.5", Hi-Res Matrix with
Plot and Word Processing firmware \$1595

The MDBS Networking Data Base
System with Query,
Recovery, Logging, Restructure, more \$1400

16KB RAM Expansion Board,
CP/M 2.2, and HDOS- CP/M
address conversion ROM \$ 280

UDS 103LP Modem,
300 baud, direct connect, phone
powered, answer/originate \$ 185
(103J-LP) with auto answer \$ 225

Magic Wand**
text editor and formatter \$ 275

★ Stop by our booth at the West Coast Computer Faire! ★
Add 1% shipping & insurance. California residents add 6% sales tax.

TARCO DEVELOPMENT CORPORATION

1445 Koll Circle, Suite III, San Jose, CA 95112 • (408) 947-1101
SOURCE: TCE421

*Trademark of Digital Research **Trademark of Small Business Applications, Inc.

Who will be first with the avionics of the 21st century?

It could be you and Hughes Radar Systems.

We pioneered pulse Doppler radar and built the first operational airborne programmable signal processor. Today, three out of the four front-line U.S. tactical aircraft have Hughes radars. We're leaders in synthetic aperture radar, in-weather reconnaissance and strike radar, high order language, antenna arrays and holographic displays. We're even building the rendezvous radar for the Space Shuttle.

And with computer-aided design, manufacturing, and testing of intelligent radar devices, the future is at Hughes.

In fact, Hughes is one of the nation's largest employers of electronic engineers and a major employer in virtually every other scientific, computer and technical discipline — with 1,500 projects and a backlog of over \$5 billion. Yet we're decentralized to give you the kinds of environments that stimulate innovation and promote recognition of your work.

Who will be first with the avionics of the future? It could be you and Hughes.

At Hughes Radar Systems, we'll introduce you to people, ideas and jobs that could change your world. And maybe ours.

Call (213) 647-4900, collect, or send resume to:

Engineering Employment
Hughes Radar Systems
P.O. Box 92426 Dept. B-4
Los Angeles, CA 90009

Current openings:

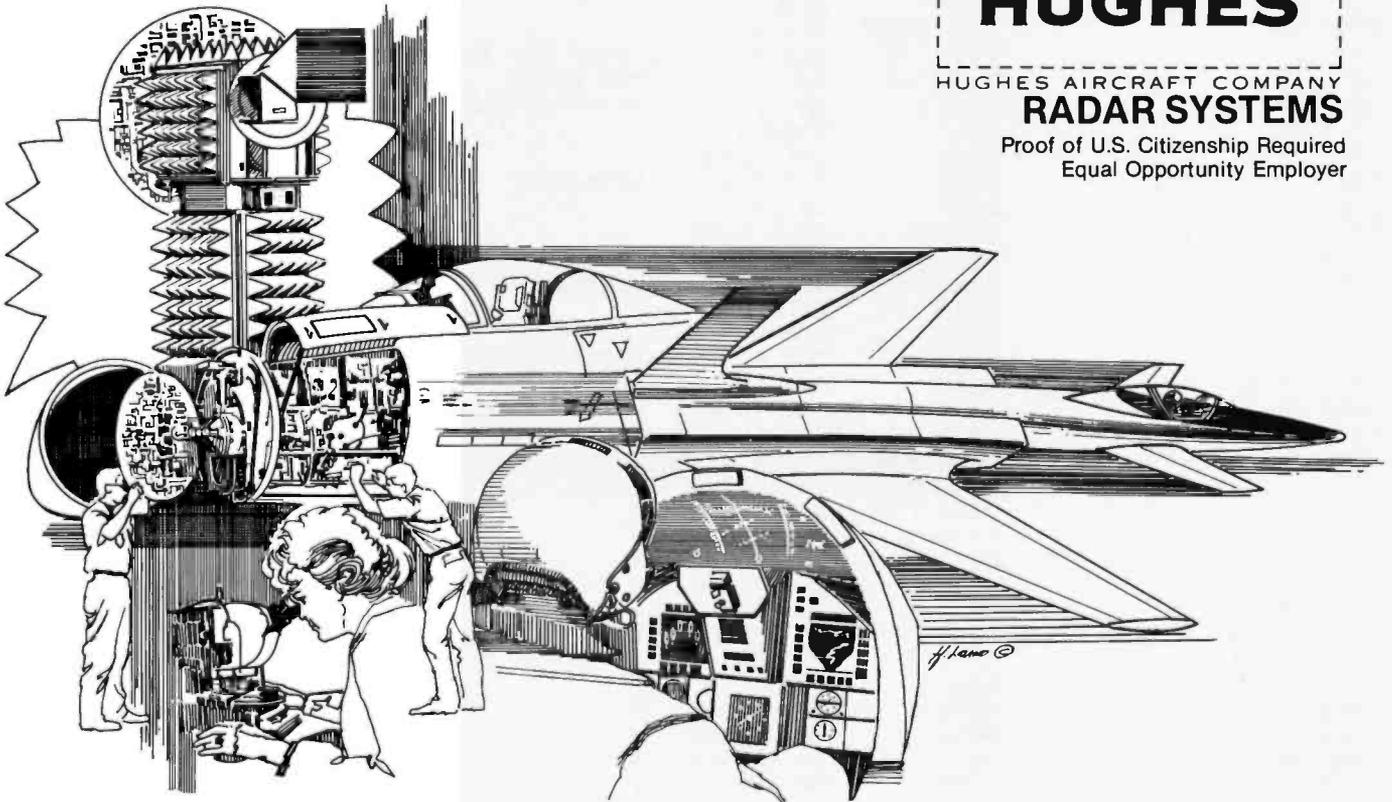
Software Design/Analysis
Software Test Engineering
Systems Integration & Test
Computer-Aided Design & Manufacturing
RF/Microwave Design
Digital Circuits Design & Test
Radar Systems Design
Large Scale Integration Design, Development & Test
Production Process Engineering
Microprocessor Development/ Applications
Antenna Systems Design & Test
Reliability Engineering
Production Test Engineering
Industrial Engineering

It could be you and Hughes Radar Systems.

HUGHES

HUGHES AIRCRAFT COMPANY
RADAR SYSTEMS

Proof of U.S. Citizenship Required
Equal Opportunity Employer



Listing 1: COMP1 text-compression routine. This routine takes only alphabetic text entered from the keyboard and converts it to the Huffman code given by the tree in figure 2. The Huffman code is stored 1 bit per byte. The routine is written in 8080 machine code.

```

2500          0001 *THIS ROUTINE TAKES TEXT, (LETTERS ONLY)
2500          0002 *AND COMPRESSES THEM USING HUFFMAN CODING. FOR
2500          0003 *TEST PURPOSES THERE IS ONE BIT PER BYTE IN THE
2500          0004 *DATA BUFFER. THE FIRST TWO BYTES IN THE DATA BUFFER
2500          0005 *ARE THE BIT COUNT. ENCODED DATA IS STORED IN DBUF AS 1 BIT
2500          0006 *PER BYTE FOR TEST PURPOSES. NORMALLY DATA WOULD BE PACKED
2500          0007 *OR OUTPUTTED SERIALY.
2500          0010 ECHO: EQU 0C500H ;OUTPUT DRIVER
2500          0011 SP: EQU 6
2500          0012 MON: EQU 0CH ;MONITOR RETURN
2500          0020 LXI SP,0
2500          0021 LXI H,0
2500          0022 SHLD DBUF ;COMPRESSED BIT COUNT
2500          0023 LXI H,DBUF+2
2500          0024 SHLD DADD ;NEXT BIT LOCATION
2500          0040 INCH: IN 8
2500          0041 RRC
2500          0042 JC INCH
2500          0043 IN 10
2500          0060 CPI '.' ;END OF TEXT
2500          0070 JZ MON ;NO MORE
2500          0073 CALL ECHO
2500          0075 ANI 07FH ;CLEAR PARITY
2500          0080 SUI 'A' ;COMPUTE INDEX
2500          0082 JC INCH
2500          0084 CPI 'Z'-'A'+1
2500          0086 JNC INCH
2500          0090 ADD A ;MULTIPLY BY 2
2500          0100 MOV C,A
2500          0110 MVI B,0
2500          0120 LXI H,TABL
2500          0130 DAD B ;INDEX
2500          0140 MOV E,M ;GET ENCODE VALUE
2500          0150 INX H
2500          0160 MOV D,M
2500          0170 MOV A,E ;GET BIT COUNT
2500          0180 ANI 0FH ;MASK COUNT
2500          0185 MOV B,A ;KEEP COUNT
2500          0187 XCHG
2500          0190 NEXT: XRA A
2500          0192 DAD H ;SHIFT OUT BIT STREAM
2500          0200 RAL ;MSB FIRST
2500          0220 ANI 1 ;SETUP OUTPUT BIT
2500          0225 PUSH H
2500          0226 LHLD DADD
2500          0228 MOV M,A ;STORE BIT
2500          0229 INX H
2500          0231 SHLD DADD
2500          0232 LHLD DBUF
2500          0235 INX H ;UPDATE BIT COUNT
2500          0236 SHLD DBUF
2500          0238 POP H
2500          0260 DCR B ;REDUCE COUNT
2500          0270 JNZ NEXT
2500          0300 JMP INCH
2500          0305 *ENCODE TABLE FORMAT- LOW ORDER 4 BITS ARE NUMBER OF BITS
2500          0306 *IN ENCODED CHARACTER. REMAINING 12 BITS ARE FOR CODE.
2500          0307 *CODE IS LEFT JUSTIFIED. E.G., AN M IS 00011
2500          0310 TABL: DW 0F004H ;A
2500          0320 DW 7006H ;B
2500          0330 DW 4005H ;C
2500          0340 DW 0D805H ;D
2500          0350 DW 8003H ;E
2500          0360 DW 4805H ;F
2500          0370 DW 805H ;G
2500          0380 DW 5004H ;H
2500          0390 DW 0A004H ;I
2500          0400 DW 0D009H ;J
2500          0410 DW 0D189H ;K
2500          0420 DW 7805H ;L

```

Listing 1 continued on page 230

COMPUTERS—TERMINALS—MODEMS!

MODEMS AND COUPLERS

Connect your Apple, TRS-80 or any other computer or terminal to the phone lines!

Penril



**Penril
300/1200**

Penril 300/1200—Bell 212A style \$799
Bell 212A style. 1200 baud and 300 baud. Manual originate, auto-answer. Full duplex. RS232. Direct connect to phone lines via RJ11C standard extension phone voice jack. 1 year warranty.

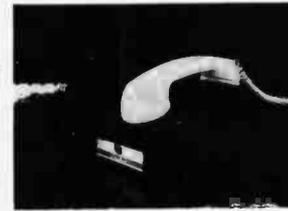


**U.S. Robotics
USR-330A
Bell 103/113 style
USR-330D
Bell 103/113 style**

USR-330D \$339

Bell 103/113 style. 330 baud. Manual originate, auto-answer. Half/full duplex. RS232. 1 year warranty. Direct connect to phone lines via RJ11C standard extension phone voice jack.

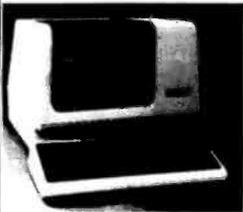
USR-330A \$399
Same as USR-330D but includes auto-dial capability.



**U.S. Robotics
The
Phone Link
Acoustic
Modem**

Bell 103/113 style \$179
300 baud. Sleek, low profile. Originate and answer capability. Half/full duplex. Self-test. RS232. Light displays for On, Carrier, Test, Send Data, Receive Data. 15 oz.

Digital Equipment Corporation



DEC VT100

DEC VT100 ... \$1668

Detachable keyboard. Separate numeric keypad with function keys. Business forms character set. Reverse video. Selectable double-size characters. Bidirectional smooth-scrolling. 80 cols or 132 cols. Split screen. Settable tabs. Line drawing graphic characters. Status line. Key-Click.

**CRT's Perkin-Elmer
Corporation**



Superowl 1251

Perkin-Elmer Superowl 1251 \$1564
Intelligent, editing CRT. Detachable keyboard. 32 fully programmable function keys. Intelligent printer part. Business forms character set. Block mode. Protected fields. Blinking fields. Numeric fields. Reverse video. Half intensity. Polling. Down line loading of options. Remote control of all options by host computer. Settable tabs. Status line. Separate numeric keypad. Transparent mode.

Perkin-Elmer Corporation



Bantam 550B \$694
Compact. Silent. Upper/lower case. 80th col. wrap-around. Bell. Integrated numeric pad. Printer port. Transparent mode. Editing features. Tabbing.

Bantam 550E ... \$755
Same as 550B plus separate numeric keypad and cursor direction keys.

Bantam 550S \$879
Same as 550E plus block mode. 8 function keys, and protected fields, reverse video fields, half intensity fields, blinking fields.

HARDCOPY TERMINALS



**Teletype
Model 43**

**Teletype
Corporation**

**Teletype Model 43 KSR with RS232
and Connector Cable \$999**
30 CPS. Dot matrix. 132 cols. True descenders on lower case. Excellent print quality for dot matrix printer. Pin feed.

NEC Corporation

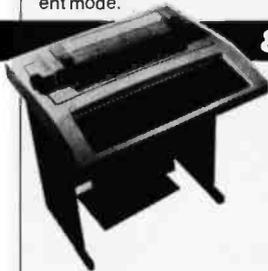
NEC Spinwriter 5510 & 5520



5520 KSR Spinwriter \$3088
55 CPS. Impact printer. Selectric print quality. Changeable print fonts. 110, 300 and 1200 baud data rate. Numeric keypad. Friction and tractor feed.

5510 Spinwriter \$2754
55 CPS. Impact printer. Selectric print quality. Changeable print fonts. 110, 300 and 1200 baud data rate. Friction and tractor feed.

& PRINTERS



DEC LA120

**Digital Equipment
Corporation**

DEC LA120 ... \$2388

180 CPS. Dot matrix. Upper/lower case. 1K buffer. Designed for 1200 baud communications. 30 character answerback message. Adjustable line spacing. Adjustable character sizes including double sized characters. Settable horizontal and vertical tabs. Top-of-form capability. RS232.

550 Options

20mA Current Loop Interface \$70
Non-Glare Screen \$25
2nd page of memory (550S only) .. \$100



**Digital
Equipment
Corp.**

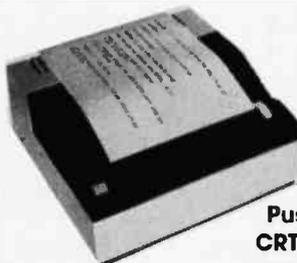
DEC LA34DA ... \$939

30 CPS. Dot matrix. Upper/lower case. 4 character sizes. Up to 217 cols per line. 6 lines per inch settings. Friction feed. Settable tabs. RS232.

DEC LA34AA \$1095
30 CPS. Dot matrix. Upper/lower case. 8 character sizes including double size characters. 6 lines per inch settings. Up to 217 cols per line. Friction feed. Settable horizontal and vertical tabs. Top-of-form capability.

Options for LA34AA and LA34DA

Tractor Feed Mechanism \$114
Numeric Keypad w/ Function Keys .. \$69
Pedestal \$100
Paper Out Sensor \$25
APL Capability with APL Keycaps .. \$499
2K Buffer with Text Editor and 1200 Baud
Communications Capability \$499



**Perkin-Elmer
Corporation**

**Pussycat 650/655
CRT Screen Printer**

650/655 Pussycat CRT Screen Printer. \$899
100 CPS. Extremely compact and quiet. 110 to 9600 baud rate. 2K buffer. Ideal for producing rapid, reliable hardcopy of your CRT screen display. Can be added to any CRT with our interface option.

Leasing rates and lease/purchase plan information is available on request.
All equipment is shipped with a 10 day money back guarantee.
We offer full service, on site maintenance plans on all equipment.
All equipment in stock.



U.S. ROBOTICS INC.
203 N. WABASH SUITE 1718 CHICAGO, ILL 60601

SALES
GENERAL OFFICES
SERVICE

(312) 346-5650
(312) 346-5651
(312) 733-0497

Listing 1 continued:

```

2570 05 18      0430      DW 1805H      ;M
2572 04 C0      0440      DW 0C004H     ;N
2574 04 E0      0450      DW 0E004H     ;O
2576 06 D4      0455      DW 0D406H     ;P
2578 4A D1      0460      DW 0D14AH     ;Q
257A 04 B0      0470      DW 0B004H     ;R
257C 04 60      0480      DW 6004H      ;S
257E 03 20      0490      DW 2003H     ;T
2580 05 10      0500      DW 1005H     ;U
2582 07 D2      0510      DW 0D207H     ;V
2584 06 74      0520      DW 7406H     ;W
2586 89 D0      0530      DW 0D089H     ;X
2588 05 00      0540      DW 5H         ;Y
258A 0A D1      0550      DW 0D10AH     ;Z
258C 00 00      0600 DADD: DW 0          ;NEXT BIT LOCATION
258E            0605      ORG 4100H
4100            0610 DBUF: DS 1000

```

Listing 2: EXP1 text-expansion routine. This routine takes the output of COMP1, information expressed in a Huffman code, and decodes it using the binary tree of figure 2. The decoded character is displayed via a user-supplied subroutine named DISP. The routine is written in 8080 machine code.

```

3000            0000 *THIS PROGRAM ACCEPTS DATA PREPARED BY THE DATA COMPRESSION
3000            0001 *(HUFFMAN CODE) PROGRAM. THE DATA BUFFER HAS THE BIT COUNT
3000            0002 *IN THE FIRST TWO BYTES. THE PROGRAM RUNS UNTIL ALL BITS
3000            0003 *HAVE BEEN PROCESSED. THE PROCESSING CONSISTS OF ADDING A
3000            0004 *DATA BIT TO THE TABLE ENTRY POINT, GETTING AN INCREMENT
3000            0005 *WHICH POINTS TO THE NEXT 0-1 PAIR AND CONTINUING UNTIL
3000            0006 *A TAG IS FOUND IN BIT 7. THIS SIGNIFIES THAT THE NEXT
3000            0007 *TABLE ENTRY IS THE DESIRED CHARACTER, IN A NON-TEST MODE
3000            0008 *DATA WOULD BE EITHER PACKED IN 8 BIT BYTES OR ARRIVING
3000            0009 *VIA A SERIAL PORT.
3000 01 00 00      0010      LXI SP,0
3003 21 02 41      0020      LXI H,DBUF+2 ;FIRST BIT
3006 22 97 30      0030      SHLD DADD ;NEXT DATA ADDRESS
3009 21 00 41      0040      LXI H,DBUF ;BIT COUNT
300C 4E          0050      MOV C,M
300D 23          0060      INX H
300E 46          0070      MOV B,M
300F C5          0080 EXP:   PUSH B
3010 21 4B 30      0090      LXI H,XTAB ;DECODE TABLE
3013 E5          0100 NEXT:  PUSH H
3014 2A 97 30      0110      LHLD DADD
3017 4E          0120      MOV C,M ;DATA VALUE
3018 23          0130      INX H
3019 06 00      0140      MVI B,0
301B 22 97 30      0150      SHLD DADD
301E E1          0160      POP H
301F 09          0170      DAD B ;TABLE + DATA BIT
3020 7E          0180      MOV A,M ;GET POINTER
3021 17          0190      RAL
3022 DA 32 30      0200      JC OUTCH
3025 1F          0205      RAR
3026 5F          0210      MOV E,A
3027 16 00      0220      MVI D,0
3029 19          0230      DAD D ;TABLE+DATA BIT + POINTER
302A C1          0240      POP B
302B CD 44 30      0250      CALL DECB ;REDUCE BIT COUNT
302E C5          0270      PUSH B
302F C3 13 30      0280      JMP NEXT
3032 1F          0290 OUTCH:  RAR
3033 E6 7F      0294      ANI 7FH ;REMOVE TAG
3035 5F          0296      MOV E,A
3036 16 00      0297      MVI D,0
3038 19          0298      DAD D
3039 7E          0299      MOV A,M ;GET DECODED CHARACTER
303A CD 00 C5      0305      CALL DISP
303D C1          0310      POP B
303E CD 44 30      0320      CALL DECB
3041 C3 0F 30      0330      JMP EXP

```

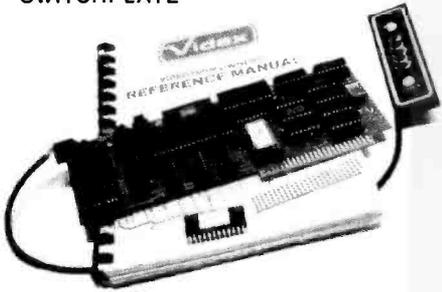
Listing 2 continued on page 232

The Text Solution for APPLE II®

Now APPLE II® Owners Can Solve Text Problems With VIDEOTERM 80 Column by 24 Line Video Display Utilizing 7 X 9 Dot Character Matrix

Perhaps the most annoying shortcoming of the Apple II® is its limitation of displaying only 40 columns by 24 lines of text, all in uppercase. At last, Apple II® owners have a reliable, trouble-free answer to their text display problem. VIDEOTERM generates a full 80 columns by 24 lines of text, in upper and lower case. Twice the number of characters as the standard Apple II® display. And by utilizing a 7 by 9 character matrix, lower case letters have true descenders. But this is only the start.

VIDEOTERM, MANUAL, SWITCHPLATE



7X12 MATRIX
18X80 OPTIONAL



7X9 MATRIX
24X80 STANDARD

VIDEOTERM

BASICs VIDEOTERM lists BASIC programs, both Integer and Applesoft, using the entire 80 columns. Without splitting keywords. Full editing capabilities are offered using the ESCape key sequences for cursor movement. With provision for stop/start text scrolling utilizing the standard Control-S entry. And simultaneous on-screen display of text being printed.

Pascal Installation of VIDEOTERM in slot 3 provides Pascal immediate control of the display since Pascal recognizes the board as a standard video display terminal and treats it as such. No changes are needed to Pascal's MISC.INFO or GOTOXY files, although customization directions are provided. All cursor control characters are identical to standard Pascal defaults.

Other Boards The new Microsoft Softcard™ is supported. So is the popular D. C. Hayes Micromodem II™, utilizing customized PROM firmware available from VIDEX. The powerful EasyWriter™ Professional Word Processing System and other word processors are now compatible with VIDEOTERM. Or use the Mountain Hardware ROMWriter™ (or other PROM programmer) to generate your own custom character sets. Naturally, VIDEOTERM conforms to all Apple OEM guidelines, assurance that you will have no conflicts with current or future Apple II™ expansion boards.

Advanced Hardware Design

VIDEOTERM's on-board asynchronous crystal clock ensures flicker-free character display. Only the size of the Pascal Language card, VIDEOTERM utilizes CMOS and low power consumption ICs, ensuring cool, reliable operation. All ICs are fully socketed for easy maintenance. Add to that 2K of on-board RAM, 50 or 60 Hz operation, and provision of power and input connectors for a light pen. Problems are designed out, not in.

Available Options

The entire display may be altered to inverse video, displaying black characters on a white field. PROMs containing alternate character sets and graphic symbols are available from Videx. A switchplate option allows you to use the same video monitor for either the VIDEOTERM or the standard Apple II™ display, instantly changing displays by flipping a single toggle switch. The switchplate assembly inserts into one of the rear cut-outs in the Apple II™ case so that the toggle switch is readily accessible. And the Videx KEYBOARD ENHANCER can be installed, allowing upper and lower case character entry directly from your Apple II™ keyboard.

Firmware

1K of on-board ROM firmware controls all operation of the VIDEOTERM. No machine language patches are needed for normal VIDEOTERM use.

Firmware Version 2.0

Characters	7 x 9 matrix	Display	24 x 80 (full descenders)
Options	7 x 12 matrix option; Alternate user definable character set option; Inverse video option.		18 x 80 (7 x 12 matrix with full descenders)

Want to know more? Contact your local Apple dealer today for a demonstration. VIDEOTERM is available through your local dealer or direct from Videx in Corvallis, Oregon. Or send for the VIDEOTERM Owners Reference Manual and deduct the amount if you decide to purchase. Upgrade your Apple II™ to full terminal capabilities for half the cost of a terminal. VIDEOTERM. At last.

Apple II™ is a trademark of Apple Computer, Inc.
ROMWriter™ is a trademark of Mountain Hardware, Inc.
Micromodem II™ is a trademark of D. C. Hayes Associates, Inc.
Softcard™ is a trademark of Microsoft.
EasyWriter™ is a trademark of Information Unlimited Software, Inc.

PRICE: • VIDEOTERM includes manual \$345
• SWITCHPLATE \$ 19
• MANUAL refund with purchase \$ 19
• 7 x 12 CHARACTER SET \$ 39
• MICROMODEM FIRMWARE \$ 25

APPLE II® OWNERS!

introducing the KEYBOARD & DISPLAY ENHANCER

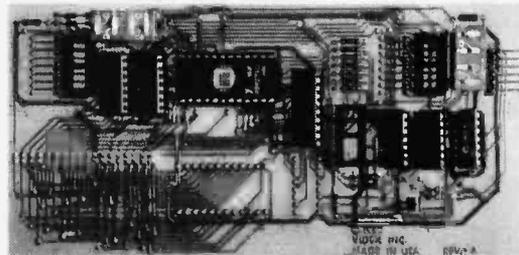
- PUT THE SHIFT AND SHIFT LOCK BACK WHERE IT BELONGS
- SEE REAL UPPER AND lower CASE ON THE SCREEN
- ACCESS ALL YOUR KEYBOARD ASCII CHARACTERS

Videx has the perfect companion for your word processor software: the **KEYBOARD AND DISPLAY ENHANCER**. Install the enhancer in your APPLE II and be typing in lower case just like a typewriter. If you want an upper case character, use the SHIFT key or the CTRL key for shift lock. Not only that, but you see upper and lower case on the screen as you type. Perfectly compatible with Apple Writer and other word processors like, for example, Super-Text.

If you want to program in BASIC, just put it back into the alpha lock mode, and you have the original keyboard back with a few im-

provements. Now you can enter those elusive 9 characters directly from the keyboard, or require the Control key to be pressed with the RESET to prevent accidental resets.

KEYBOARD AND DISPLAY ENHANCER is recommended for use with all revisions of the APPLE II. It includes 6 ICs, and EPROM and dip-switches mounted on a PC board, and a jumper cable. Easy installation, meaning no soldering or cutting traces. Alternate default modes are dip-switch selectable. You can even remap the keyboard, selecting an alternate character set, for custom applications.



PRICE • KDE-700 (REV. 7 or greater) \$129.
• KDE-000 (REV. 6 or less) \$129.

Apple II® is a trademark of Apple Computer, Inc.



VIDEX  
897 N.W. Grant Avenue
Corvallis, Oregon 97330
Phone (503) 758-0521

Listing 2 continued:

```

3044 0B          0340 DECB:   DCX B           ;REDUCE BIT COUNT
3045 79          0350           MOV A,C
3046 B0          0360           ORA B
3047 CA 0C 00    0365           JZ MON
304A C9          0370           RET
304B            4000 *THE DECODE TABLE HAS THE FOLLOWING FORMAT:
304B            4010 *THE TABLE VALUE IS THE INCREMENT NECESSARY TO GET TO THE
304B            4020 *NEXT 0-1 PAIR AS THE PROGRAM STEPS THROUGH THE DATA.
304B            4030 *THE TABLE VALUE JUST PRECEEDING A CHARACTER HAS A TAG
304B            4040 *SET IN BIT 7, IN ADDITION TO THE INCREMENT, TO INDICATE
304B            4050 *THAT THE NEXT VALUE IA A CHARACTER.
304B 2A          5000 XTAB:   DB 42           ;0 0
304C 01          5010           DB 1            ;1 1
304D 02          5020           DB 2            ;2 0
304E 08          5030           DB 8            ;3 1
304F 82          5040           DB 130         ;4 0
3050 02          5050           DB 2            ;5 1
3051 45          5060           DB 'E'         ;6
3052 82          5070           DB 130         ;7 0
3053 82          5080           DB 130         ;8 1
3054 49          5090           DB 'I'         ;9
3055 52          5100           DB 'R'         ;10
3056 06          5102           DB 6            ;11 0
3057 01          5104           DB 1            ;12 1
3058 82          5106           DB 130         ;13 0
3059 82          5108           DB 130         ;14 1
305A 4F          5110           DB 'O'         ;15
305B 41          5120           DB 'A'         ;16
305C 82          5130           DB 130         ;17 0
305D 02          5140           DB 2            ;18 1
305E 4E          5150           DB 'N'         ;19
305F 03          5160           DB 3            ;20 0
3060 81          5170           DB 129         ;21 1
3061 44          5180           DB 'D'         ;22
3062 03          5190           DB 3            ;23 0
3063 81          5200           DB 129         ;24 1
3064 50          5210           DB 'P'         ;25
3065 03          5220           DB 3            ;26 0
3066 81          5230           DB 129         ;27 1
3067 56          5240           DB 'V'         ;28
3068 02          5250           DB 2            ;29 0
3069 05          5260           DB 5            ;30 1
306A 82          5270           DB 130         ;31 0
306B 82          5280           DB 130         ;32 1
306C 4A          5290           DB 'J'         ;33
306D 58          5300           DB 'X'         ;34
306E 03          5310           DB 3            ;35 0
306F 81          5320           DB 129         ;36 1
3070 4B          5330           DB 'K'         ;37
3071 82          5340           DB 130         ;38 0
3072 82          5350           DB 130         ;39 1
3073 5A          5360           DB 'Z'         ;40
3074 51          5370           DB 'Q'         ;41
3075 02          5380           DB 2            ;42 0
3076 0E          5390           DB 14          ;43 1
3077 03          5400           DB 3            ;44 0
3078 81          5410           DB 129         ;45 1
3079 54          5420           DB 'T'         ;46
307A 02          5430           DB 2            ;47 0
307B 05          5440           DB 5            ;48 1
307C 82          5450           DB 130         ;49 0
307D 82          5460           DB 130         ;50 1
307E 59          5470           DB 'Y'         ;51
307F 47          5480           DB 'G'         ;52
3080 82          5490           DB 130         ;53 0
3081 82          5500           DB 130         ;54 1
3082 55          5510           DB 'U'         ;55
3083 4D          5520           DB 'M'         ;56
3084 02          5530           DB 2            ;57 0
3085 08          5540           DB 8            ;58 1
3086 03          5550           DB 3            ;59 0
3087 81          5560           DB 129         ;60 1

```

Listing 2 continued on page 234

DIGITAL HARMONY

A new synthesis
of sight and sound

Digital Harmony
by John Whitney

Digital Harmony lays the foundation for the whole new field of audio-visual art made possible by microcomputers. John Whitney, a pioneer of the special effects technology used in *STAR WARS* and *2001: A SPACE ODYSSEY*, explains the special union of computer graphics and music. His computer-generated visual art graphically depicts the laws of harmonic motion common to all music.

Digital Harmony includes a complete description of Whitney's computer, peripherals, and film techniques. Colorful illustrations are included, as well as the program listings that generated them. The descriptions are sufficient for anyone to begin to explore this new territory as a composer and computer experimenter — transforming the small computer into an ideal instrument for creating compositions in aural and visual art.

John Whitney is on the Faculty in the Department of Art at the University of California, Los Angeles.

ISBN 07-070015-X
\$21.95



Available Now

Toll Free # 1-800-258-5420



Please remit in U.S. funds or draw on a U.S. Bank

Please send _____ copies of
Digital Harmony

Name _____ Title _____ Company _____

Street _____ City _____ State/Province _____ Code _____

Check enclosed in the amount of \$ _____
 Bill Visa Bill Master Charge
 Card No. _____
 Exp. Date _____

Add 75¢ per book to cover
postage and handling.



70 Main Street
Peterborough, New Hampshire 03458

Listing 2 continued:

```

3088 48          5570          DB 'H'           ;61
3089 82          5580          DB 130           ;62 0
308A 82          5590          DB 130           ;63 1
308B 43          5600          DB 'C'           ;64
308C 46          5610          DB 'F'           ;65
308D 82          5620          DB 130           ;66 0
308E 02          5630          DB 2             ;67 1
308F 53          5640          DB 'S'           ;68
3090 03          5650          DB 3             ;69 0
3091 81          5660          DB 129          ;70 1
3092 4C          5670          DB 'L'           ;71
3093 82          5680          DB 130           ;72 0
3094 82          5690          DB 130           ;73 1
3095 42          5700          DB 'B'           ;74
3096 57          5710          DB 'W'           ;75
3097 02 41       5720 DADD:      DW DBUF+2      ;NEXT DATA ADDRESS
3097          5909          ORG 4100H
4100          6000 DBUF:      DS 1000
44E8          9000 DISP:     EQU 0C500H    ;DISPLAY A CHARACTER
44E8          9010 MON:      EQU 000CH    ;MONITOR RETURN
44E8          9020 SP:      EQU 0

```

Listing 3: COMP2 text-compression routine. This routine is identical to COMP1 (listing 1) except that the Huffman code information is packed and stored 8 bits to the byte. The routine is written in 8080 machine code.

```

2600          0001 *THIS ROUTINE TAKES TEXT (LETTERS ONLY)
2600          0002 *AND COMPRESSES THEM USING HUFFMAN CODING.
2600          0004 *THE FIRST TWO BYTES IN THE DATA BUFFER
2600          0005 *ARE THE BIT COUNT. ENCODED DATA IS STORED IN DBUF
2600          0006 *IN A PACKED FORM, 8 BITS TO THE BYTE.
2600          0010 ECHO: EQU 0C500H ;OUTPUT DRIVER
2600          0011 SP: EQU 6
2600          0012 MON: EQU 0CH      ;MONITOR RETURN
2600 31 00 00     0020          LXI SP,0
2603 21 00 00     0021          LXI H,0
2606 22 00 41     0022          SHLD DBUF ;COMPRESSED BIT COUNT
2609 21 02 41     0023          LXI H,DBUF+2
260C 22 BA 26     0024          SHLD DADD ;NEXT BIT LOCATION
260F AF          0025          XRA A
2610 32 BC 26     0026          STA POS
2613 DB 08        0040 INCH: IN 8      ;INPUT CODE
2615 0F          0041          RRC
2616 DA 13 26     0042          JC INCH
2619 DB 0A        0043          IN 10
261B FE 2E        0045          CPI '.' ;END OF TEXT
261D C2 37 26     0047          JNZ PROS
2620 2A BA 26     0050          LHL DADD ;CLEAN UP PARTIAL BYTE
2623 3A BC 26     0052          LDA POS
2626 47          0054          MOV B,A ;COMPUTE SHIFT COUNT
2627 3E 08        0056          MVI A,8
2629 90          0058          SUB B
262A E6 07        0060          ANI 7
262C 47          0062          MOV B,A ;KEEP SHIFT COUNT
262D 7E          0064          MOV A,M ;GET PACKED BYTE
262E CA 0C 00     0066 SHFT: JZ MON   ;FINISHED
2631 17          0068          RAL
2632 05          0070          DCR B
2633 77          0071          MOV M,A ;REPLACE PACKED BYTE
2634 C3 2E 26     0072          JMP SHFT
2637 CD 00 C5     0073 PROS: CALL ECHO
263A E6 7F        0075          ANI 07FH ;CLEAR PARITY
263C D6 41        0080          SUI 'A' ;COMPUTE INDEX
263E DA 13 26     0082          JC INCH
2641 FE 1A        0084          CPI 'Z'-'A'+1
2643 D2 13 26     0086          JNC INCH
2646 87          0090          ADD A ;MULTIPLY BY 2
2647 4F          0100          MOV C,A
2648 06 00        0110          MVI B,0
264A 21 86 26     0120          LXI H,TABL
264D 09          0130          DAD B ;INDEX

```

Listing 3 continued on page 236

THE ADVANTAGES OF THE FUNCTIONAL GROUP:



Diversity of projects.
Varied technical challenge.

Involvement from concept through implementation.

Broad interaction and cooperation between software and hardware.

We've got it all at Harris Composition Systems in Melbourne, Florida.

We're pioneers in word processing. And the world's first and leading supplier of total word processing systems for use in the newspaper industry.

And we're now extending that "system-oriented" approach into the *office systems* field—integrating data processing, word processing,

electronic mail, advanced communications and networking. With an ambitious program representing the largest investment Harris Corporation has ever made to develop a new product.

That means the opportunity for personal participation and immediate contribution—across the board—in both newspaper word processing and office systems.

For experienced professionals with expertise in
 Real Time Software and Hardware/Firmware Development
 Digital Design
 Analog Design
 Applications Programming.

All supported by a billion dollar, Fortune 500 corporation. All in a modern, stimu-

lating work environment. All in beautiful, affordable Melbourne, Florida—on the shores of the deep blue Atlantic.

Send your resume and salary history to: **Daphne Cumberland, Composition Systems Division, Dept. BT, P.O. Box 2080, Melbourne, Florida 32901.** Or call COLLECT (305) 242-5321, in Florida. Outside Florida call 1-800-327-1493.

Share the advantages with us.

100% PURE OPPORTUNITY.



HARRIS

COMMUNICATION AND INFORMATION PROCESSING

An Equal Opportunity Employer M/F/V/H.

Listing 3 continued:

```

264E 5E          0140      MOV E,M      ;GET ENCODE VALUE
264F 23          0150      INX H
2650 56          0160      MOV D,M
2651 7B          0170      MOV A,E      ;GET BIT COUNT
2652 E6 OF      0180      ANI 0FH     ;MASK COUNT
2654 47          0185      MOV B,A      ;KEEP COUNT
2655 EB          0187      XCHG
2656 AF          0190      NEXT: XRA A
2657 29          0192      DAD H      ;SHIFT OUT BIT STREAM
2658 17          0200      RAL        ;MSB FIRST
2659 E6 01      0220      ANI 1      ;SETUP OUTPUT BIT
265B E5          0225      PUSH H
265C 2A BA 26   0226      LHLD DADD
265F 57          0228      MOV D,A
2660 3A BC 26   0229      LDA POS
2663 5F          0231      MOV E,A      ;KEEP CURRENT POSITION
2664 7E          0233      MOV A,M      ;GET OLD PACKED DATA
2665 17          0235      RAL        ;MAKE ROOM
2666 B2          0237      ORA D      ;PACK
2667 77          0239      MOV M,A      ;PUT IT AWAY
2668 1C          0240      INR E      ;UPDATE POSITION
2669 7B          0242      MOV A,E
266A FE 08      0244      CPI 8      ;FULL BYTE?
266C C2 74 26   0246      JNZ STOR
266F AF          0248      XRA A      ;INITIALIZE POSITION
2670 23          0250      INX H      ;UPDATE DADD
2671 22 BA 26   0252      SHLD DADD
2674 32 BC 26   0258      STOR: STA POS
2677 2A 00 41   0260      LHLD DBUF
267A 23          0262      INX H      ;UPDATE BIT COUNT
267B 22 00 41   0264      SHLD DBUF
267E E1          0266      POP H
267F 05          0268      DCR B      ;REDUCE COUNT
2680 C2 56 26   0270      JNZ NEXT
2683 C3 13 26   0300      JMP INCH
2686             0305      *ENCODE TABLE FORMAT- LOW ORDER 4 BITS ARE NUMBER OF BITS
2686             0306      *IN ENCODED CHARACTER.REMAINING 12 BITS ARE FOR CODE.
2686             0307      *CODE IS LEFT JUSTIFIED. E.G., AN M IS 00011.
2686 04 F0        0310      TABL: DW 0F004H ;A
2688 06 70        0320      DW 7006H ;B
268A 05 40        0330      DW 4005H ;C
268C 05 D8        0340      DW 0D805H ;D
268E 03 80        0350      DW 8003H ;E
2690 05 48        0360      DW 4805H ;F
2692 05 08        0370      DW 805H ;G
2694 04 50        0380      DW 5004H ;H
2696 04 A0        0390      DW 0A004H ;I
2698 09 D0        0400      DW 0D009H ;J
269A 89 D1        0410      DW 0D189H ;K
269C 05 78        0420      DW 7805H ;L
269E 05 18        0430      DW 1805H ;M
26A0 04 C0        0440      DW 0C004H ;N
26A2 04 E0        0450      DW 0E004H ;O
26A4 06 D4        0455      DW 0D406H ;P
26A6 4A D1        0460      DW 0D14AH ;Q
26A8 04 B0        0470      DW 0B004H ;R
26AA 04 60        0480      DW 6004H ;S
26AC 03 20        0490      DW 2003H ;T
26AE 05 10        0500      DW 1005H ;U
26B0 07 D2        0510      DW 0D207H ;V
26B2 06 74        0520      DW 7406H ;W
26B4 89 D0        0530      DW 0D089H ;X
26B6 05 00        0540      DW 5H ;Y
26B8 0A D1        0550      DW 0D10AH ;Z
26BA 00 00        0600      DADD: DW 0 ;NEXT BIT LOCATION
26BC             0603      POS: DS 1 ;BIT POSITION
26BD             0605      ORG 4100H
4100             0610      DBUF: DS 1000

```

IF YOU CAN WAIT A MINUTE, WE CAN SAVE YOU \$1,000.

With the Starwriter™ Daisy Wheel 25 cps printer from C. Itoh.

A business letter, written on a 45 cps word-processing printer, might take about two minutes to print.

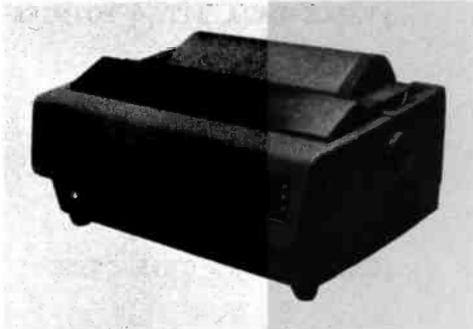
With the Starwriter, it might take closer to three.

The typical 45 cps printer retails for about \$3,000.

But the Starwriter 25 retails for about \$1,895—thus saving you about \$1,000.

And therein lies the biggest difference between the Starwriter 25 and the more expensive, daisy wheel printers.

The Starwriter 25 comes complete and ready-to-use, requiring no changes in hardware or software. It uses industry-standard ribbon cartridges, and it's "plug-in" compatible to interface with a



wide variety of systems, to help lower system-integration costs.

Using a 96-character wheel, it produces excellent letter-quality printing on three sharp copies with up to 163 columns, and offers the most precise character-placement available, for outstanding print performance.

C. Itoh's warranty:

3 months on parts and labor, supported by one of the best service organizations in the industry.

\$1,000 OFF

**Leading Edge Products, Inc.,
225 Turnpike Street,
Canton, Massachusetts 02021**

Dear Leading Edge:
I'd like to know more about the Starwriter, and how spending a minute can save me a grand.
Please send me the name of my nearest dealer.

Name _____
Title _____
Company _____
Street _____
State _____ Zip _____
Phone: Area Code _____
Number _____

LEADING EDGE.

Leading Edge Products, Inc., 225 Turnpike Street, Canton, Massachusetts 02021
Dealers: For immediate delivery from the Leading Edge Inventory Bank™ call toll free 1-800-343-6833
In Massachusetts, call collect (617)828-8150. Telex 951-624

Listing 4: EXP2 text-expansion routine. This routine takes the output of COMP2, information expressed in a packed Huffman code, and decodes it using the binary tree of figure 2. The decoded character is displayed via a user-supplied subroutine named DISP. The routine is written in 8080 machine code.

```

3000          0000 *THIS PROGRAM ACCEPTS DATA PREPARED BY THE DATA COMPRESSION
3000          0001 *(HUFFMAN CODE) PROGRAM THE DATA BUFFER HAS THE BIT COUNT
3000          0002 *IN THE FIRST TWO BYTES. THE PROGRAM RUNS UNTIL ALL
3000          0003 *BITS HAVE BEEN PROCESSED THE PROCESSING CONSISTS OF
3000          0004 *ADDING A DATA BIT TO THE TABLE ENTRY POINT, GETTING AN
3000          0005 *INCREMENT WHICH POINTS TO THE NEXT 0-1 PAIR AND CONTINUING
3000          0006 *UNTIL A TAG IS FOUND IN BIT 7 THIS SIGNIFIES THAT THE
3000          0007 *NEXT TABLE ENTRY IS THE DESIRED CHARACTER.
3000          0008 *THIS IS THE PACKED VERSION WHICH PROCESSES DATA FROM
3000          0009 *8 BIT BYTES, MSB FIRST.
3000          0010 DISP: EQU 0C500H      ;DISPLAY CHARACTER
3000          0011 MON: EQU 000CH      ;MONITOR RETURN
3000          0012 SP: EQU 6
3000 31 00 00          0015 LXI SP,0
3003 21 02 41          0020 LXI H,DBUF+2      ;FIRST BIT
3006 22 C0 30          0030 SHLD DADD         ;NEXT DATA ADDRESS
3009 21 00 41          0040 LXI H,DBUF         ;BIT COUNT
300C 4E              0050 MOV C,M
300D 23              0060 INX H
300E 46              0070 MOV B,M
300F 3E 01          0074 MVI A,1          ; INITIALIZE POSITION
3011 32 C2 30          0076 STA POS
3014 C5              0080 EXP: PUSH B
3015 21 74 30          0090 LXI H,XTAB        ;DECODE TABLE
3018 E5              0100 NEXT: PUSH H
3019 2A C0 30          0110 LHLD DADD
301C 3A C2 30          0120 LDA POS          ;GET BIT POSITION
301F 47              0122 MOV B,A
3020 7E              0124 MOV A,M          ;GET DATA
3021 17              0126 BIT: RAL          ;GET DESIRED BIT INTO CARRY
3022 05              0128 DCR B
3023 C2 21 30          0130 JNZ BIT
3026 3E 00          0132 MVI A,0
3028 17              0134 RAL          ;RESTORE SINGLE BIT
3029 4F              0136 MOV C,A          ;DATA VALUE
302A 06 00          0140 MVI B,0
302C 22 C0 30          0150 SHLD DADD
302F E1              0160 POP H
3030 09              0170 DAD B          ;TABLE + DATA BIT
3031 7E              0180 MOV A,M          ;GET POINTER
3032 17              0190 RAL
3033 DA 43 30          0200 JC OUTCH
3036 1F              0205 RAR
3037 5F              0210 MOV E,A
3038 16 00          0220 MVI D,0
303A 19              0230 DAD D          ;TABLE+DATA BIT + POINTER
303B C1              0240 POP B
303C CD 55 30          0250 CALL DECB      ;REDUCE BIT COUNT
303F C5              0270 PUSH B
3040 C3 18 30          0280 JMP NEXT
3043 1F              0290 OUTCH: RAR
3044 E6 7F          0294 ANI 7FH        ;REMOVE TAG
3046 5F              0296 MOV E,A
3047 16 00          0297 MVI D,0
3049 19              0298 DAD D
304A 7E              0299 MOV A,M          ;GET DECODED CHARACTER
304B CD 00 C5          0305 CALL DISP
304E C1              0310 POP B
304F CD 55 30          0320 CALL DECB
3052 C3 14 30          0330 JMP EXP
3055 0B              0340 DECB: DCX B   ;REDUCE BIT COUNT
3056 79              0350 MOV A,C
3057 B0              0360 ORA B
3058 CA 0C 00          0365 JZ MON
305B 3A C2 30          0370 LDA POS
305E 3C              0380 INR A          ;UPDATE BIT POSITION
305F 32 C2 30          0385 STA POS
3062 FE 09          0390 CPI 9          ;8 BITS PROCESSED?

```

Listing 4 continued on page 240

DYNACOMP

Quality software for⁺:

ATARI
PET
APPLE II Plus

TRS-80 (Level II)*
NORTH STAR
CP/M 8" Disk

GAMES, SIMULATIONS, EDUCATION and MISCELLANEOUS

BRIDGE 2.0 (Available for all computers) Price: \$17.95 Cassette/\$21.95 Diskette
An all-inclusive version of this most popular of card games. This program both BRIDGES and PLAYS either contract or duplicate bridge. Depending on the contract, your computer opponents will either play the offense OR defense. If you bid too high, the computer will double your contract! BRIDGE 2.0 provides challenging entertainment for advanced players and is an excellent learning tool for the bridge novice.

HEARTS 1.5 (Available for all computers) Price: \$14.95 Cassette/\$18.95 Diskette
An exciting and challenging computer version of this popular card game. Hearts is a trick-oriented game in which the purpose is not to take any hearts or the queen of spades. Play against two computer opponents who are armed with hard-to-beat playing strategies.

STUD POKER (ATARI only) Price: \$11.95 Cassette/\$15.95 Diskette
This is the classic gambler's card game. The computer deals the cards one at a time and you (and the computer) bet on what you see. The computer does not cheat and usually bets the odds. However, it sometimes bluffs! Also included is a five-card draw poker betting practice program. This package will run on a 16K ATARI. Color, graphics, sound.

POKER PARTY (Available for all computers) Price: \$17.95 Cassette/\$21.95 Diskette
POKER PARTY is a draw poker simulation based on the book, POKER, by Oswald Jacoby. This is the most comprehensive version available for microcomputers. The party consists of yourself and six other (computer) players. Each of these players (you will get to know them) has a different personality in the form of a winning propensity to bluff or fold under pressure. Practice with POKER PARTY before going to that expensive game tonight! Apple Cassette and diskette versions require a 32 K (or larger) Apple II.

VALDEZ (Available for all computers) Price: \$14.95 Cassette/\$18.95 Diskette
A simulation of supersonic navigation in the Prince William Sound and Valdez Narrows. The program uses an extensive 256x256-rendered radar map and employs physical models of ship response and tidal patterns. Chart your own course through ship and iceberg traffic. Any standard terminal may be used for display.

FLIGHT SIMULATOR (Available for all computers) Price: \$17.95 Cassette/\$21.95 Diskette
A realistic and extensive mathematical simulation of take-off, flight and landing. The program utilizes aerodynamic equations and the characteristics of a real airfoil. You can practice instrument approaches and navigation using radials and compass headings. The more advanced flyer can also perform loops, half-rolls and similar aerobically maneuvers.

CRIBBAGE 2.0 (TRS-80 only) Price: \$14.95 Cassette/\$18.95 Diskette
This is a well-designed and nicely executed two-handed version of the classic card game, cribbage. It is an excellent program for the cribbage player in search of a worthy opponent as well as the beginner wishing to learn the game, in particular the scoring and jargon. The standard cribbage score board is continually shown at the top of the display utilizing the TRS-80's graphics capabilities, with the cards shown underneath. The computer automatically scores and also announces the points using the traditional phrases.

CHIESS MASTER (North Star and TRS-80 only) Price: \$19.95 Cassette/\$23.95 Diskette
This complete and very powerful program provides five levels of play. It includes casting, en passant captures and the promotion of pawns. Additionally, the board may be preset before the start of play, permitting the examination of "book" plays. To maximize execution speed, the program is written in assembly language (by SOFTWARE SPECIALISTS of California). Full graphics are employed in the TRS-80 version, and two widths of alphanumeric display are provided to accommodate North Star users.

STARTRK 3.2 (Available for all computers) Price: \$ 9.95 Cassette/\$13.95 Diskette
This is the classic Star Trek simulation, but with several new features. For example, the Klingons now shoot at the Enterprise without warning while also attacking starbases in other quadrants. The Klingons also attack with both light and heavy cruisers and more when shot at! The situation is hectic when the Enterprise is besieged by three heavy cruisers and a starbase S.O.S. is received! The Klingons get even!

SPACE TILT (Apple only) Price: \$10.95 Cassette/\$14.95 Diskette
Use the game paddles to tilt the plane of the TV screen to "roll" a ball into a hole in the screen. Sound simple? Not when the hole gets smaller and smaller! A built-in timer allows you to measure your skill against others in this habit-forming action game.

GAMES PACK I (Available for all computers) Price: \$9.95 Cassette/\$13.95 Diskette
GAMES PACK I contains the classic computer games of BLACKJACK, LUNAR LANDER, CRAPS, HORSESHOE, SWITCH and more. These games have been combined into one large program for ease in loading. They are individually accessed by a convenient menu.

GAMES PACK II (Available for all computers) Price: \$9.95 Cassette/\$13.95 Diskette
GAMES PACK II includes the games CRAZY EIGHTS, JOTTO, ACEY-DUCEY, LIFE, WUMPUS and others. As with GAMES PACK I, all the games are loaded as one program and are called from a menu.
Why pay \$19.95 or more per program when you can buy a DYNACOMP collection for just \$9.95!

NOMINOES JIGSAW (ATARI and TRS-80 only) Price: \$16.95 Cassette/\$20.95 Diskette
NOMINOES JIGSAW is an intriguing and sophisticated graphical puzzle. The Jigsaw consists of 9 by 9 board partially filled with randomly chosen shapes (nominos), of which there are 60 types. By knowing that the shapes must be logically connected, and by guessing the shape at each location, all the nominos may be eventually deduced. Scoring is based on the number of guesses required and the difficulty of the board set-up.

MOVING MAZE (Apple only) Price: \$10.95 Cassette/\$14.95 Diskette
MOVING MAZE employs the game paddles to direct a puck from one side of a maze to the other. However, the maze is dynamically (and randomly) built and is continually being modified. The objective is to cross the maze without touching (or being hit by) a wall. Scoring is by a elapsed time indicator, and three levels of play are provided.

BLACK HOLE (Apple only) Price: \$14.95 Cassette/\$18.95 Diskette
This is an exciting graphical simulation of the problems involved in closely observing a black hole with a space probe. The object is to enter and maintain, for a prescribed time, an orbit close to a small black hole. This is to be achieved without coming so near the anomaly that the tidal stress destroys the probe. Control of the craft is realistically simulated using joystick for rotation and main thrusters for acceleration. This program employs Hi-Res graphics and is educational as well as challenging.

TEACHER'S PET I (Available for all computers) Price: \$ 9.95 Cassette/\$13.95 Diskette
This is the first of DYNACOMP's educational packages. Primarily intended for preschool to grade 3, TEACHER'S PET provides the young student with counting practice, letter-word recognition and three levels of math skill exercises.

CRYSTALS (ATARI only) Price: \$ 9.95 Cassette/\$13.95 Diskette
A unique algorithm randomly produces fascinating graphics displays accompanied with tones which vary as the patterns are built. No two patterns are the same, and the combined effect of the sound and graphics are mesmerizing. CRYSTALS has been used in local stores to demonstrate the sound and color features of the Atari.

CRANSTON MANOR ADVENTURE (North Star only) Price: \$19.95
At last! A comprehensive Adventure game for the North Star. CRANSTON MANOR ADVENTURE takes you into mysterious CRANSTON MANOR where you attempt to gather fabulous treasures. Lurking in the manor are wild animals and robots who will not give up the treasures without a fight. The number of rooms is greater and the associated descriptions are much more elaborate than the current popular series of Adventure programs, making this game the top in its class. Play can be stopped at any time and the status stored on diskette. Requires 32K.

NORTH STAR SOFTWARE EXCHANGE (NSSE) LIBRARY Price: \$9.95 Diskette
DYNACOMP now distributes the 20+ volume NSSE library. Most of these diskettes offer an outstanding value for the purchase price. Write for details regarding the contents of this library and quantity (four or more) orders.

Circle 154 on inquiry card.

Availability

DYNACOMP software is supplied with complete documentation containing clear explanations and examples. Unless otherwise specified, all programs will run within 16K program memory space (ATARI requires 24K). Except where noted, programs are available on ATARI, PET, TRS-80 (Level II) and Apple (Apple II) cassette and diskette as well as North Star single density (double density compatible) diskette. Additionally, most programs can be obtained on standard IBM format 8" CP/M floppy disks for systems running under MIBASIC.

* ATARI, PET, APPLE II, TRS-80, NORTH STAR, CP/M and IBM are registered trade names and/or trademarks.

BUSINESS AND UTILITIES

MAIL LIST II (Apple and North Star diskettes only) Price: \$24.95
This many-featured program now includes full alphabetic and zip code sorting as well as file merging. Entries can be retrieved by user-defined code, client name or Zip Code. The printout format allows the use of standard size address labels. Each diskette can store more than 1100 entries (single density North Star or Apple DOS 3.2; over 2200 with double density North Star or Apple DOS 3.3!).

FORM LETTER SYSTEM (FLS) (Apple and North Star diskette only) Price: \$17.95
FLS may be employed to generate individually addressed form letters. The user creates the address file and separately composes the letter. FLS will then print form letters using each address. FLS is completely compatible with MAIL LIST II, which may be used to manage your address files.
FLS and MAIL LIST II are available as a combined package for \$37.95.

TEXT EDITOR I (Letter Writer) Price: \$14.95 Cassette/\$18.95 Diskette
An easy to use, line-oriented text editor which provides variable line widths and simple paragraph indenting. This text editor is ideally suited for composing letters and is quite capable of handling much larger jobs. Available for all computers.

PERSONAL FINANCE SYSTEM (ATARI only) Price: \$34.95 Diskette
PFS is a single disk menu-oriented system composed of 10 programs designed to organize and simplify your personal finances. Features include a 300 transaction capacity; fast access; 26 optional user codes; data retrieval by month, code or payer; optional printing of reports; checkbook balancing; bar graph plotting and more. Also provided on the diskette is ATARI DOS 2.

FINDIT (North Star only) Price: \$19.95
This is a three-in-one program which maintains information accessible by keywords of three types: Personal (eg: last name), Commercial (eg: plumber) and Reference (eg: magazine articles, record albums, etc.). In addition to keyword searches, there are birthday, anniversary and appointment searches for the personal records and appointment searches for the commercial records. Reference records are accessed by a single keyword or by cross-referencing two or three keywords.

DFILE (North Star only) Price: \$19.95
This handy program allows North Star users to maintain a specialized data base of all files and programs in the stack of the programs in which it is variably accumulated. DFILE is easy to set up and use. It will organize your disks to provide efficient locating of the desired file or program.

COMPARE (North Star only) Price: \$12.95
COMPARE is a single-disk utility software package which compares two BASIC programs and displays the file sizes of the programs in bytes, the lengths in terms of the number of statement lines, and the line numbers at which various listed differences occur. COMPARE permits the user to examine versions of his software to verify which are the more current, and to clearly identify the changes made during development.

COMPRESS (North Star only) Price: \$12.95
COMPRESS is a single-disk utility program which removes all unnecessary spaces and (optionally) REMARK statements from North Star BASIC programs. The source file is processed one line at a time, thus permitting very large programs to be compressed using only a small amount of computer memory. File compressions of 20-50% are commonly achieved.

GRAFIX (TRS-80 only) Price: \$12.95 Cassette/\$16.95 Diskette
This unique program allows you to easily create graphics directly from the keyboard. You "draw" your figure using the program's extensive cursor and keyboard. Once the figure is made, it is automatically appended to your BASIC program as a string variable. Draw a "happy face", call it H\$ and then print it from your program using PRINT H\$. This is a very easy way to create and save graphics.

TIDY (TRS-80 only) Price: \$10.95 Cassette/\$14.95 Diskette
TIDY is an assembly language program which allows you to remember the lines in your BASIC programs. TIDY also removes unnecessary spaces and REMARK statements. The result is a compacted BASIC program which uses much less memory space and executes significantly faster. Once loaded, TIDY remains in memory; you may load any number of BASIC programs without having to reload TIDY!

STATISTICS AND ENGINEERING

DATA SMOOTHER (Not available for ATARI) Price: \$14.95 Cassette/\$18.95 Diskette
This special data smoothing program may be used to rapidly derive useful information from noisy business and engineering data which are equally spaced. The software features choice in degree and range of fit, as well as smoothed first and second derivative calculation. Also included is automatic plotting of the input data and smoothed results.

FOURIER ANALYZER (Available for all computers) Price: \$14.95 Cassette/\$18.95 Diskette
Use this program to examine the frequency spectra of limited duration signals. The program features automatic scaling and plotting of the input data and results. Practical applications include the analysis of complicated patterns in such fields as electronics, communications and business.

TFA (Transfer Function Analyzer) Price: \$19.95 Cassette/\$23.95 Diskette
This is a special software package which may be used to evaluate the transfer functions of systems such as hi-fi amplifiers and filters by examining their response to pulsed inputs. TFA is a major modification of FOURIER ANALYZER and contains an engineering-oriented decibel versus log-frequency plot as well as data editing features. Whereas FOURIER ANALYZER is designed for educational and scientific use, TFA is an engineering tool. Available for all computers.

HARMONIC ANALYZER (Available for all computers) Price: \$24.95 Cassette/\$28.95 Diskette
HARMONIC ANALYZER was designed for the spectrum analysis of repetitive waveforms. Features include data file generation, editing and storage/retrieval as well as data and spectrum plotting. One particularly unique facility is that the input data need not be equally spaced or in order. The original data is sorted and a cubic spline interpolation is used to create the data file required by the FFT algorithm.
FOURIER ANALYZER, TFA and HARMONIC ANALYZER may be purchased together for a combined price of \$44.95 (three cassettes) and \$56.95 (three diskettes).

REGRESSION I (Available for all computers) Price: \$19.95 Cassette/\$23.95 Diskette
REGRESSION I is a unique and exceptionally versatile one-dimensional least squares "polynomial" curve fitting program. Features include very high accuracy; an automatic degree determination option; an extensive internal library of fitting functions; data editing; automatic data and curve plotting; a statistical analysis (eg: standard deviation, correlation coefficient, etc.) and much more. In addition, new fit may be tried without reentering the data. REGRESSION I is certainly the cornerstone program in any data analysis software library.

REGRESSION II (PARAFIT) (Available for all computers) Price: \$19.95 Cassette/\$23.95 Diskette
PARAFIT is designed to handle those cases in which the parameters are imbedded (possibly non-linearly) in the fitting function. The user simply inserts the functional form, including the parameters (A11, A22, etc.) as one or more BASIC statement lines. Data and results may be manipulated and plotted as with REGRESSION I. Use REGRESSION I for polynomial fitting, and PARAFIT for those complicated functions.

MULTILINEAR REGRESSION (MLR) (Available for all computers) Price: \$19.95 Cassette/\$23.95 Diskette
MLR is a professional software package for analyzing data sets containing two or more linearly independent variables. Besides performing the basic regression calculation, this program also provides easy to use data entry, storage, retrieval and editing functions. In addition, the user may interrogate the solution by supplying values for the independent variables. The number of variables and data sets is limited only by the available memory.
REGRESSION I, II and MULTILINEAR REGRESSION may be purchased together for \$49.95 (three cassettes) or \$61.95 (three diskettes).

BASIC SCIENTIFIC SUBROUTINES, Volume I (Not available for ATARI)
DYNACOMP is the exclusive distributor for the software keyed to the text *BASIC Scientific Subroutines, Volume I* by F. Ruckdeschel (see the BYTE/McGraw-Hill advertisement in BYTE magazine, January 1981). These subroutines have been assembled according to chapter. Included with each collection is a menu program which selects and demonstrates each subroutine.

- Collection #1: Chapters 2 and 3: Data and function plotting, complex variables
- Collection #2: Chapter 4: Matrix and vector operations
- Collection #3: Chapters 5 and 6: Random number generators, series approximation

Price per collection: \$14.95 Cassette/\$18.95 Diskette
All three collections are available for \$39.95 (three cassettes) and \$49.95 (three diskettes).
Because the text is a vital part of the documentation, *BASIC Scientific Subroutines, Volume I* is available from DYNACOMP for \$19.95 plus 75¢ postage and handling.

ROOTS (Available for all computers) Price: \$9.95 Cassette/\$13.95 Diskette
In a nutshell, ROOTS simultaneously determines all the zeroes of a polynomial having real coefficients. There is no limit on the degree of the polynomial, and because the procedure is iterative, the accuracy is generally very good. No initial guesses are required as input, and the calculated roots are substituted back into the polynomial and the residuals displayed.

Ordering Information

All orders are processed and shipped postpaid within 48 hours. Please enclose payment with order along with computer information. If paying by VISA or MasterCard, include all numbers on card. For orders outside North America add 10% for shipping and handling.

Add \$2.50 to diskette price for 8" floppy disk (IBM format soft sector, CP/M, Microsoft BASIC)

*TRS-80 diskettes are not supplied with DOS or BASIC.

Deduct 10% when ordering 3 or more programs.

Ask for DYNACOMP programs at your local software dealer. Write for detailed descriptions of these and other programs from DYNACOMP.

DYNACOMP, Inc.

1427 Monroe Avenue

Rochester, New York 14618

24 hour mail order phone: (716)586-7579
Office phone (9AM-5PM EST): (716)442-8960



New York State residents please add 7% NYS sales tax.

Listing 4 continued:

```

3064 C0          0400          RNZ
3065 3E 01      0410          MVI A,1          ;RESET POSITION
3067 32 C2 30   0420          STA POS
306A E5         0430          PUSH H
306B 2A C0 30   0440          LHL DADD
306E 23         0442          INX H          ;UPDATE BYTE ADDRESS
306F 22 C0 30   0444          SHLD DADD
3072 E1         0450          POP H
3073 C9         0460          RET
3074           4000 *THE DECODE TABLE HAS THE FOLLOWING FORMAT:
3074           4010 *THE TABLE VALUE IS THE INCREMENT NECESSARY TO GET THE
3074           4020 *NEXT 0-1 PAIR AS THE PROGRAM STEPS THROUGH THE DATA
3074           4030 *THE TABLE VALU JUST PRECEEDING A CHARACTER HAS A TAG
3074           4040 *SET IN BIT 7, IN ADDITION TO THE INCREMENT, TO INDICATE
3074           4050 *THAT THE NEXT VALUE IS A CHARACTER.
3074 2A         5000 XTAB: DB 42          ;0 0
3075 01         5010          DB 1           ;1 1
3076 02         5020          DB 2           ;2 0
3077 08         5030          DB 8           ;3 1
3078 82         5040          DB 130        ;4 0
3079 02         5050          DB 2           ;5 1
307A 45         5060          DB 'E'        ;6
307B 82         5070          DB 130        ;7 0
307C 82         5080          DB 130        ;8 1
307D 49         5090          DB 'I'        ;9
307E 52         5100          DB 'R'        ;10
307F 06         5102          DB 6           ;11 0
3080 01         5104          DB 1           ;12 1
3081 82         5106          DB 130        ;13 0
3082 82         5108          DB 130        ;14 1
3083 4F         5110          DB 'O'        ;15
3084 41         5120          DB 'A'        ;16
3085 82         5130          DB 130        ;17 0
3086 02         5140          DB 2           ;18 1
3087 4E         5150          DB 'N'        ;19
3088 03         5160          DB 3           ;20 0
3089 81         5170          DB 129        ;21 1
308A 44         5180          DB 'D'        ;22
308B 03         5190          DB 3           ;23 0
308C 81         5200          DB 129        ;24 1
308D 50         5210          DB 'P'        ;25
308E 03         5220          DB 3           ;26 0
308F 81         5230          DB 129        ;27 1
3090 56         5240          DB 'V'        ;28
3091 02         5250          DB 2           ;29 0
3092 05         5260          DB 5           ;30 1
3093 82         5270          DB 130        ;31 0
3094 82         5280          DB 130        ;32 1
3095 4A         5290          DB 'J'        ;33
3096 58         5300          DB 'X'        ;34
3097 03         5310          DB 3           ;35 0
3098 81         5320          DB 129        ;36 1
3099 4B         5330          DB 'K'        ;37
309A 82         5340          DB 130        ;38 0
309B 82         5350          DB 130        ;39 1
309C 5A         5360          DB 'Z'        ;40
309D 51         5370          DB 'Q'        ;41
309E 02         5380          DB 2           ;42 0
309F 0E         5390          DB 14         ;43 1
30A0 03         5400          DB 3           ;44 0
30A1 81         5410          DB 129        ;45 1
30A2 54         5420          DB 'T'        ;46
30A3 02         5430          DB 2           ;47 0
30A4 05         5440          DB 5           ;48 1
30A5 82         5450          DB 130        ;49 0
30A6 82         5460          DB 130        ;50 1
30A7 59         5470          DB 'Y'        ;51
30A8 47         5480          DB 'G'        ;52
30A9 82         5490          DB 130        ;53 0
30AA 82         5500          DB 130        ;54 1
30AB 55         5510          DB 'U'        ;55
30AC 4D         5520          DB 'M'        ;56

```

Listing 4 continued on page 244

For \$4,995* you not only get a word processor.

Automatic screen prompting guides user through operations.

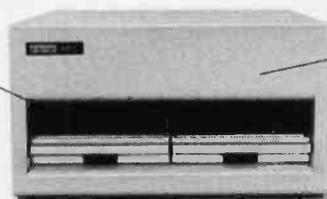
Familiar, typewriter-like keyboard. Powerful, versatile user-defined keys reduce many word processing jobs to just two keystrokes.



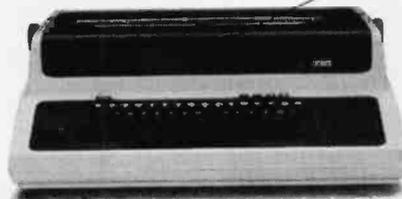
Communications options let you transmit information electronically. Communicate with other computer systems.

Flexible text editing features, easy to learn, easy to use. Boilerplate library of commonly used text. Abbreviation (or short-hand) library.

Word Processing software is only \$500. Optional List Processing software, with the powerful conditional select feature, is only \$400. Optional Accounting software is available through Digital's Computer Stores.



Dual 8" floppy disk drive. Convenient storage with flexible diskettes.



Standard 30 cps draft printer. (Select optional Letter Quality Printer instead of draft printer and system price becomes \$7295.*)

You also get the Digital factor.

At \$4,995, Digital's Word Processing has to be the best value in the industry. Value which includes immediate delivery. Special discounts on 3-pack systems. And the Digital Factor. What's that? Read on.

Since we're the world's largest maker of small computers, you get the benefits of our considerable size and experience. Benefits such as a 14,000-person customer service organization, 111 Sales Offices, complete training at any one of the 25 Computer Stores or 6 regional training centers, and a 30-day money-back guarantee.

That's the Digital Factor.

For a personal demonstration, call 800-528-6050, ext. 1276. In Arizona, 800-352-0458. For \$4,995, you get a lot more than a word processor.

*Software and destination charges not included. Prices quoted apply in U.S. only.

digital

We change the way
the world thinks.

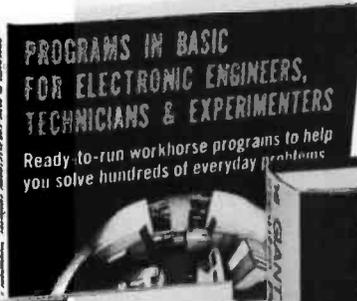
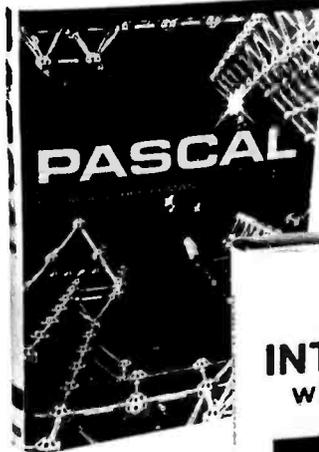
Into computers? Want to get started?

What is The Computer Book Club? An exciting new concept that puts hobbyists and businessmen on top of the fast-paced, dynamic world of computers. CBC will bring you info on software, hardware, applications, and theory... at savings up to 75% on hundreds of fact-packed volumes.

CBC is not just another book club! You can get in on Members' Bonus Benefits, like discounts on practical software packages, games, cassettes and disks, plus extra-value book dividends, and much, much more!

This introductory membership offer is for a limited time only. Join today!

1205
List \$15.95

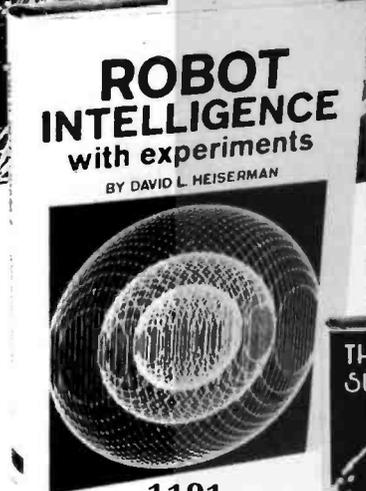


1095
List \$8.95

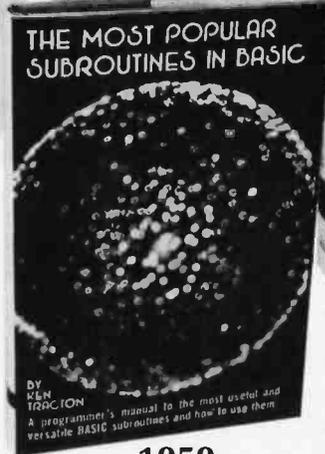
1169
List \$14.95



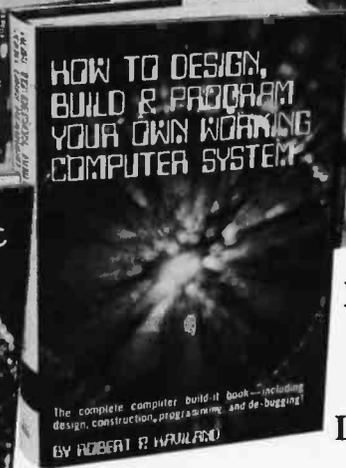
1187
List \$14.95



1191
List \$16.95

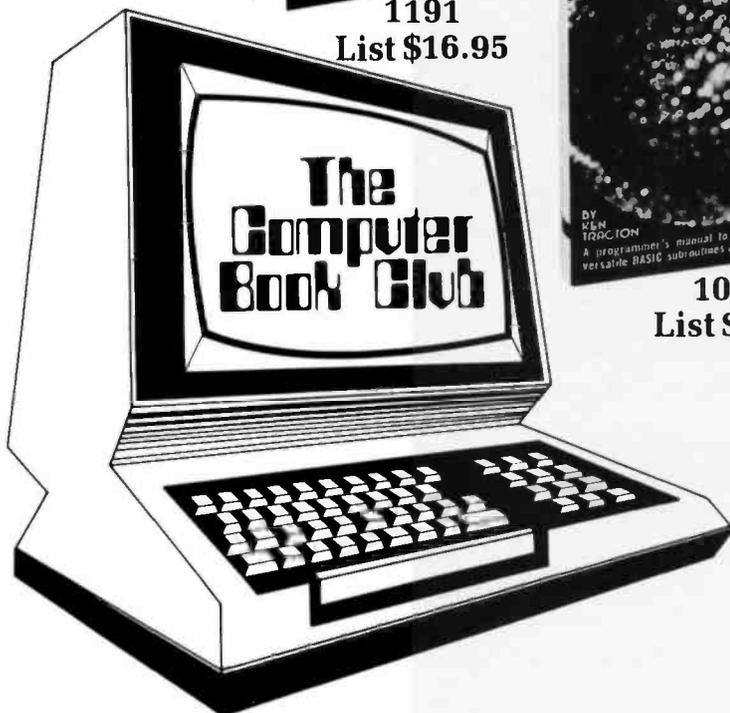


1050
List \$9.95



1062
List \$12.95

1111
List \$14.95



More books to pick from...

- The Complete Handbook of Robotics. List \$12.95. No. 1071
- 57 Practical Programs & Games in BASIC. List \$10.95. No. 1000
- Illustrated Dictionary of Microcomputer Terminology. List \$13.95. No. 1088
- Handbook of Remote Control & Automation Techniques. List \$16.95. No. 1077

FREE
when
you
join...

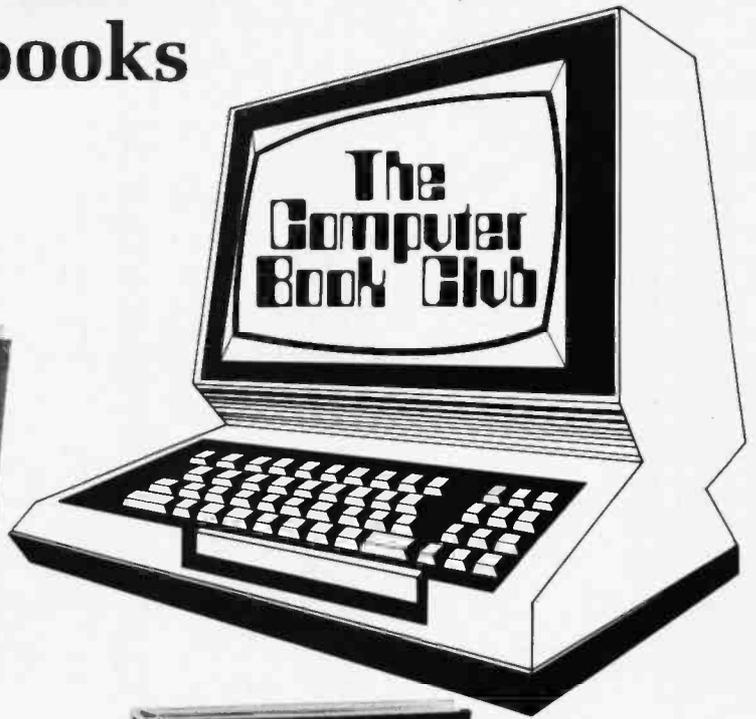


List \$4.95

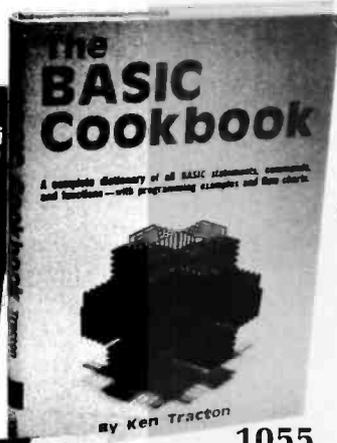
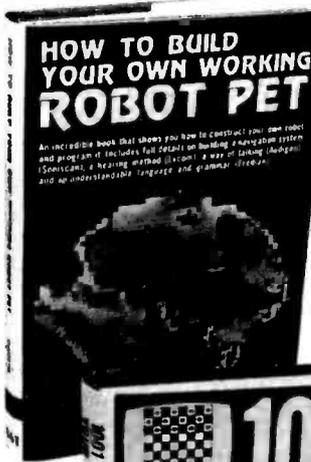
Take 4 exciting books for \$1.00

(values to \$70.75)

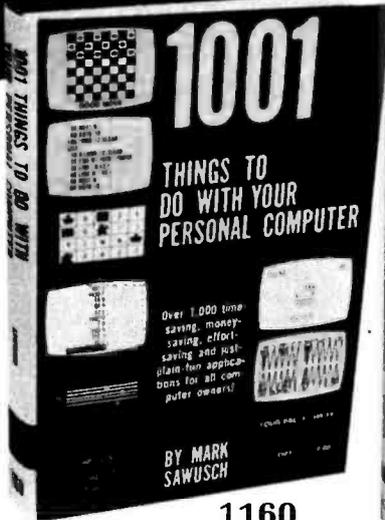
... and get one FREE!



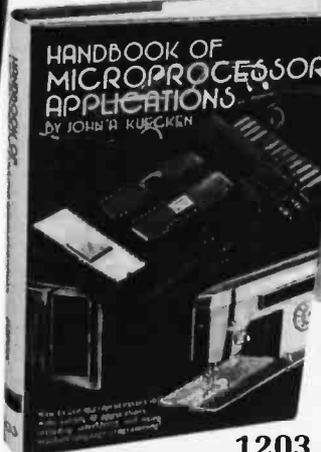
1141
List \$12.95



1055
List \$7.95



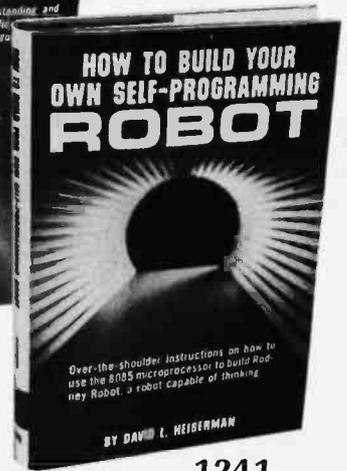
1160
List \$12.95



1203
List \$14.95



1045
List \$10.95



1241
List \$12.95

7 very good reasons to try The Computer Book Club...

- **Reduced Member Prices.** Save up to 75% on books sure to increase your know-how
- **Satisfaction Guaranteed.** All books returnable within 10 days without obligation
- **Club News Bulletins.** All about current selections—mains, alternates, extras—plus bonus offers. Comes 10 times a year with dozens of up-to-the-minute titles you can pick from
- **"Automatic Order"**. Do nothing, and the Main selection will be shipped automatically! But . . . if you want an Alternate—or no books at all—we'll follow the instructions you give on the reply form provided with every News Bulletin
- **Continuing Benefits.** Get a Dividend Certificate with every book purchased after fulfilling Membership obligation, and qualify for discounts on many other volumes
- **Extra Bonuses.** Take advantage of added-value promotions, plus special discounts on software, games, and more
- **Exceptional Quality.** All books are first-rate publisher's editions, filled with up-to-the-minute info

THE COMPUTER BOOK CLUB Blue Ridge Summit, PA 17214

Please accept my Membership in The Computer Book Club and send the 4 volumes circled below, plus a free copy of *Computerist's Handy Databook/Dictionary*. I understand the cost of the books selected is \$1.00 (plus shipping/handling). If not satisfied, I may return the books within ten days without obligation and have my Membership cancelled. I agree to purchase 4 or more books at reduced Club prices during the next 12 months, and may resign any time thereafter.

1000 1045 1050 1055 1062 1071 1077 1088 1095
1111 1141 1160 1169 1187 1191 1203 1205 1241

Name _____ Phone _____

Address _____

City _____

State _____ Zip _____

(Valid for new members only. Foreign and Canada add 20%. Orders outside U.S. must be prepaid with international money orders in U.S. dollars.)

BY-481

Listing 4 continued:

```

30AD 02          5530          DB 2           ;57 0
30AE 08          5540          DB 8           ;58 1
30AF 03          5550          DB 3           ;59 0
30B0 81          5560          DB 129        ;60 1
30B1 48          5570          DB 'H'        ;61
30B2 82          5580          DB 130        ;62 0
30B3 82          5590          DB 130        ;63 1
30B4 43          5600          DB 'C'        ;64
30B5 46          5610          DB 'F'        ;65
30B6 82          5620          DB 130        ;66 0
30B7 02          5630          DB 2           ;67 1
30B8 53          5640          DB 'S'        ;68
30B9 03          5650          DB 3           ;69 0
30BA 81          5660          DB 129        ;70 1
30BB 4C          5670          DB 'L'        ;71
30BC 82          5680          DB 130        ;72 0
30BD 82          5690          DB 130        ;73 1
30BE 42          5700          DB 'B'        ;74
30BF 57          5710          DB 'W'        ;75
30C0 02 41      5720 DADD:    DW DBUF+2   ;NEXT DATA ADDRESS
30C2             5990 POS:    DS 1       ;BIT POSITION
30C3             5999          ORG 4100H
4100             6000 DBUF:    DS 1000

```

Listing 5: BASIC frequency-analysis program *FREQ*. Written in Microsoft BASIC, this program receives text entered by the user and prints the frequency distribution of all letters and symbols. One symbol that does not appear by itself in a line of text is defined as marking the end of text; the symbol, defined in line 100, is presently "%".

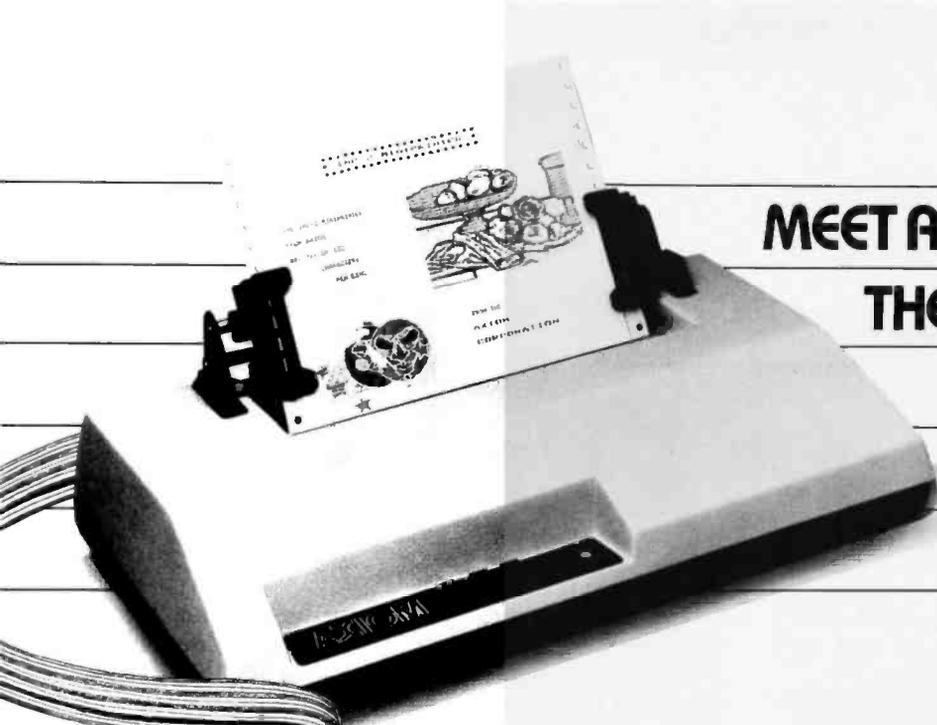
LIST *FREQ* (FREQUENCY ANALYSIS PROGRAM)

```

10 CLEAR 3000
12 D=45
15 S=0
20 DIM B$(2550)
30 DIM C(D)
40 DIM L$(D)
50 FOR N=0 0 TO D
60 L$(N)=""
70 NEXT N
75 PRINT "ENTER ANALYSIS TEXT, TERMINATE WITH %"
80 FOR N=0 TO 10
90 INPUT B$(N)
100 IF B$(N)="" GOTO 120
110 NEXT N
120 F=N-1
125 FOR M=0 TO F
130 L=LEN(B$(N))
140 FOR K= 1 TO L
150 A$=MID$(B$(N),K,1)
160 FOR J=0 TO D
170 IF L$(J)=A$ GOTO 220
180 NEXT J
190 L$(S) = A$
200 C(S)=C(S)+1
205 T=T+1
210 S=S+1
215 GOTO 230
220 C(J)=C(J)+1
225 T=T+1
230 NEXT K
240 NEXT N
245 M=1
250 FOR K=1 TO S-2
255 FOR N=1 TO S-M
260 IF C(N-1) < C(N) GOTO 274
262 T$=L$(N-1)
264 U=C(N-1)
266 L$(N-1)=L$(N)
268 C(N-1)=C(N)

```

Listing 5 continued on page 246



MEET AXIOM'S IMP — THE ONLY LOW COST IMPACT PRINTER DESIGNED FOR APPLE* COMPUTERS.

Three-Way Forms Handling

IMP is equipped with both friction and adjustable tractor feed (2-1/2 to 9-1/2 inches) to provide three-way forms handling — single sheet, roll paper, and fan fold.

Hardware and Software Compatible

Priced at only \$699, Axiom's versatile IMP-APPLE is the only high quality impact printer specifically designed to operate with the popular APPLE computers. It's completely hardware and software compatible with APPLE. Even comes with cables and connectors for direct plug-in to the computer. No additional interface is needed.

Enhances HiRes Graphics

IMP greatly enhances HiRes graphics. While other printers can only reproduce graphics on a 1 for 1 basis, IMP provides over 20 different aspect ratios, with complete control over horizontal and vertical resolution, placement, and orientation. For example, a chart could be reduced and printed on one portion of the paper, with text added. IMP also enhances APPLE's alphanumeric capability by providing lower case. It's super simple to operate, too, with all printer commands controlled with a simple key stroke. Another plus, IMP is one of the few printers compatible with PASCAL. How is all this versatility made possible? For one thing, IMP has a 2K byte ROM in its special APPLE interface, while others have 256 bytes or less.

The Nitty Gritty

IMP prints 80, 96 or 132 columns of crisp hardcopy at a speed of one line per second. The 7x7 dot matrix has a standard 96 ASCII character set. IMP's stylish low profile case will complement APPLE in any home or office. And, in addition to being distinctively styled, IMP is rugged, with a heavy duty mechanism, ribbon cartridge and single snap-out board for easy maintenance.

Visit your local computer store to see Axiom's IMP-APPLE in action.

*Trademark of Apple Computer, Inc.

AXIOM

AXIOM CORPORATION

1014 Griswold Avenue • San Fernando, CA 91340
Telephone: (213) 365-9521 • TWX: 910-496-1746



Listing 5 continued:

```

270 L$(N)=T$
272 C(N)=U
274 NEXT N
276 M=M+1
278 NEXT K
291 PRINT "LETTER FREQUENCY ANALYSIS"
292 PRINT
293 PRINT "LETTER", "COUNT", "PROBABILITY"
294 PRINT "-----"
295 PRINT
300 FOR N= 0 TO D
310 PRINT L$(N),C(N),C(N)/T
320 NEXT N
OK

```

Text continued from page 226:

is uniquely dependent upon the code being used. However, the basic structure and program can be used with any Huffman code.

There are three parts to the table structure: the index values that allow the program to step through the appropriate number of table entries (ie: tree branches) as the data-stream bit values are serially examined; the decoded character that results from the search; and a flag to indicate to the program that the next table entry found is a character and not an index value. The index values are always in pairs, with separate index values for a 1 or a 0 bit-stream value. Therefore, as the program scans through the table at each pair of index values, one or the other is selected, depending upon whether the bit in the

data stream is a 1 or a 0.

The table-scanning process consists of adding the data bit to the current table address. This gives a new address whose contents, an index value, is added to the address of the index value itself. This new table address is the address of the next node in the tree of figure 2.

This process continues until a flag is detected, indicating that the next entry is the desired letter. This test is performed each time an index-value address has been computed. The flag is the most significant bit in the table entry. The remaining 7 bits are interpreted as an ASCII character if the flag is on (logical 1) or as an index value if the flag is off (logical 0). This limits the index value to 127, the maximum distance in the table that can be skipped when processing 1 data bit. To help explain this process, a portion of the table is shown in figure 3.

In the Huffman code used in this program, the letter "I" is 1010. The decoding program identifies the corresponding letter by using the data bit stream and the decoding table previously described. The first data bit is added to the table address, TAB, giving a new address, TAB+1.

BYTE BACK ISSUES FOR SALE

The following issues are available:
 1976: July and November
 1977: March, May thru December
 1978: February thru October, December
 1979: January thru December except March
 1980: January to current issue except February and October
 Cover price for each issue through August 1977 is \$1.75 Domestic; \$2.75 Canada and Mexico; \$3.75 Foreign.
 September 1977 through October 1979 issues are \$2.50 Domestic; \$3.25 Canada and Mexico; \$4.00 Foreign.
 November 1979 to current is \$3.00 Domestic; \$3.75 Canada and Mexico; \$4.50 Foreign.



Send requests with payment to:

BYTE Publications
 70 Main St.
 Peterborough NH
 03458
 Attn: Back Issues

TABLE ADDRESS	TABLE ENTRY	FLAG	DATA BIT	
TAB +0	42	OFF	0	} CHOOSE FIRST BIT
+1	ADD 1 → ①	OFF	1	
+2	ADD 2 → ②	OFF	0	} CHOOSE SECOND BIT
+3	8	OFF	1	
+4	130	ON	0	} CHOOSE THIRD BIT
+5	ADD 2 → ②	OFF	1	
+6	E	OFF		} CHOOSE FOURTH BIT
+7	130 * 128 + 2 → 130	ON	0	
+8	130	ON	1	
+9	ADD 2 → 1	-	1010	DECODED
+10	R			
+11	6		0	
+12	1		1	
(ETC.)				

Figure 3: Use of the binary tree tables in programs EXP1 and EXP2. This annotated table interprets the first 13 bytes of the lookup table in both the code-expansion routines. It corresponds to the part of the binary tree in figure 2 that leads to the letters E, I, and R. This figure shows the process by which 1010 is decoded as the letter I.

The COMPUTER FACTORY

TO ORDER CALL (212) 687-5000

SUPERBRAIN™

INTERTEC DATA SYSTEMS
64K ONLY
\$3395



32K \$2795

More than an intelligent terminal, the SuperBrain outperforms many other systems costing three to five times as much. Endowed with a hefty amount of available software (BASIC, FORTRAN, COBOL), the SuperBrain is ready to take on your toughest assignment. You name it! General Ledger, Accounts Receivable, Payroll, Inventory or Word Processing...the SuperBrain handles all of them with ease.

FEATURES INCLUDE:

- 2 dual-density minifloppies with 360K bytes of disk storage • A CP/M Disk Operating System with a high-powered text editor, assembler and debugger

Model QD

720K Bytes disk storage and 64K RAM
\$3895

SUPER BRAIN HARD DISKS

10 Megabyte
List \$4995
\$4495

16 Fixed-16 Removable
\$9995



NEW 96K

80 Column Commodore CBM
Basic 4.0 Operating System

- 80 column by 25 line display
- 12" CRT
- New screen editor
- Split screen processing
- Super fast string handling
- 15 additional basic commands
- Supports relative record processing

Model 8032
32K memory
\$1795

NEW!
Model 8096
96K memory
Call for price

NEW 8050 DUAL DISK \$1795
1 million bytes on-line storage and DOS 2.0 operating system
NEW 2031 SINGLE DISK \$595

Commodore Computer

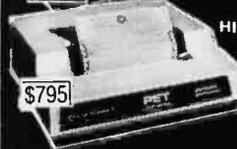
These low cost Commodore PET Business Computers have virtually unlimited business capabilities. Accounts Receivable, Inventory Records, Payroll, and other accounting functions.

- PET 16N & 32N COMPUTERS
- Full size keyboard
- 16 or 32,000 Bytes Memory
- Level III Operating System
- Full Screen Editor
- Upper lower case & 64 graphic characters



PET DUAL FLOPPY DISK

- Stores 360,000 Bytes on-line
- Microprocessor controlled
- Uses single or dual sided floppies



HI-SPEED PRINTER

- 150 characters per second • Up to 4 copies 8" wide
- Microprocessor Controlled • Prints All Graphics • Full Formatting Capability



CORVUS

10 megabyte disk and mirror available



Call **APPLE II PLUS** for price

A complete self-contained computer system with APPLESOFT floating point BASIC in ROM, full ASCII keyboard in a light weight molded carrying case.

Features Include:

- auto-start ROM • Hi-Res graphics and 15 color video output
- Expandable to 48K.

Supertalker	\$279	Micromodem	\$379
Disk	645	Superterm (24 x 80)	395
Add-on Disk	525	Speechlab	229
Pascal Card	495	Communication Card	225
Business Software	625	Modem	200
Monitor	159	Graphics Printer	595
Printer Card	180	Graphics Tablet	795

apple III
IS FINALLY HERE
128K RAM!!



FOR BEST DELIVERY AND SUPPORT SEE IT AT THE COMPUTER FACTORY

PRINTERS

CENTRONICS SALE

737-3 ONLY

\$888

CENTRONICS 704



- 180 cps Bi-Directional • Up to 15" Paper Width • 9 x 9 Matrix
- Upper/Lower Case
- Tractor Feed
- RS-232C Serial Interface

\$1795

CENTRONICS 700-9

- 60 cps • Up to 15" paper width
- Tractor Feed • Parallel Interface for Apple & TRS-80 • 2 channel vertical forms! • Top of Form!

\$1295 List \$1895
CENTRONICS 737 Parallel \$895



VR-300 \$1795
(25cps Letter Quality)
EPSON MX-80 \$ 645
Paper Tiger 445 795
Paper Tiger 460 1295

MONITORS

SANYO 12" GREEN \$355
BMC 12" GREEN 295
LEDEX 13" COLOR 449
ZENITH 13" COLOR 395
LEDEX 12" B&W 159

ANDERSON JACOBSON



841 I/O Terminal Ideal for word processing and small businesses.

- ASCII Code
- 15 CPS Printout
- High Quality Selectric Printing
- Reliable heavy duty mechanism
- Completely Refurbished by A.J.
- Delivered FREE to nearest service center

Serial \$995

DIABLO 630

Letter Quality

Special \$2495

List \$2755



- 40 Cps
- Uses all 100 metal & plastic daisy wheels
- Automatic bidirectional printing
- Fewer moving parts

On Site Warranty

DEALER INQUIRIES INVITED
ON DIABLO, CENTRONICS,
SUPERBRAIN, DYNABYTE



XYMEC HQ 1000

with 10, 12, 15 Pitch & Proportional Spacing
• Z-80 controlled
• Up to 198 columns
\$2495



Min. Credit Card Order \$75

N.Y. residents add 8% sales tax
• Same Day shipment on prepaid and credit card orders

CLOSE OUT SPECIALS!

	List	Special
Chatsworth Card Reader for TRS-80	750	450
Axiom 801	495	195
Protonline PET to Centronics Interface	199	49
Microtronics PET/Ham Interface	125	49

TEXAS Instruments 99/4 \$695 (with 13" color Monitor)

Over 1000 software tapes, books, disks, on display. Come in and browse.

Leedex-80 12" \$89

TO ORDER CALL (212) 687-5000

Open

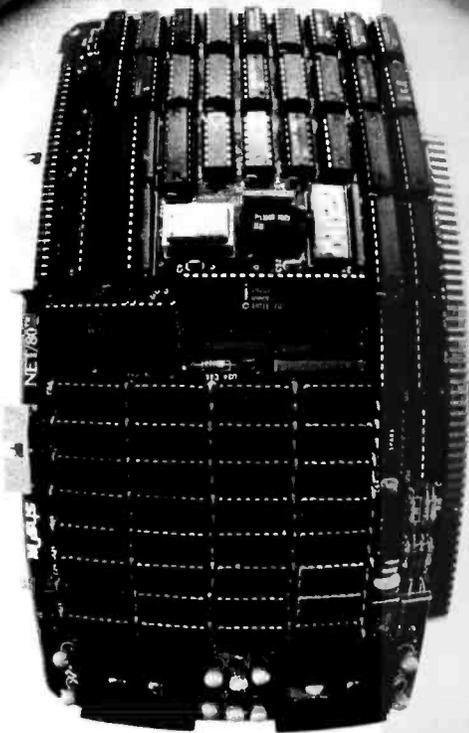
Mon-Fri. 10-6 Sat. 11-5

The COMPUTER FACTORY®

485 Lexington Ave., New York, NY 10017 (46th St. Lobby)

Foreign order desk — Telex 640055

NEW



The single board microcomputer that's perfect for CP/Net™

Everything you need for a network slave is built in: Z-80 processor, 64K dynamic RAM, even the console serial port. The forthcoming expansion board will add additional ports, priority interrupt control, and IEEE S-100 bus master capability for the network master processor. And MuSYS delivers all the software support you need to take advantage of CP/NET™ and the advanced MP/M™ operating system. For your multi-user system, it's the ideal way to add stations, share common resources (peripherals, programs, data bases), and increase total throughput, while maintaining hardware isolation for each user.

Just \$1,395 ea. Generous dealer and quantity discounts available. Call or write today for more details.

CP/Net and MP/M are trademarks of Digital Research.

MUSYS

Multi-user Microsystems

1451 Irvine Blvd., Suite 11, Tustin, CA 92680
(714) 730-5692. TWX: 910-595-1967
CABLE: MUSYSTSTN

The index value here, a 1, is added to the previous result, giving TAB+2. The first bit has now been processed.

Beginning on the second bit, 0 is added to the previous result and the new index value pointed to is 2. This is added to the previous result, giving a new address of TAB+4.

The second bit has now been processed. The next data bit, a 1, is added to the previous result, giving the address TAB+5. Adding the index value at this location, a 2, gives the new address, TAB+7. The third bit has now been processed.

Adding the last data bit, a 0, gives the entry 130. The fact that this value is greater than 128 proves that it is really an index value of 2 with the flag bit set; $130 = 128 + 2$. This tells the user that the next entry, two locations further, is the desired character. Adding the index value of 2 points you to the letter "I". Since a letter was found, the process is repeated from the beginning, continuing with the next bit in the data stream (providing that the supply of data has not been exhausted).

Shorter codes are used for the more frequently occurring data elements, and longer codes are used for less frequently occurring data elements.

COMP2 Description

The COMP2 program, given in listing 3, is similar to COMP1 except for one significant difference—the serial bit stream that results from the encoding process is packed and stored 8 bits to the byte. This provides true compression and is useful when the compressed file is stored in main memory or when the mass-storage device requires an 8-bit word. An interesting occurrence in using a compression scheme like this is that a low degree of data encryption occurs automatically when the bit stream is broken into 8-bit bytes. Referring back to the example where the word "compression" was represented by 47 bits, you can see that the 8-bit bytes look like the following:

(Binary)	(Hexadecimal)	(ASCII Meaning)
01000111	47	G
00001111	0F	SI (Control character)
01011011	5B	Left bracket
10001100	8C	Not defined in 7-bit ASCII
11010101	D5	Not defined in 7-bit ASCII
11011100	D(?)	Insufficient data

If someone looked at this data, it would not be immediately obvious that this is the word "compression". Some knowledge about the processing method or some effort in decoding it would be necessary to retrieve the original word.

EXP2 Description

The EXP2 program, given in listing 4, is similar to EXP1 except that it expects to find the data to be decoded in a packed form of 8-bit bytes. It works in conjunction with COMP2. As in EXP1, the decoded data is sent to some sort of terminal device. Any other destination could be used with a slight code change.

BASF presents a strong case for floppy disks.

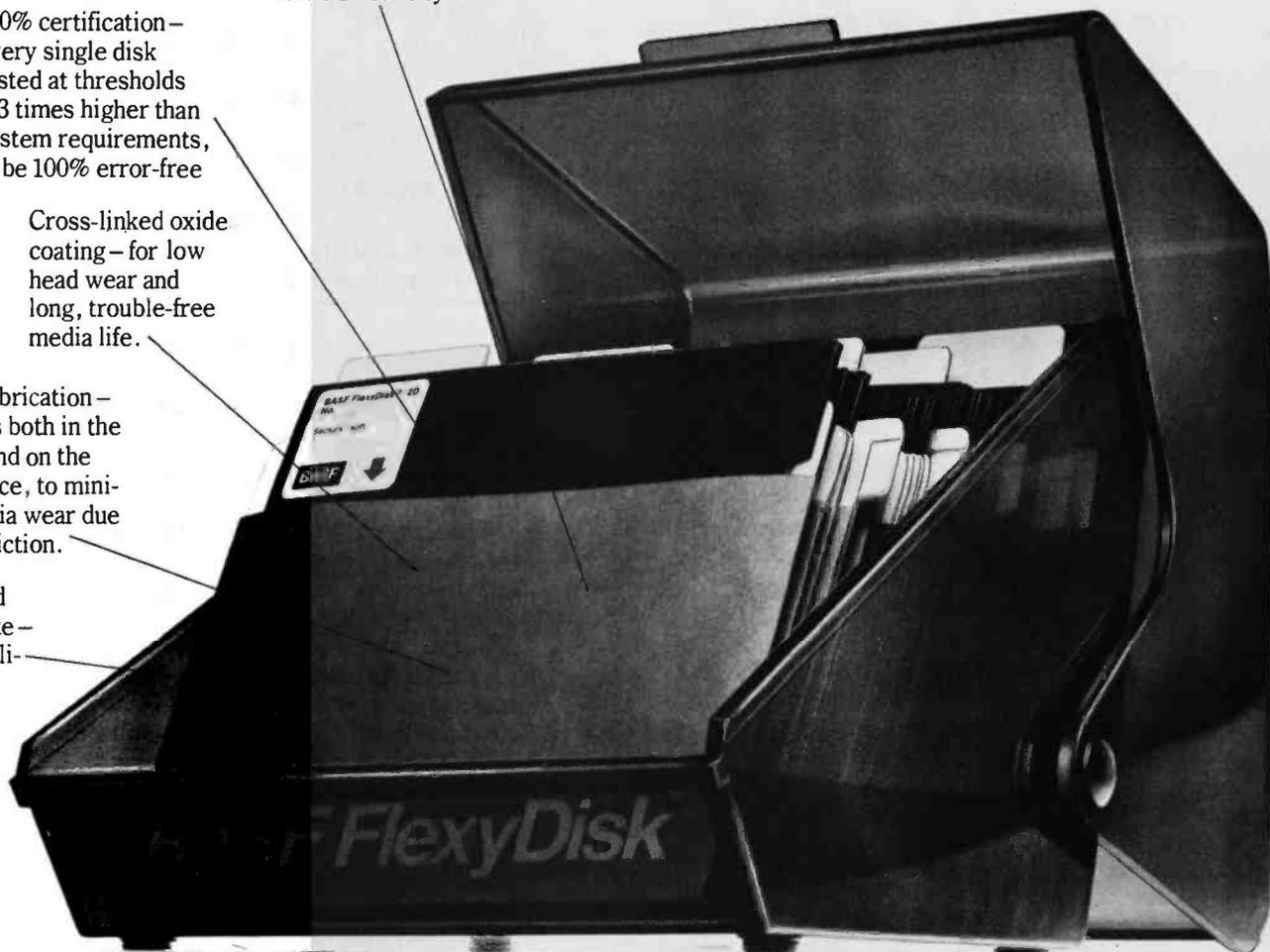
Tough Tyvek sleeve—
no paper dust, no
static electricity.

100% certification—
every single disk
tested at thresholds
2-3 times higher than
system requirements,
to be 100% error-free

Cross-linked oxide
coating— for low
head wear and
long, trouble-free
media life.

Double lubrication—
lubricants both in the
formula and on the
disk surface, to mini-
mize media wear due
to head friction.

Bi-axially oriented
polyester substrate—
for uniform and reli-
able performance
year after year.



Not just a strong case...but an attractive, dust-proof, easy-to-carry case, with 40 BASF FlexyDisks® included. Best of all, our new case is available in both 5.25" and 8" configurations.

Our strongest case is inside—BASF FlexyDisks®, the product of more than four decades of experience in magnetic media...the best value available in premium-grade floppy disks. For the name of your nearest supplier, write BASF Systems, Crosby Drive, Bedford, MA 01730, or call 617-271-4030.

BASF Systems Corp.
Computer Mktg. Svcs.
Crosby Drive
Bedford, MA 01730



BASF

Please send me more information and prices on the new
BASF 40-pack in 5.25" 8" configuration.

Name _____ Title _____
Company _____
Address _____
City _____ State _____ Zip _____
Telephone _____

Listing 6: Listing of the execution of program *FREQ* (listing 5). This listing is the result of running the *FREQ* program, using eight lines of *BASIC* code as the text to be analyzed.

```
OK
RUN OF FREQUENCY ANALYSIS PROGRAM

ENTER ANALYSIS TEXT, TERMINATE WITH %
? "120 f=n-1"

? "125 for n=0 to f"

? "130 l=len(b$(n))"

? "140 for k= 1 to l"

? "150 a$=mid$(b$(n),k,1)"

? "160 for j=0 to d"

? "170 if l$(j)=a$ goto 220"

? "180 next j"

? %
```

LETTER FREQUENCY ANALYSIS

LETTER	COUNT	PROBABILITY
-	1	7.75194E-03
3	1	7.75194E-03
A	1	7.75194E-03
M	1	7.75194E-03
6	1	7.75194E-03
7	1	7.75194E-03
G	1	7.75194E-03
8	1	7.75194E-03
X	1	7.75194E-03
5	2	1.55039E-02
E	2	1.55039E-02
B	2	1.55039E-02
K	2	1.55039E-02
A	2	1.55039E-02
I	2	1.55039E-02
D	2	1.55039E-02
,	2	1.55039E-02
R	3	2.22558E-02
J	3	2.32558E-02
2	4	3.10078E-02
L	4	3.10078E-02
T	5	3.87597E-02
(5	3.87597E-02
)	5	3.87597E-02
F	6	4.65116E-02
N	6	4.65116E-02
\$	6	4.65116E-02
=	7	5.42636E-02
O	8	6.20155E-02
0	10	7.75194E-02
1	11	8.52713E-02
	21	1.62791
%	0	0

FREQ Description

To aid in doing frequency analysis, a small program, *FREQ*, was written in Microsoft *BASIC*. (See listing 5.) This program counts the occurrence of symbols (letters, spaces, punctuation marks, etc) that have been entered

Line	Operation Performed
10	Assign string space.
12	Maximum number of unique symbols expected.
15	Number of unique symbols entered.
20	Text working buffer.
30	Symbol count array.
40	Symbol array.
50 thru 110	Entry of text to be analyzed.
80	Loop control for number of lines (may be increased).
120	F is number of text lines entered.
125 thru 180	Input line is transferred to text buffer.
190 thru 240	Count number of each type of symbol; T is total count; C is count of corresponding symbol in symbol array.
245 thru 278	Sort symbols by count in ascending order.
291 thru 320	Computer probability and output results.

Table 3: Operations performed by lines of code in the *BASIC* program *FREQ* of listing 5.

and prints the frequency analysis. In order to include spaces in the count, the input array should be initialized to be filled with a symbol not occurring by itself in the text stream. The same symbol can be used to terminate the text-entry operation: I used a percent sign (%).

The size of the text block to be analyzed is limited only by available memory. To get a reasonably accurate analysis, the text block should be more than several hundred characters and be representative of the entire text. It is not necessary to do a frequency analysis every time a code is constructed. However, the closer the code lengths correspond to the frequency of occurrence, the more efficient the resulting compression will be.

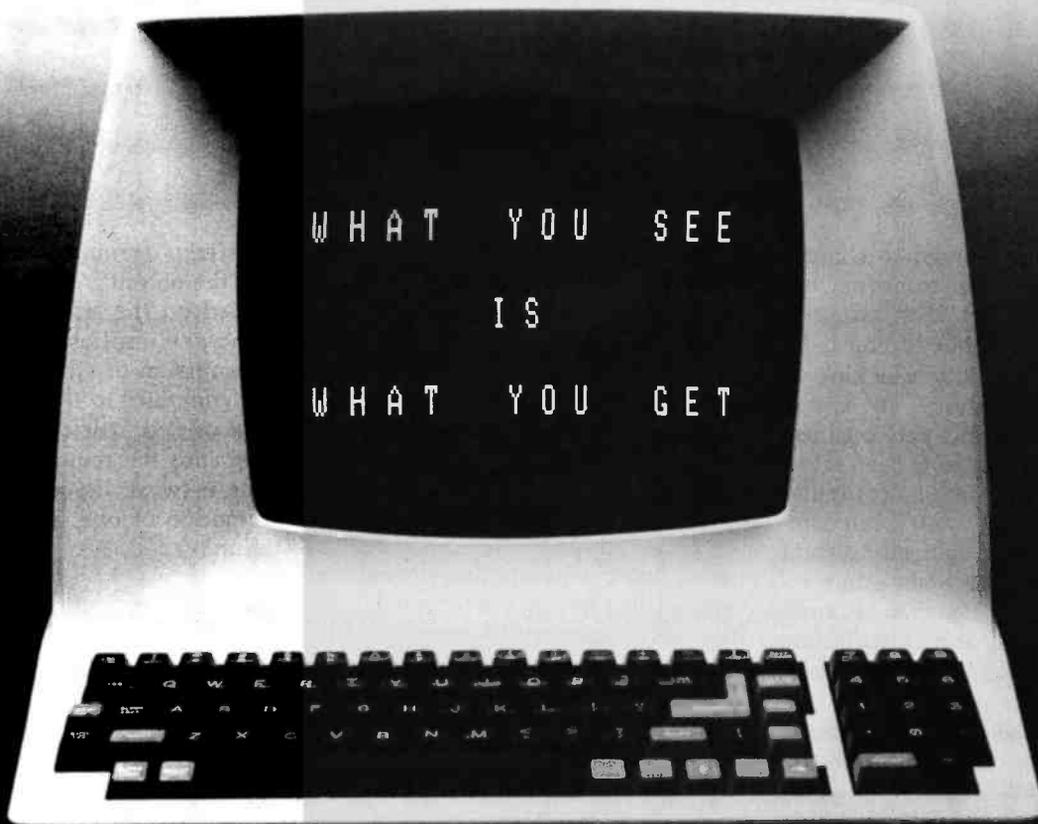
A sample run of *FREQ* is shown in listing 6 with the text input being part of the program itself. By comparing this output with the figures of table 1, you can see how the letter frequency for a *BASIC* source program compares to that of plain English text.

Finally, since there are no remarks in the *FREQ* program, the information in table 3 will help you understand the program. ■

References

- Hoffman, L J, *Modern Methods for Computer Security and Privacy*, Prentice-Hall, 1977.
- Huffman, D A, *A Method for Construction of Minimum-Redundancy Codes*, Proceedings of the Institute of Radio Engineers, September 1952.
- Tao, W Y, *A Firmware Data Compression Unit*, University of Illinois, January 1974.
- Williams, Gregg and Rick Meyer, "The Panasonic and Quasar Hand-Held Computers: Beginning a New Generation of Consumer Computers," *BYTE*, January 1981, pages 34 thru 45.

Can your word processor pass this screen test?



WordStar™ software does*! And does it better than any other word processing system. Not only do you get all the sophisticated features you'd expect from the high-priced WP system, with WordStar you have a true screen image of what your printout will look like **before you print it!**

With WordStar, you'll erase, insert, delete and move entire blocks of copy. Page breaks are

displayed and automatically revised on the screen. You can specify enhancements like underlining and boldfacing, and much more.

And WordStar's so much easier to learn because of its unique and extensive self-help menus. Every typist in your office can be an instant screen star. Call (415) 457-8990 and ask for a copy of our WordStar demon-

stration booklet. Remember, when you're the star, we're the star.

MicroPro™
INTERNATIONAL CORPORATION
The Star Maker

MicroPro International Corporation
1299 4th Street, San Rafael, CA 94901
(415) 457-8990 TELEX 340388
Sold through authorized dealers and distributors only. OEM inquiries invited.

*Runs on most Z80/8080/8085 microcomputers with CP/M (TM of Digital Research); 48K; and terminal with addressable cursor.

Build an Intercomputer Data Link

Mike Wingfield
93 Pine Hill Rd
Bedford MA 01730

Have you ever wanted to share a program or data with someone, but had no way to get it from your machine to his without typing it by hand? While this facility is lacking on most microcomputers, it is so necessary to scientific and business computers that it has long been taken for granted. The power of a computer is greatly enhanced when it can communicate with geographically distant computers. Computers can attain increased efficiency by sharing both resources and data, or by distributing the work load among connected computers. These capabilities also increase the versatility of the computer as a tool, and make possible such services as electronic mail and quick access to data. These and similar advantages will become available to the hobbyist and the small businessman through the use of intercomputer data links.

This article describes a specific implementation of a connection be-

The power of a computer is greatly enhanced when it can communicate with geographically distant computers

tween two computers that provides a symmetrical facility for terminal linking and memory-to-memory file

transfers. *Terminal linking* implies that the output from each terminal is echoed on the remote terminal. *File transfer* implies the error-free transmission of a block of data from one computer to the other. The purpose of this article is to provide insight into the requirements of large-scale network design through an examination of one specific implementation.

System Overview

As presented in figure 1, each end

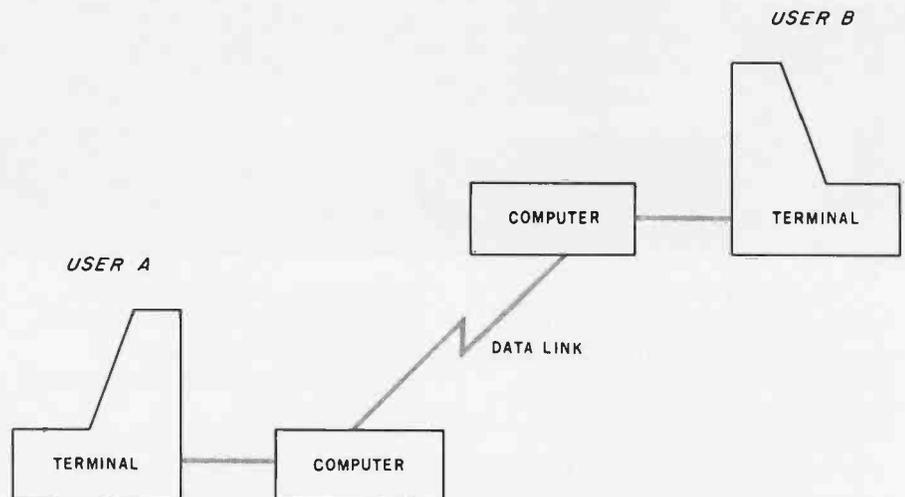
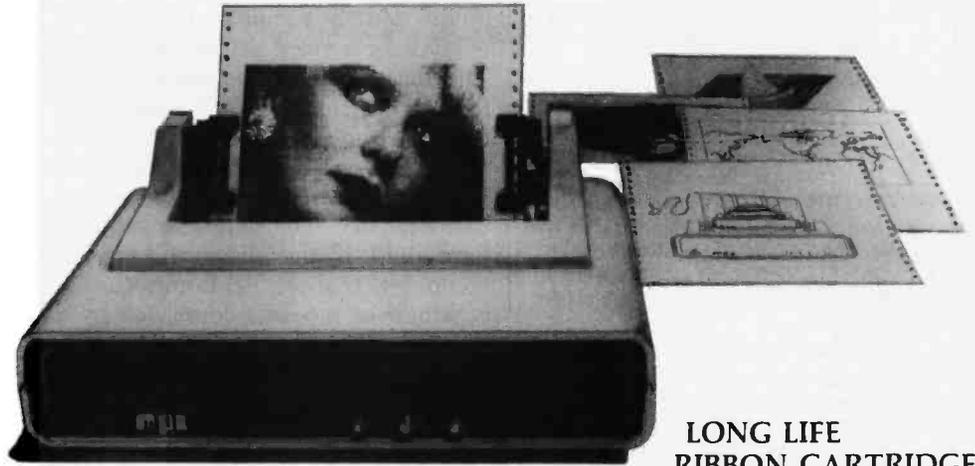


Figure 1: Typical data-link system configuration. Although the connection between the terminal and the computer is hardwired (ie: a direct electrical connection), the data link between computers (bridging a large distance) is usually accomplished via radio or telephone link.

About the Author

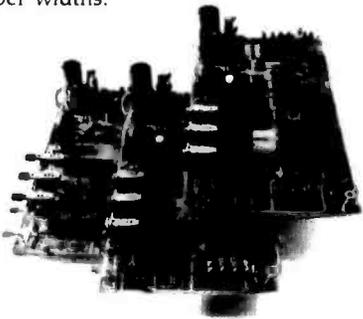
Mike Wingfield graduated from the University of California at Los Angeles in 1972 with a PhD in computer science. Presently, he is working for the computer consulting firm of Bolt, Beranek, and Newman in Cambridge, Massachusetts, where his specialty is the design and implementation of intercomputer communication software. His hobbies include gardening and experimentation with 6800- and 6809-based microcomputers.

Why is the 88G Printer the new industry leader?



QUALITY

The attractive, durable 88G casework is formed from impact-resistant, flame-retardant Styron. Microprocessor controlled stepper motors provide precision control over print head and paper positioning. Computer quality tractors position paper for readability and are fully adjustable to accommodate varying paper widths.



VERSATILITY

The 88G prints a full upper and lower case 96 character ASCII set with a crisp, clear 7x7 matrix in 80, 96, or 132 column formats. For text processing and correspondence applications, an 11x7, 80 column serif style matrix can be selected by switch or software command. The dual tractor/pressure-feed paper drive system allows the user to choose either pin-feed, roll, or single sheet papers up to 9.5 inches wide.

Complete forms control allows the 88G to be quickly configured for printing single or multiple-ply invoices, purchase orders, checks, or any type of preprinted form. Optional paper roll holders and single sheet feeders can be quickly attached.

The wide use range of the 88G makes it the perfect companion for business systems, data processing, RO teleprinter and terminal printer applications.

GRAPHICS

A high-resolution, dot-addressable graphics option can be added for applications requiring plotting, printing of screen graphics, drawings, illustrations, etc. Single dot print resolution greatly extends the usefulness of the graphics capability. Selection of one of the four horizontal dot densities available customizes the graphic printout, and alphanumeric characters can easily be included for titling of graphs and illustrations.

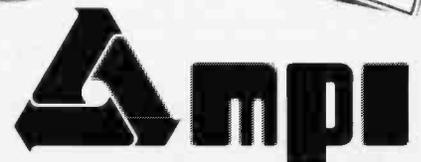
LONG LIFE RIBBON CARTRIDGE

Ribbon difficulties are minimized through use of a continuous loop cartridge with a five million character life. It is easily changed without opening the case, and without any complicated or messy threading operations.



PRICE

Every detail is directed toward providing a heavy-duty, commercial quality printer for only \$749.00. No other printer on the market today can provide its quality, features and performance at a comparable price. The 88G is an obvious industry leader.

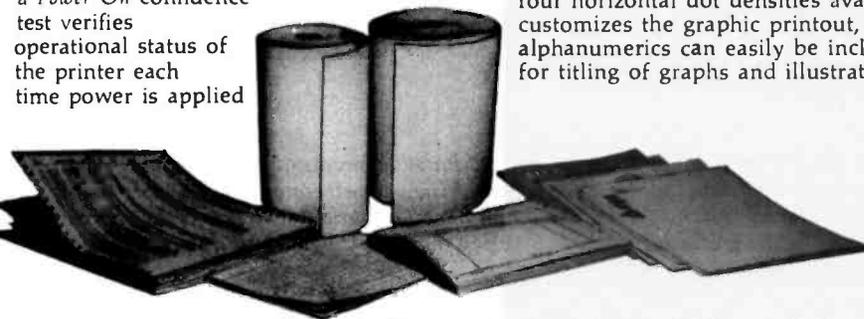


Micro Peripherals, Inc.
4426 South Century Drive
Salt Lake City, Utah 84107
Phone (801) 263-3081

MICROPROCESSOR CONTROLLED INTERFACE

The microprocessor array provides the intelligence for a dual RS232 serial and a Centronics® type parallel interface. Both inputs are fully buffered to allow the 88G to receive data and print simultaneously. A 1K character buffer is standard with a 2K buffer available as an option.

The short line thruput of the 88G has been increased by incorporation of a *Quick Cancel* feature that fully utilizes the bidirectional/unidirectional printing capabilities. Built-in diagnostic and self-test capabilities allow the user to easily pinpoint system problems and a *Power On* confidence test verifies operational status of the printer each time power is applied

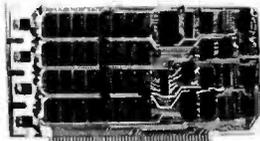


®Centronics is a registered trademark of the Centronics Data Computer Corp.

Now-Break Through The 64K
Micro-Memory Limit!

SWEET SIXTEEN

Bank Selectable 16K Static RAM



SAVE \$50.00
LIMITED TIME OFFER

Don't buy any more antique RAMs (RAM without bank select) — now there's Netronic's new SWEET SIXTEEN board featuring a universal software bank select system. SWEET SIXTEEN is capable of addressing 2,048 different banks. With SWEET SIXTEEN boards you can add memory beyond the 64K limit, or expand to a multi-terminal system.

LOOK AT THESE FEATURES:

- 300 NS, low power 2114's.
- **Software Bank Selector** — Universal decoder works with Cromenco, Alpha Micro, Netronics, most other systems, or your design. Onboard dip switches: Bank Select Enable; Reset Enable; Reset Disable; Port Address; Port Data.
- **All Inputs And Outputs** meet the proposed IEEE standards for the S-100 bus.
- **4.0 MHz Operation.**
- **Schmitt Trigger Buffer** on all signals for maximum noise immunity.
- **Addressable On 16k Boundaries**, 0-64k, dip switch selectable.
- **Phantom Option**, dip switch selectable.
- **PWR/MWRITE Option**, dip switch selectable.
- **LED Indicator** to display status.
- **Glass Epoxy PC Board** with gold-plated contacts and double-sided solder mask.
- **Fully Socketed.**
- **Four Separate Regulators** for maximum stability.

10-Day Money-Back Policy For Wired & Tested Unit: Try a fully wired board — then either keep it, return it for kit, or simply return it in working condition.

Continental U.S.A. Credit Card Buyers
Outside Connecticut:

CALL TOLL FREE:
800-243-7428

From Connecticut Or For Assistance:
(203) 354-9375

Please send the items checked below:

- SWEET SIXTEEN kit; No. S-16** ... (reg. price \$249.95) now \$199.95*
- SWEET SIXTEEN, fully assembled, tested, burned in; No. S-16W** ... (reg. price \$289.95) now \$239.95*

*Plus \$2 postage & insurance. Connecticut residents add sales tax.

Total Enclosed: \$ _____

Personal Check Money Order/Cashier's Check

VISA Master Charge (Bank No. _____)

Acct. No. _____ Exp. Date _____

Signature _____

Print _____

Name _____

Address _____

City _____

State _____ Zip _____

NETRONICS

RESEARCH & DEVELOPMENT, LTD.
333 Litchfield Rd., New Milford, CT 06776

Computers can attain increased efficiency by sharing both resources and data.

of the connection consists of a computer and a terminal (such as a teletype or a video display terminal). The local computer is connected to the remote computer via a data link that is implemented by an asynchronous serial hardware interface and the software necessary to support data transfer. The data link may be hardwired if the distance between computers is short; or, it may consist of a pair of modems connected by a telephone line if a hardwired line is inconvenient. Figure 2 illustrates the

hardware configuration of each computer—in this case, a 6800-based system. Two ACIAs (asynchronous communications interface adapters) provide the necessary interfaces to the terminal and to the line. The software involved occupies approximately 700 bytes of memory.

The *user interface* can be defined as the view the user has of his computer. The interface to the data-link software was designed to be as simple as possible (to reduce the amount of software), and yet provide the user with two capabilities:

- **Echoing of characters typed by one terminal on the other terminal.** This feature enables two persons to communicate with each other. This is the *transparent* or *linking mode*, which is the default state of the software.

- **Initiation of a file transfer from one**

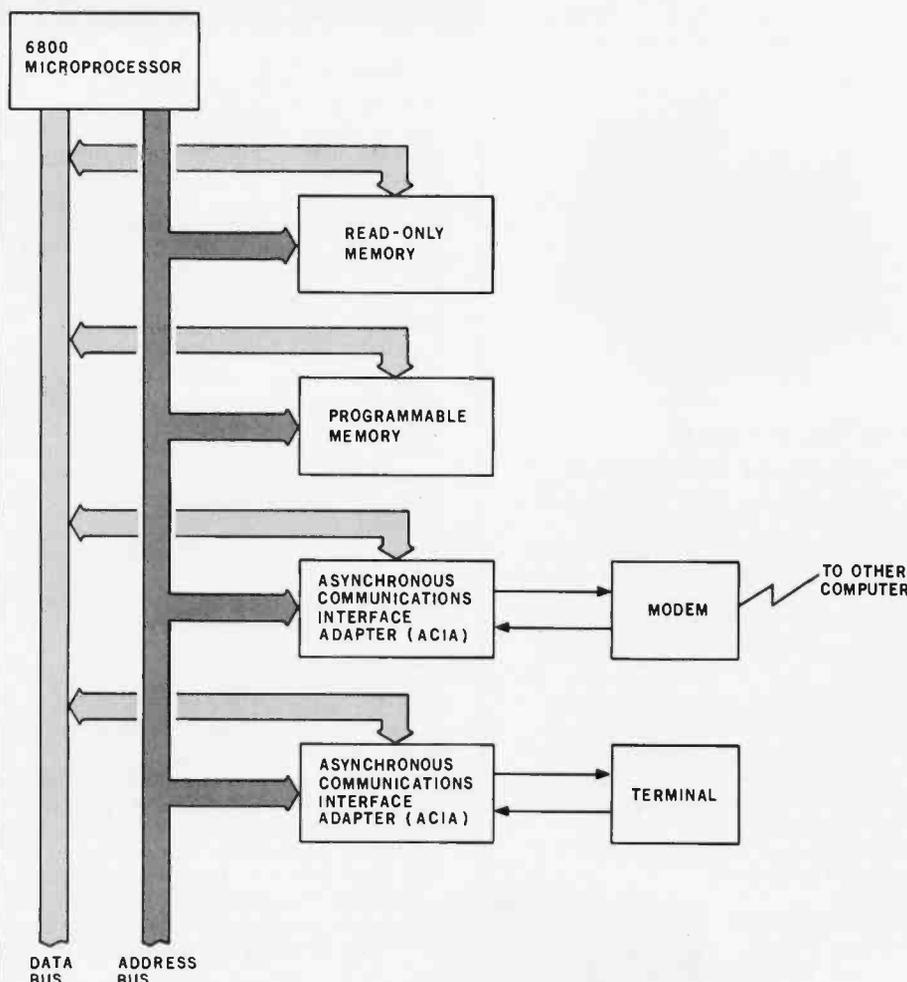


Figure 2: Hardware configuration of a 6800-based computer. The computer communicates across the data link by means of the ACIA, which converts the 8-bit bytes of information to a continuous (serial) stream of bits. This serial bit stream is transmitted by use of the modem, which translates between the binary signal and a signal that can be carried across telephone lines.

**FOR OVERWORKED COMPUTER OPERATORS,
OUR SLC-1 MAKES THE PERFECT ASSISTANT.**

Your computer may lose track of things once in a while. The time, for example. When it does, your operator has to make sure it gets things right again — which costs you time and money. If they make a keying error, these costs go up.

That's one good reason to get your computer a smart new assistant like the SLC-1. It listens to everything your computer says. When it recognizes a key phrase, it flashes back the answer instantly. A battery backup system keeps the SLC-1 running, come power failure or system crash. And unlike your regular operator, the SLC-1 doesn't make mistakes.

Plus the SLC-1 does a lot more than timekeeping. It also provides instant answers to a variety of mainframe questions. You pick the key phrase it looks for, and type in the responses. Then — for example — if your computer goes

down, it can be automatically re-booted back into action under the SLC-1's supervision.

The SLC-1 does all this because it's driven by its own computer, a 6502 microprocessor. So when you want to use your main computer for something else, you still have — for backup — the SLC-1, with its own 1K bytes of RAM (expandable to 12K).

But even with its optional 10-digit display, the SLC-1 is inexpensive to hire. And it's simple to train. Just plug it into the RS-232 or 20-mA current loop serial link between your computer and terminal, enter your message responses, and you're all set.

So give yourself a break: talk to our personnel counselor today at Digital Pathways, 1260 L'Avenida, Mountain View, CA 94043. Or contact us at (415) 969-7600. TWX 910-379-5034. We'll introduce you to a new assistant that doesn't talk back. Except to your computer.

**DIGITAL
PATHWAYS**

**MEET THE ASSISTANT COMPUTER OPERATOR
THAT NEVER TAKES A COFFEE BREAK.**

PERSONNEL FILE

Name: SLC-1

Title: Assistant Computer Operator

Qualifications: Smart
Makes no mistakes
Always on time
Compatible with any computer

Salary requirements: Works overtime for free

Hired by: Digital Pathways

Superior performer.

EMPLOYEE
FILE

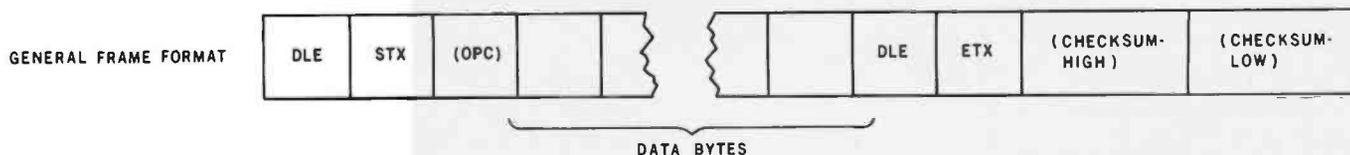


Figure 3: Frame format for data transmission. A frame is information that will be transmitted across the data link as a unit and checked for accuracy upon receipt. For the purposes of transmission accuracy, the data is preceded by a header and followed by a trailer. DLE and STX are both 1-byte ASCII characters. (OPC) stands for opcode, which is a 1-byte quantity that tells the receiver what kind of data follows. A running 2-byte total of the data bytes is kept. This is deposited as a checksum, high byte first, and is used by the receiving computer as a check against transmission errors.

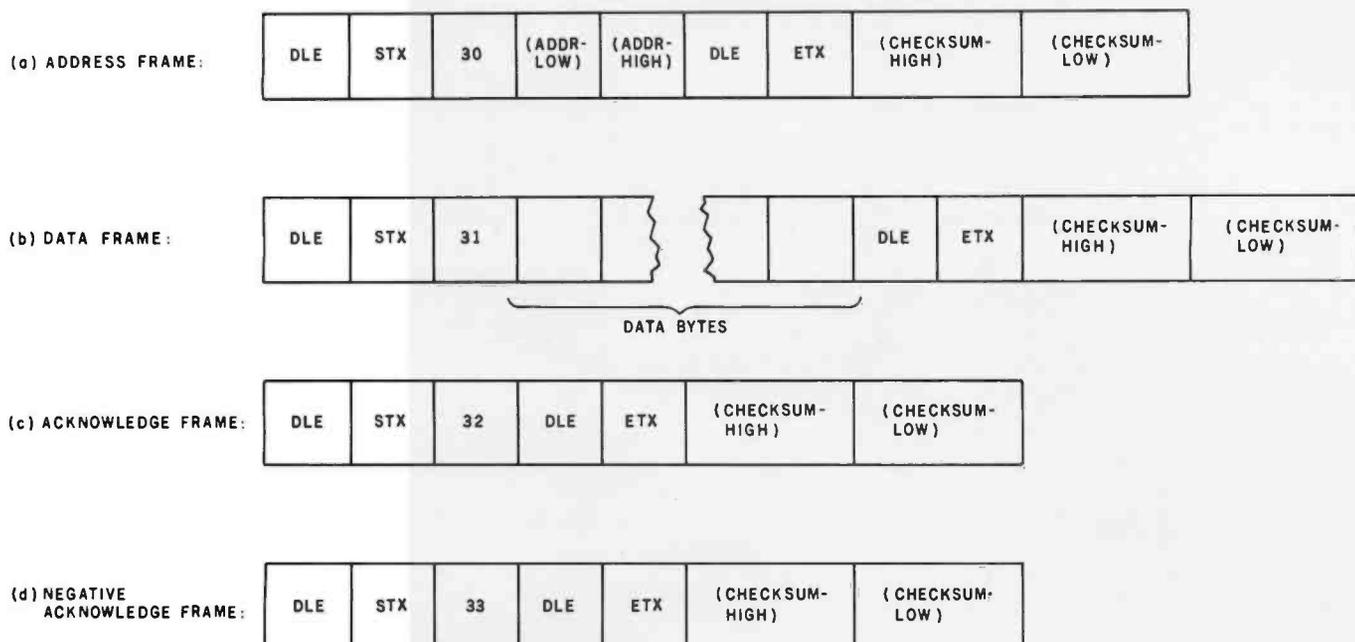


Figure 4: Frame formats for different types of data. The third byte in each frame dictates the type of data sent in that frame. A hexadecimal 30 means that the current frame contains a 2-byte hexadecimal address, sent high byte first: this is an address frame, with format as illustrated in figure 4a. A hexadecimal 31 denotes a data frame, which is the only frame that has a variable length. (See figure 4b.) Because the end of the data is marked by a DLE ETX sequence, a DLE within the data byte area is transmitted twice to indicate that it is data, rather than the end of valid data. A hexadecimal 32 denotes an acknowledge or ACK frame (figure 4c), while a hexadecimal 33 denotes a negative acknowledge or NAK frame (figure 4d). The address and data frames are sent to the computer that is receiving data. The ACK and NAK frames are sent from the receiving computer to acknowledge error-free or faulty transmission of the previous frame, respectively.

computer to the other. This is done by specifying a local starting address of the file, the remote loading-start address, and the byte count of the file. This is accomplished by a simple command interpreter that asks for these three parameters and initiates the transfer. Data blocks are transmitted by one computer, and their reception acknowledged by the other. This is the *file-transfer mode* of the software.

The following information outlines the sequence of events leading to the transfer of a file between computers. User A dials up user B over the telephone and both computers are connected via modems. (See figure 1.) User B tells user A, via the link, the

name and loading location of the desired file. The file can be a BASIC program, an assembly program, a letter, or any other kind of file.

User A types a control-F that initiates the local command interpreter, resulting in "S:" being displayed. User A keys in four hexadecimal digits (representing the source address) and a carriage return. The command interpreter types "D:" and waits for four more hexadecimal characters and a carriage return (representing the destination address).

Finally, a "#" directs user A to type in the byte count and a carriage return; this begins the file transfer. When the transfer is complete, user A's computer returns to the linking mode. Further file transfers can then

be negotiated before the telephone connection is manually broken.

During specification of the addresses and byte count, a backspace erases the previously typed character and a control-X aborts the command interpretation and returns the computer to the linking mode. Any illegal hexadecimal characters typed are ignored and the terminal bell is sounded for each occurrence.

Communication Protocol

To insure correct interpretation of a sequential stream of bytes, a communication protocol that imposes meaning on the data stream must be specified. Computer protocols, like human protocols, are those modes of behavior agreed upon between

Mark of the Unicorn



Amethyst

puts you in **C**ommand
of your text

Talk with Amethyst about words, sentences, paragraphs, chapters, quotations, footnotes, and more—it understands. Its ability to edit and display several documents and programs at once is absolutely unequalled by any other system.

Amethyst can be modified to suit your needs because we supply the source for the commands. You can arbitrarily alter the behavior of any command!

One year's support is included—we don't leave you to fend for yourself. And our thorough, readable documentation has received high acclaim from our users. Amethyst comes with the **BDS C** compiler. How many other word processing systems let you write programs as well?

Amethyst \$350 (less C compiler \$250) manual \$35

Mince (Amethyst text editor) \$125 manual \$15 demo disk \$10

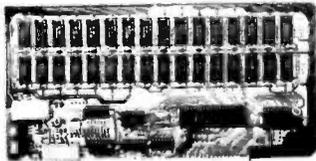
Scribble (Amethyst text formatter) \$125 manual \$15

Mince and Scribble ordered together \$175

48K CP/M^R required. Available on 8" soft sector diskettes. Mince and Amethyst require a cursor-addressable terminal. Dealer, site, OEM, and **NIX versions and licenses available.

Mark of the Unicorn, P.O. Box 423, Arlington, MA. 02174 (617) 489-1387

The days of complicated, unreliable, dynamic RAM are gone:



INTRODUCING JAWS

the ultrabyte memory board

\$199.95 (complete kit with 16K memory)

Netronics consistently offers innovative products at unbeatable prices. And here we go again — with JAWS, the ultrabyte 64K S100 memory board.

ONE CHIP DOES IT ALL

JAWS solves the problems of dynamic RAM with a state-of-the-art chip from Intel that does it *all*. Intel's single chip 64K dynamic RAM controller eliminates high-current logic parts . . . delay lines . . . massive heat sinks . . . unreliable trick circuits.

REMARKABLE FEATURES OF JAWS

Look what JAWS offers you: Hidden refresh . . . fast performance . . . low power consumption . . . latched data outputs . . . 200 NS 4116 RAMs . . . on-board crystal . . . 8K bank selectable . . . fully socketed . . . solder mask on both sides of board . . . designed for 8080, 8085, and Z80 bus signals . . . works in Explorer, Sol, Horizon, as well as all other well-designed S100 computers.

GIVE YOUR COMPUTER A BIG BYTE OF MEMORY POWER WITH JAWS — SAVE UP TO \$90 ON INTRODUCTORY LIMITED-OFFER SPECIAL PRICES!

UNDECIDED? TRY A WIRED 16K JAWS IN YOUR COMPUTER ON OUR 10-DAY MONEY-BACK OFFER (SPECIFY YOUR COMPUTER).

CONTINENTAL U.S.A. CREDIT CARD BUYERS OUTSIDE CONNECTICUT CALL

CALL TOLL FREE 800-243-7428

From Connecticut Or For Assistance: (203) 354-9375 Dept. (B4)

NETRONICS RESEARCH & DEVELOPMENT LTD.

333 Litchfield Road, New Milford, CT 06776

Please send the items checked below:

- JAWS 16K RAM kit, No. 6416, \$199.95.*
- JAWS 16K RAM fully assembled, tested, burned in, No. 6416W, \$229.95.*
- JAWS 32K RAM kit, No. 6432, (reg. price \$329.95), SPECIAL PRICE \$299.95.*
- JAWS 32K RAM fully assembled, tested, burned in, No. 6432W, (reg. price \$369.95), SPECIAL PRICE \$339.95.*
- JAWS 48K RAM kit, No. 6448, (reg. price \$459.95), SPECIAL PRICE \$399.95.*
- JAWS 48K fully assembled, tested, burned in, No. 6448W, (reg. price \$509.95), SPECIAL PRICE \$449.95.*
- JAWS 64K RAM kit, No. 6464, (reg. price \$589.95), SPECIAL PRICE \$499.95.*
- JAWS 64K RAM fully assembled, tested, burned in, No. 6464W, (reg. price \$649.95), SPECIAL PRICE \$559.95.*
- Expansion kit, JAWS 16K RAM module, to expand any of the above in 16K blocks up to 64K, No. 16EXP, \$129.95.*

*All prices plus \$2 postage and handling. Connecticut residents add sales tax.

Total enclosed: \$

Personal Check Money order or Cashiers Check

VISA MASTER CHARGE (Bank No.)

Acct. No. _____ Exp. Date _____

Signature _____

Print Name _____

Address _____

City _____

State _____

Zip _____

Send me more information

parties. Bridge-bidding sequences are an example of a human protocol, although the complete protocol agreement between partners must be negotiated. Computers require precisely specified protocols.

To encode meaning into a data stream, the concept of a *frame* must be introduced. A frame is a stream of bytes with a beginning-of-frame mark, a coded portion (which determines the use of the data), the data, and an end-of-frame mark. To enable more reliable communications along a noisy channel, a *checksum* is appended to the end of the frame; this is used by the receiver to verify that no bits have been dropped. Figure 3 presents the structure of the frames selected for this file-transfer application.

Computer protocols, like human protocols, are those modes of behavior agreed upon between parties.

Since each byte in a stream can assume any one of 256 values, a special technique is used to denote the beginning and ending of a frame. One particular byte is selected to be the data-link escape (DLE), to signify that the next byte is to be interpreted as either start of frame (STX) or end of frame (ETX). The receiver, when seeing a DLE and a STX in series, knows that a frame has begun. When the DLE ETX pair is received, it knows that the end of frame has been reached and that the next 2 bytes contain the checksum. To preclude the appearance of a DLE STX or DLE ETX pair within the data portion of the frame, all DLEs in a data frame are doubled—that is, transmitted as DLE DLE. The receiver, seeing two sequential DLE bytes, simply discards one of them to restore the frame to its original length.

The byte following the DLE STX is assigned the function of an operation code (*opc*) that is used to give meaning to the data portion of the frame. Four types of frames are defined: an address frame (hexadecimal 30), a data frame (hexadecimal 31), an acknowledge frame (hexadecimal 32),

and a negative acknowledge frame (hexadecimal 33). These four frames represent the minimum set required to successfully get a file transferred from one computer to another in a simple, yet reliable fashion.

One design possibility not used here would put the address field in the data frame so that the start-load address for each frame would be available just before its associated data. This would have eliminated the necessity for the address frame; however, it would require a buffer in the receiver equal to the length of the frame. The buffer would be used to hold the data until the checksum verified that the received data is perfect. If the data were not buffered, but was simply stored at the address specified, then an error in the address bytes would cause the data to be stored in the wrong portion of memory. With a separate address frame, the address will be verified as correct before the data arrives so that no receive buffering is required.

Following receipt of the address or data frame, the receiver returns either an acknowledge (ACK) or a negative acknowledge (NAK) frame, thus indicating whether the frame received is perfect. The sender uses this information to decide whether or not to retransmit the frame. Thus, both computers must communicate to get the whole file transferred without error.

Figure 4 illustrates the structure of each of the four types of frames. Data bytes corresponding to the code for DLE are doubled only in the data frame, which has variable length. This is unnecessary in the other three frames because they have a predefined length.

The checksum is simply a 16-bit sum of all the bytes in the frame (except the first DLE and the trailing ETX). This provides an *undetected bit-error* rate which is adequate for this application.

The frame structure is used only in file-transfer mode; in linking mode, each character is sent immediately; no error checking is considered to be necessary.

The lowest level of protocol involves the hardware interface between the two computers. In this application, the two computers are connected over an asynchronous bit-serial channel. This technique was selected for several reasons. A serial

NEECO

... Why not buy from the best?



commodore

4008 (8K RAM - 40 Column)	\$ 795
16K "B" (16K RAM - 40 Column)	995
32K "B" (32K RAM - 40 Column)	995
32K "N" (32K RAM - 40 Column)	1295
4032 "B" (32K RAM 4.0 Basic - 40 Column)	1295
4032 "N" (32K RAM 4.0 Basic - 40 Column)	1295
4016 "B" (16K RAM 4.0 Basic - 40 Column)	995
4016 "N" (16K RAM 4.0 Basic - 40 Column)	995
2022 Tractor Printer	795
4040 Dual Disk (340 2.0 DOS)	1295
8050 Dual Disk (1 Meg, 2.0 DOS)	1795
8010 IEEE Modem	395
CZN Cassette	95
PET - IEEE Cable	40
IEEE-IEEE Cable	50

INTERTEC DATA SYSTEMS

32K Superbrain (360K Disk Storage), CP/M*	\$2995
64K Superbrain (360 Disk Storage), CP/M*	3150
64K Quad Density Superbrain (700K Disk Storage), CP/M*	3995

ATARI COMPUTER SYSTEMS



ATARI 400 (8K RAM)	\$499.00
ATARI 400 (16K RAM)	630.00
ATARI 800 (16K RAM)	1,080.00
ATARI 410 RECORDER	89.95
ATARI 810 DISK DRIVE	599.95

NEECO also carries all available ATARI software

ALTOS COMPUTER SYSTEMS

	RAM	DISK	
ACS 8000-1S	64K	250K	\$2840
ACS 8000-28	64K	500K	3500
ACS 8000-1	64K	500K	3840
ACS 8000-2	64K	1M	4500
ACS 8000-4	64K	2M	5600
ACS 8000-5	64K	1M	5990
ACS 8000-6 Mul2 - Multi-User			
(14.5 M-Winchester)	112K	1M	10,670
(29 M-Winchester)	112K	1M	11,870
ACS 8000-6 Mul4 Multi-User			
(14.5 M-Winchester)	208K	1M	11,960
(29 M-Winchester)	208K	1M	13,160



apple computer
Authorized Dealer



16K APPLE II+	\$1330
32K " II+	1430
48K " II+	1530
APPLE DISK w/3.3 DOS	650
APPLE DRIVE Only	495

APPLE III in Stock!!

128K, with Monitor and Info Analytpak	4740
---	------

EPSON PRINTER MX-80

80 Columns, 9x9 Dot Matrix Bidirectional Printing ..	\$645
Interface Cards	
8140 (RS-232)	\$55
8161 (IEEE 488)	55
8131 (Apple Card)	85
8230 (Apple Cable)	25
8220 (TRS-80 Cable)	35

PROFESSIONAL SOFTWARE

WordPro I (8K) ...	\$29.95
WordPro III (40 Col.) 16K	199.95
WordPro III+ Enhanced Version	295.00
WordPro IV 80 Col., 32K	375.00
WordPro IV+ Enhanced Version	450.00

Multi-Cluster for Commodore Systems.

Allows 3 CPU's (Expandable to 8) to access a single Commodore Disk.

Multi-Cluster	\$795 (3 CPU's)
Each Additional CPU	\$199 (up to 8)

DIABLO 630

45 CPS, Letter Quality RS-232 Port	\$2,710
Tractor Option	250



NEC Spinwriter



5530 (Parallel)	\$3055
5510 (Serial)	3055
5520 (KSR-Serial)	3415
TRACTOR OPTION	225
55 CPS Letter Quality High Reliability	

C. ITOH Starwriter



Serial or Parallel \$1995

FP 1500
25 CPs,
Letter
Quality

NEECO

679 Highland Avenue
Needham, MA 02194

NEECO Order Lines: (617) 449-1760

MON - FRI 9:00 - 5:00 VISA/MC Accepted Telex 951021

NEECO Order Lines: (617) 449-1760

NEW!!! THE ELECTRIC MOUTH*



ELF II VERSION

for S100, Elf II, Apple, TRS-80 Level II*

From \$99.95 kit

Now — teach your computer to talk, dramatically increasing the interaction between you and your machine.

That's right: the ELECTRIC MOUTH actually lets your computer talk! Installed and on-line in just minutes, it's ready for spoken-language use in office, business, industrial and commercial applications, in games, special projects, R&D, education, security devices — there's no end to the ELECTRIC MOUTH's usefulness. Look at these features:

- * Supplied with 143 words/letters/phonemes/numbers, capable of producing hundreds of words and phrases.
- * Expandable on-board up to thousands of words and phrases (just add additional speech ROMs as they become available).
- * Four models, which plug directly into S100, Apple, Elf II and TRS-80 Level II computers.
- * Get it to talk by using either Basic or machine language (very easy to use, complete instructions with examples included).
- * Uses National Semiconductor's "Digitalker" system.
- * Includes on-board audio amplifier and speaker, with provisions for external speakers and amplifier.
- * Adds a new dimension and excitement to programming: lets you modify existing programs and games to add spoken announcements of results, warnings, etc.
- * Installs in just minutes.

Principle of Operation: The ELECTRIC MOUTH stores words in their digital equivalents in ROMs. When words, phrases, and phonemes are desired, they are simply called for by your program and then synthesized into speech. The ELECTRIC MOUTH system requires none of your valuable memory space except for a few addresses if used in memory mapped mode. In most cases, output ports (user selectable) are used.

Spoken Material Included

one	eighteen	at	dollar	inches	number	ss	c	i	
two	nineteen	cancel	down	is	of	second	d	u	
three	twenty	case	equal	il	nff	set	e	v	
four	thirty	cent	greater	kilo	on	space	f	w	
five	forty	400hertz	tone	feet	left	out	spread	g	x
six	fifty	80hertz	tone	flow	less	over	star	h	y
seven	sixty	20ms	silence	fuel	lesser	parenthesis	start	i	z
eight	seventy	40ms	silence	gallon	limit	percent	stop	k	
nine	eighty	80ms	silence	go	low	please	than	k	
ten	ninety	160ms	silence	gram	lower	plus	the	l	
eleven	hundred	320ms	silence	great	mark	point	time	m	
twelve	thousand	centi	greater	meter	pound	try	n		
thirteen	million	check	have	milli	pulses	up	o		
fourteen	zero	comma	high	milli	rate	volt	p		
fifteen	again	control	higher	minus	re	weight	q		
sixteen	ampere	danger	hour	minute	ready	a	e		
seventeen	and	degree	in	near	right	l	s		

*"Elf II" and "The Electric Mouth" are reg. trademarks of Netronics R&D Ltd. "Apple" is a reg. trademark of Apple Computer Inc. "TRS-80 Level II" is a reg. trademark of Tandy Corp.

Continental U.S.A. Credit Card Buyers Outside Connecticut

CALL TOLL FREE 800-243-7428

To Order From Connecticut Or For Technical Assistance, Etc.

Call (203) 354-9375

NETRONICS R&D LTD. Dept B4

333 Litchfield Road, New Milford, CT 06776

Please send the items checked below:

- S100 "Electric Mouth" kit \$99.95
- Elf II "Electric Mouth" kit \$99.95
- Apple "Electric Mouth" kit \$119.95
- TRS-80 Level II "Electric Mouth" kit \$119.95

Add \$20.00 for wired & tested units. All plus \$3.00 postage & insurance. Conn res. add sales tax.

Total Enclosed \$

Personal Check Cashier's Check/Money Order

Visa Master Charge (Bank No. _____)

Acct. No. _____

Signature _____ Exp. Date _____

Print Name _____

Address _____

City _____

State _____ Zip _____

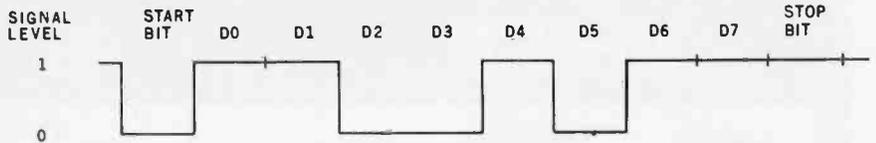


Figure 5: Serial transmission of data. When transmitting data between two computers on an asynchronous serial line, the data is transmitted 1 bit at a time with each byte of data (8 bits) framed by a start bit and a stop bit; a parity bit usually comes between the last data bit (D₇) and the stop bit but is omitted in this application due to the error checking already provided. Here, the byte being transmitted is binary 11010011 (read from right to left).

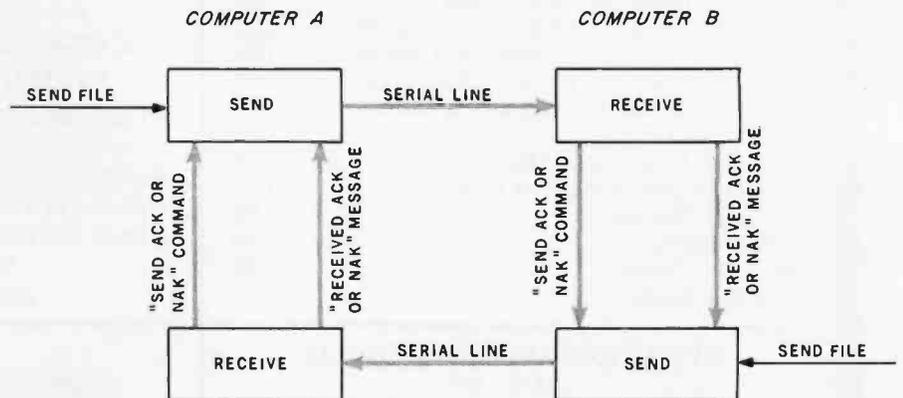


Figure 6: The interconnection of send and receive software modules. When computer A sends a data frame to computer B, the receive module of computer B tells its send module to transmit an ACK frame (if the data agrees with the checksum) or a NAK frame (if it does not). This acknowledgment frame is received by computer A, which then informs its send module to transmit new data, or retransmit the previous frame, as necessary.

channel uses few wires when a direct connection is possible. For longer distances, the link can be made by a telephone line and standard modems. Also, there are integrated circuits interfacing directly to the microprocessor that can handle this format very well. Figure 5 demonstrates how 8-bit bytes are transmitted along with their start and stop bits. To improve efficiency, no parity bit is used since the checksum provides error control.

Software Description

The software is organized into three cooperating modules: the *send routine*, the *receive routine*, and the *command interpreter*. The send and receive modules are used mainly for file transfer. The conceptual connection of these two software modules in both computers is detailed in figure 6. The send routine of computer A sends to the receive routine in computer B, and vice versa.

When the send module in A sends a frame, the receive module in B

verifies the checksum and tells the send module in B to send either an ACK or a NAK back to A. The send module in B sends the ACK or NAK to A's receive module, which then informs A's send module that an ACK or a NAK was received. Thus, two flags are necessary for communicating between the send and receive modules: one commanding "send ACK or NAK," and the other stating "received ACK or NAK." A "send file" flag to the send module of A initiates the file transfer.

Note the symmetry. Because the send and receive sections in each computer are independent, and because they communicate by flags, the send output can be fed directly into the receive input in the same computer for test purposes during debugging. Files can be moved from one place in memory to another within the same machine, simulating the actions of two coupled machines.

The third module of code is the command interpreter, which is used to specify the source starting address,

Text continued on page 266

QUALITY DISK SOFTWARE

BACKED BY ON-GOING APPLICATIONS SUPPORT

from SPECTRUM SOFTWARE

APPLE II (A)

TRS-80 (T)

HOME FINANCE PAK I: Entire Series \$49.95 (A) (T)

CHECK REGISTER AND BUDGET: This comprehensive CHECKING ACCOUNT MANAGEMENT SYSTEM not only keeps complete records, it also gives you the analysis and control tools you need to actively manage your account. The system provides routines for BUDGETING INCOME AND EXPENSE, AUTOMATIC CHECK SEARCH, and BANK STATEMENT RECONCILING. CRT or printer reports are produced for ACTUAL EXPENSE vs BUDGET, CHECK SEARCH DISPLAY RECONCILIATION REPORT and CHECK REGISTER DISPLAY by month. Check entry is prompted by user-defined menus of standard purposes and recipient codes, speeding data entry and reducing disk storage and retrieval time. Six fields of data are stored for each check: amount, check no., date, purpose, recipient and TAX DEDUCTIBLE REMINDER. CHECK SEARCH routines allow searching on any of these data fields. Routines are also provided for CHECK SORT by date and check no., DATA EDITING and Report Formats. Up to 100 checks/mo. storage \$39.95

SAVINGS: Account management system for up to 20 separate Savings accounts. Organizes, files and displays deposits, withdrawals and interest earned for each account. Complete records shown via CRT or printer \$14.95

CREDIT CARD: Get Control of your credit cards with this program. Organizes, stores and displays purchases, payments and service charges for up to 20 separate cards. Use for credit cards or bank loans. CRT or printer reports \$14.95

UNIVERSAL COMPUTING MACHINE: \$49.95 (A)

A user programmable computing system structured around a 50 row x 50 column table. User defines row and column names and equations forming a unique computing machine. Table elements can be multiplied, divided, subtracted or added to any other element. User can define repeated functions common to row or column greatly simplifying table setup. Hundreds of unique computing machines can be defined, used and stored, and recalled, with or without old data, for later use. Excellent for sales forecasts, engineering design analysis, budgets, inventory lists, income statements, production planning, project cost estimates-in short for any planning, analysis or reporting problem that can be solved with a table. Unique cursor commands allow you to move to any element, change its value and immediately see the effect on other table values. Entire table can be printed by machine pages (user-defined 3-5 columns) on a 40 column printer.

COLOR CALENDAR: \$29.95 (A)

Got a busy calendar? Organize it with Color Calendar. Whether it's birthdays, appointments, business meetings or a regular office schedule, this program is the perfect way to schedule your activities.

The calendar display is a beautiful HI-RES color graphics calendar of the selected month with each scheduled day highlighted in color. Using the daily schedule, you can review any day of the month and schedule an event or activity in any one of 20 time slots from 8:00 A.M. to 5:30 P.M. Your description can be up to 20 characters long. The system will also print out hard copies on your minimum 40-column printer.

BUSINESS SOFTWARE: Entire Series \$159.95 (A) (T)

MICROACCOUNTANT: The ideal accounting system for small businesses. Based on classic T-accounts and double-entry booking, this efficient program provides a ledger journal for recording posting and reviewing up to 1,000 transactions per month to any one of 300 accounts. The program produces CRT and printer reports covering:

Transaction Journal	Balance Sheet
Accounts Ledgers	Income and Expense Statement

Includes a short primer on Financial Accounting. Requires 48K Ram \$49.95

UNIVERSAL BUSINESS MACHINE: This program is designed to SIMPLIFY and SAVE TIME for the serious businessman who must periodically Analyze, Plan and Estimate. The program was created using our Universal Computing Machine and it is programmed to provide the following planning and forecasting tools.

CASH FLOW ANALYSIS	SALES FORECASTER
PROFORMA PROFIT & LOSS	SOURCE AND USE OF FUNDS
PROFORMA BALANCE SHEET	JOB COST ESTIMATOR
REAL ESTATE INVESTMENT	INVENTORY ANALYSIS

Price, including a copy of the Universal Computing Machine \$89.95

BUSINESS CHECK REGISTER AND BUDGET: Our Check Register and Budget programs expanded to include up to 50 budgetable items and up to 400 checks per month. Includes bank statement reconciling and automatic check search (48K) \$49.95

ELECTRONICS SERIES: Entire Series \$259.95

LOGIC SIMULATOR: SAVE TIME AND MONEY. Simulate your digital logic circuits before you build them. CMOS, TTL, or whatever, if it's digital logic, this program can handle it. The program is an interactive, menu driven, full-fledged logic simulator capable of simulating the bit-time response of a logic network to user-specified input patterns. It will handle up to 1000 gates, including NANDS, NORs, INVERTERS, FLIP-FLOPS, SHIFT REGISTERS, COUNTERS and user-defined MACROS. UP to 40 user-defined random, or binary input patterns. Simulation results displayed on CRT or printer. Accepts network descriptions from keyboard or from LOGIC DESIGNER for simulation \$159.95 (A) (T)

LOGIC DESIGNER: Interactive HI-RES Graphics program for designing digital logic system. A menu driven series of keyboard commands allow you to draw directly on the screen up to 15 different gate types, including 10 gate shape patterns supplied with the program and 5 reserved for user specification. Standard patterns supplied are NAND, NOR, INVERTER, EX-OR, T-FLOP, JK-FLOP, D-FLOP, RS-FLOP, 4 BIT COUNTER and N-BIT SHIFT REGISTER. User interconnects gates just as you would normally draw using line graphics commands. Network descriptions for LOGIC SIMULATOR generated simultaneously with the CRT diagram being drawn . . . \$159.95 (A)

MANUAL AND DEMO DISK: Instruction Manual and demo disk illustrating capabilities of both programs \$29.95

MATHEMATICS SERIES: Entire Series \$49.95 (A)

STATISTICAL ANALYSIS I: This menu driven program performs LINEAR REGRESSION analysis, determines the mean, standard deviation and plots the frequency distribution of user-supplied data sets. Printer, Disk, I/O routines \$19.95

NUMERICAL ANALYSIS: HI-RES 2-Dimensional plot of any function. Automatic scaling. At your option, the program will plot the function, plot the INTEGRAL, plot the DERIVATIVE, determine the ROOTS, MAXIMA, MINIMA, INTEGRAL VALUE \$19.95

MATRIX: A general purpose, menu driven program for determining the INVERSE and DETERMINANT of any matrix, as well as the SOLUTION to any set of SIMULTANEOUS LINEAR EQUATIONS. \$19.95

3-D SURFACE PLOTTER: Explore the ELEGANCE and BEAUTY of MATHEMATICS by creating HI-RES PLOTS of 3-dimensional surfaces from any 3-variable equation. Disk save and recall routines for plots. Menu driven to vary surface parameters. Hidden line or transparent plotting . . . \$19.95

ACTION ADVENTURE GAMES: Entire Series \$29.95 (A)

RED BARON: Can you outfly the RED BARON? This fast action game simulates a machine-gun DOGFIGHT between your WORLD WAR I BI-PLANE and the baron's. You can LOOP, DIVE, BANK or CLIMB-and so can the BARON. In HI-RES graphics. \$14.95

BATTLE OF MIDWAY: You are in command of the U.S.S. HORNETS' DIVE-BOMBER squadron. Your targets are the Aircraft carriers, Akagi, Soryu and Kaga. You must fly your way through ZEROS and AA FIRE to make your DIVE-BOMB run. In HI-RES graphics \$14.95

FREE CATALOG-All programs are supplied on disk and run on Apple II w/Disk & Applesoft ROM Card & TRS-80 Level II and require 32K RAM unless otherwise noted. Detailed instructions included. Orders shipped within 5 days. Card users include card number. Add \$1.50 postage and handling with each order. California residents add 6 1/2% sales tax. Foreign orders add \$5.00 postage and handling.



SPECTRUM SOFTWARE
142 Carlow, P.O. Box 2084
Sunnyvale, CA 94087

FOR PHONE ORDERS: (408) 738-4387
DEALER INQUIRIES INVITED.



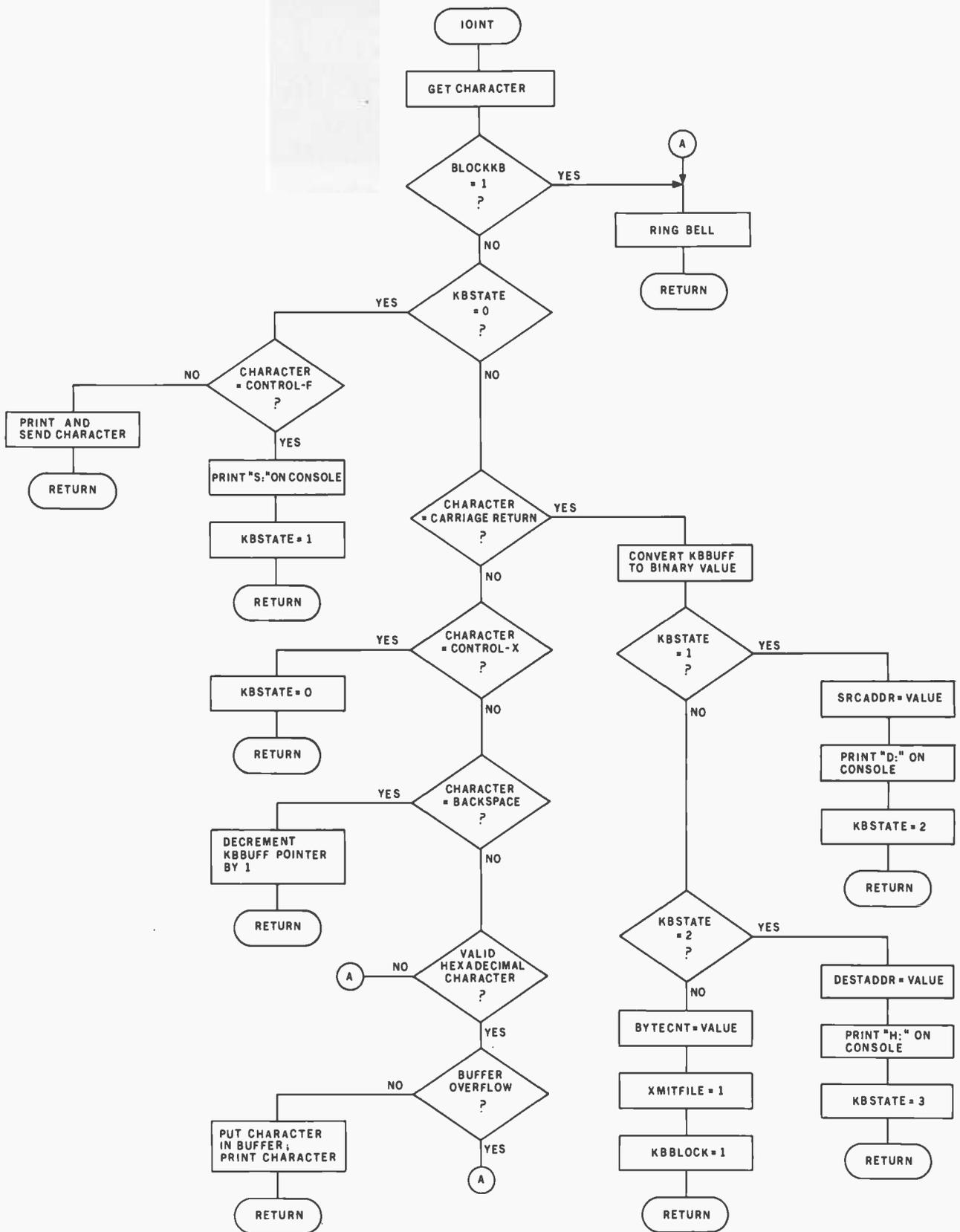


Figure 7: Flowchart for the command interpreter, IOInt. This routine gathers the information necessary to initiate the transfer of a given block of information between computers. An interrupt from the keyboard causes this routine to be executed (from the beginning) every time a key is pressed. The value of KBSTATE (keyboard state) causes the routine to ask for the starting address of the block to be sent (with the prompt "S:"). This is followed by a request for the destination address for the first byte (prompted with "D:"), and the number of bytes to be transferred (prompted with "#:"). Once this information has been given, the routine disables the keyboard from further input (KBBLOCK=1) and sets a flag that tells the software send module to begin sending the block of data (XMITFILE=1).

MAIN FRAME POWER— MICRO PRICE



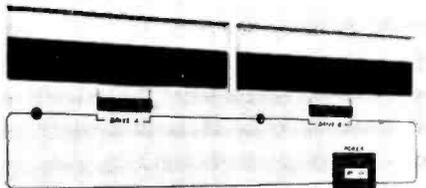
OSM's ZEUS multiprocessor computer system delivers main frame performance for one to 64 users—**performance impossible in a single processor micro!** We start with the S100 bus and mount a Z80A as master processor to control the shared resources of disk and printer. Then we add a separate single board Z80A processor for each user (no bank switching!) so ZEUS can **grow any time from a single user to many** with no changes in programs or files. And each user is independent of reset or program crash in other users.

OSM's MUSE operating system—the Multi User System Executive—is **many times faster than other leading operating systems.** Each user owns a resident copy of MUSE so you don't wait for the bus or interrupt the master processor to do console I/O and applications code. MUSE finds files fast with a random directory access similar to random file access. And MUSE protects shared files from simultaneous update to the same record by different users. We designed MUSE from the start for multi-user data base environments—yet MUSE is **CP/M* compatible!**

Check the other multi-processors!

Check the hardware!

- S100 compatible master processor (4MHz Z80A, 32K dynamic RAM) for disk and shared printer control
- single board processor (4MHz Z80A, 64K dynamic RAM), with I/O on board, for each user
- serial and parallel ports on each user board support optional slave printer or other user devices
- rack mountable enclosure built to highest industrial standards for reliable continuous operation
- readily field expandable to any configuration from 1 user, 64K RAM, to 64 users, 4 Megabyte RAM
- 2.4 Megabyte double sided dual density 8" floppy disk
- 26 to 96 Megabyte hard disk option
- independent user processor reset directly from each keyboard



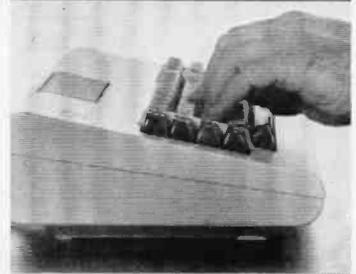
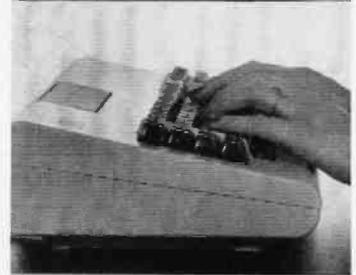
Check the operating system!

- all MUSE code written in Z80 native code (not 8080 code) for fast response
- MUSE user operating system in 7K RAM on board each user processor reduces calls to the master processor
- transfer of data between master and users via single Z80 block move command for highest speed
- random directory search provides immediate file access
- common file area for shared programs and files eliminates redundant files while individual user file areas protect each user's private files
- shared file update with record level lockout
- spool file can be displayed, updated, reprinted
- password security protects multiple user data bases
- MUSE supports standard CP/M* word processors, utilities, and languages: MBASIC, CBASIC, PASCAL, FORTRAN, COBOL, FORTH, C, PL/1, etc.

Check the price!

- under \$15,000 for 2 user, 160K RAM, 26 Megabyte ZEUS system with dual floppy drives

See OSM at the West Coast Computer Faire booth 1635, in San Francisco, April 3-4-5



**WE'RE SHIPPING ZEUS MICRO MAIN FRAMES!
CALL US TODAY 408-496-6910 ex 40**

**2364 Walsh Avenue #4
Santa Clara, CA 95051**

OSM

*CP/M is a registered trade mark of Digital Research

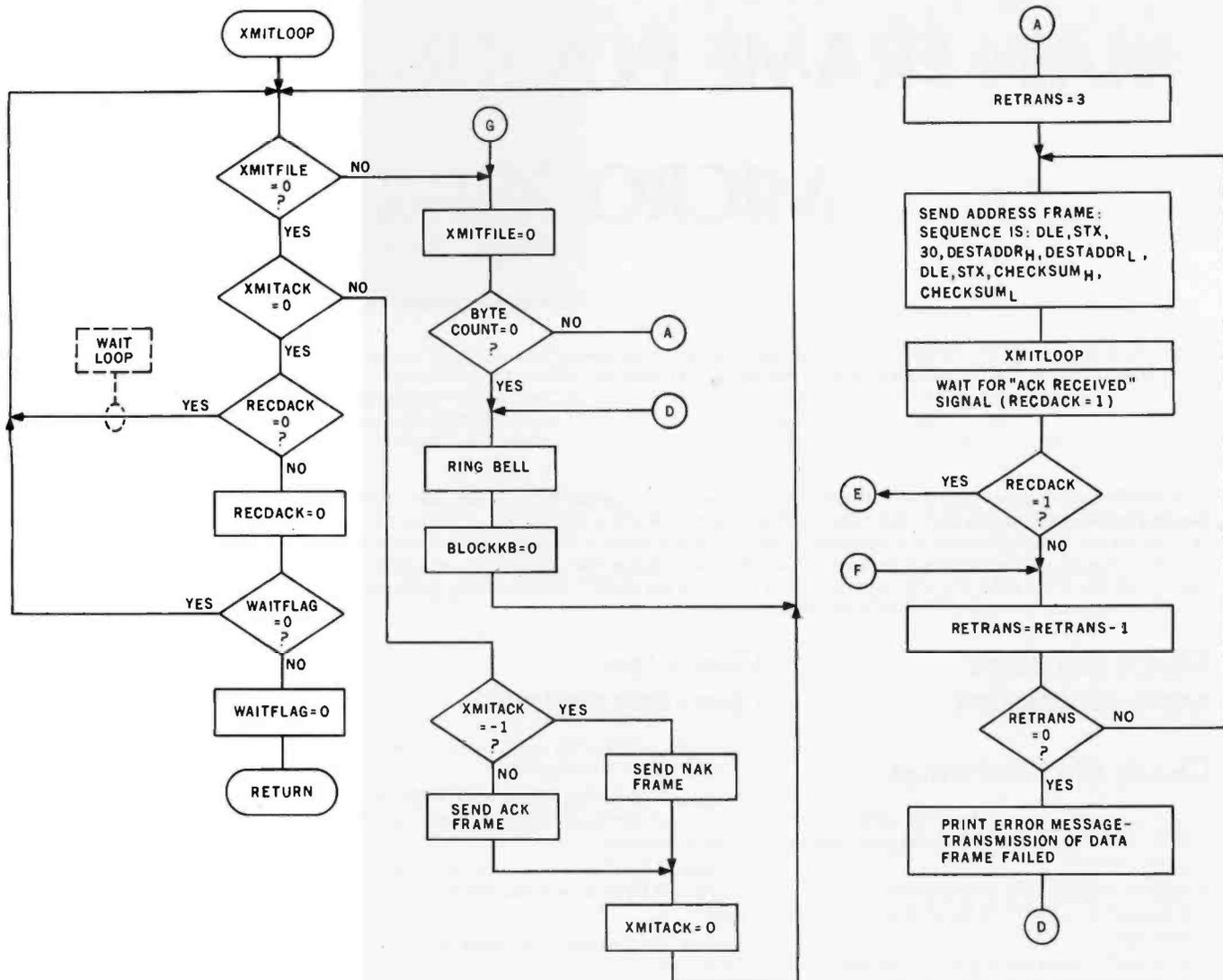


Figure 8: Flowchart for the send module. This routine, when activated by the condition `XMITFILE=1`, causes the computer to transmit a block of data in the form of an address frame, followed by a data frame. It waits in a loop until `XMITFILE` is set to 1, signaling that a block of data is ready to be transmitted. It then sends the address data frames, waiting after each for an ACK frame response from the receiving computer. If either frame is received imperfectly, the process begins again with the address frame. Software limits repetition to a total of three tries. All numbers used in this figure are hexadecimal. Also, the variables `ADDRESS`, `BYTECNT`, `CHECKSUM`, `DESTADDR`, `INDEX`, and `SRCADDR` are all 2-byte variables. The subscripts `H` and `L` refer to the high and low bytes, respectively, of a 2-byte variable. If the block to be transmitted is more than decimal 256 (hexadecimal 100) bytes long, it is transmitted in blocks of 256 bytes.

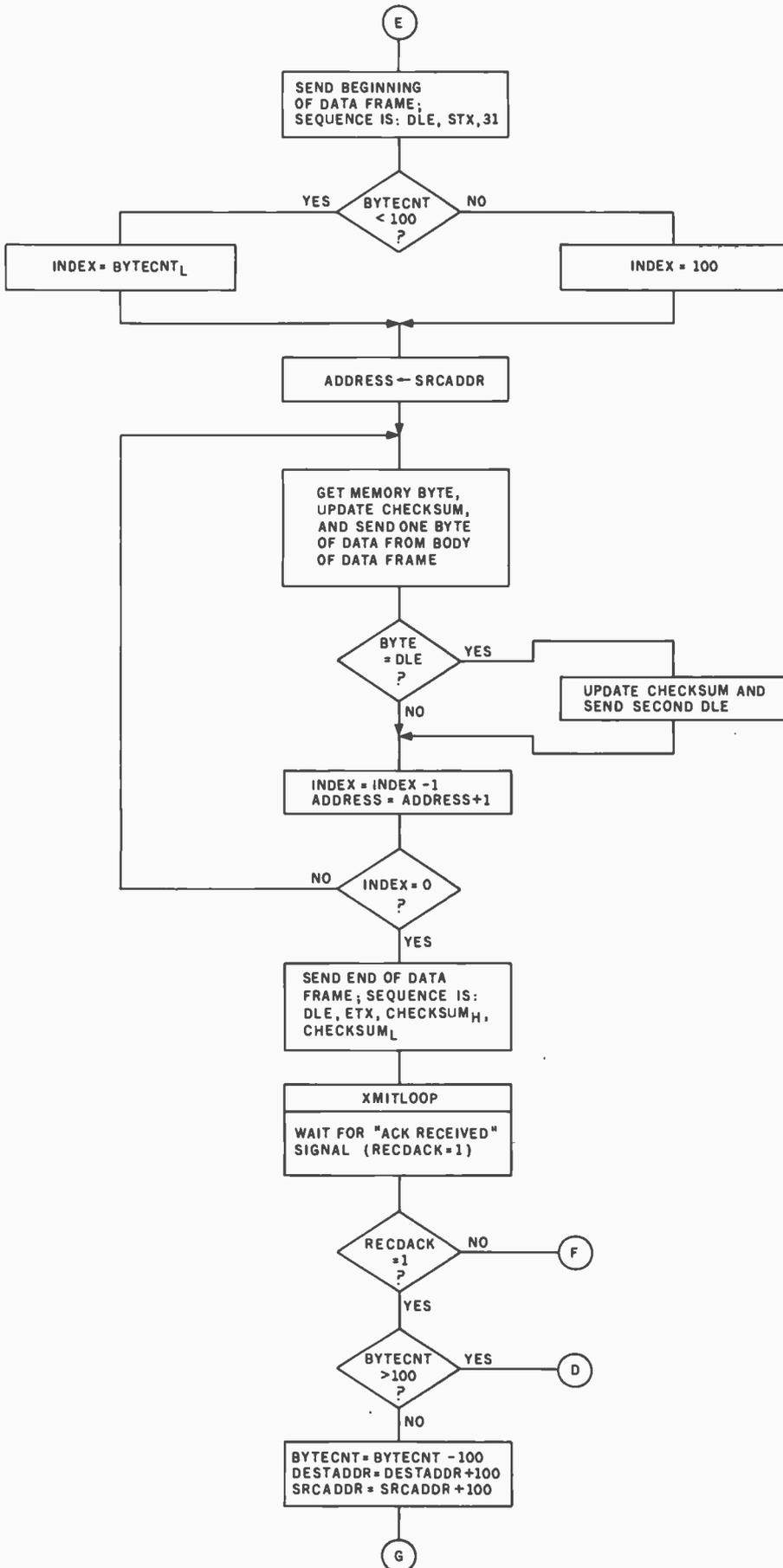
On Flowcharting Interrupt-Driven Routines

The perceptive reader may notice that the flowchart of figure 9 (on page 266) does not have a return or end block. Although it may not be immediately obvious, the same is true of the flowchart in figure 8. (The one return block that does exist is used only when the `XmitLoop` routine is returning from calling itself.) The reason for this and other seeming omissions has to do with the function of interrupts in the data-link routines.

When the data-link software (see listing 1) is running, it is usually in the `XmitLoop` routine, repeating the wait loop marked in the flowchart of `XmitLoop`. (See figure 8.) If an interrupt comes from the keyboard, control transfers to the `IOInt` routine, flowcharted in figure 7, and returns to the routine that was executing before the interrupt.

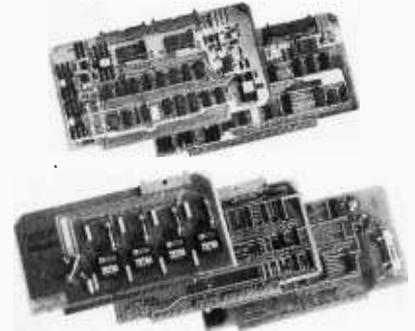
If an interrupt comes from the serial line, control transfers to some location within the `LineInput` routine, but, instead of starting at

the beginning of the routine (as is done with the `IOInt` routine), control transfers to the instruction directly after the "bsr `GetByte`" (branch to `GetByte` subroutine) instruction most previously executed. (See figure 9.) This can be accomplished because the `GetByte` subroutine stores the return address in the variable `ACIAState`; it is this address that is jumped to upon a serial line interrupt (see routine `IOInt` in listing 1).



TOUGHEST BOARDS IN TOWN FOR S-100's

Monitor and control in wicked environments.



Want to put your S-100 system to work in the world of computerized monitoring and process control?

Dual Systems has all the boards it takes to do the job in the toughest factory environments. All are designed to function dependably in the real world of industrial control. All operate with Cromemco, North Star and other S-100 systems.

A/D board. 12-bit precision. 32 single-ended inputs. Or 16 differential inputs. 25 μs conversion time. Vectored interrupt. \$635. Or \$725 with 1 to 1000 gain transducer amplifier. Works with our thermocouple compensation board and our 4-20 mA input boards as well.

D/A board. Four independent channels. 12-bit precision. Input is binary or 2's complement. Compatible with all existing I/O mapped software. \$495. Drives our amplifier board which outputs 4-20 mA.

CMOS RAM board. On-board battery back-up preserves data a year. 200 ns read/write time. Runs at 4 MHz. 8K bytes \$590. 16K bytes \$990.

CMOS clock board. On-board battery back-up keeps clock running a year. New LSI chip carries date, hours, minutes and seconds. Read or write directly from I/O port. Vectored interrupt. \$250.

We also provide complete main-frame systems. OEM and dealer inquiries are invited.

Contact Dual Systems Control Corp., Dept. B, 1825 Eastshore Hwy., Berkeley, CA 94710. Phone (415) 549-3854.



Two-on-the-aisle. New Clipper® Class style.

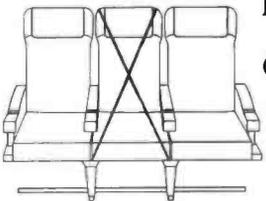


No more middle seat in our brand new business section.

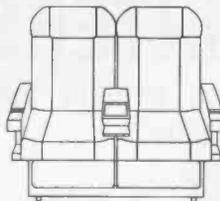
We've redesigned Clipper Class completely.

So you'll never get stuck in the middle seat. Or by an elbow.

You'll never be more than one seat from an aisle, either. Even if there's a full house.



What's more, our Clipper Class seats are wider and more comfortable than ever before. In fact, they're the same seats selected for first class on the next generation of jets.



The ones due for delivery around 1985.

You see, Pan Am's new Clipper Class isn't just an upgraded economy section. It's a totally separate part of the plane especially for business travelers.

With all the extras you'd expect and a lot you wouldn't.

New Clipper Class is now offered on selected Pan Am 747 routes. And by mid-year, we'll have it on our entire 747 fleet worldwide.

Ask your Travel Agent, Corporate Travel Department or us about Pan Am's new Clipper Class.

PAN AM



Say hello to Pan Am.

The operation of the interpreter is a function of the state variable, KBSTATE. If the state is zero, the transparent mode case, the character is echoed locally and sent to the remote computer. Otherwise, the character is tested for being a carriage return (CR).

The carriage return causes the keyboard buffer (which collects address or byte-count hexadecimal characters) to be converted to a binary value. If the character is a control-X, the interpreter mode is aborted and KBSTATE is returned to zero.

If the character is a BS (backspace), the pointer into the keyboard buffer is decremented (after first checking for underflow). If none of the above is true, the character is checked for being a proper hexadecimal character and is then put in the keyboard buffer (after checking for overflow). The keyboard buffer holds as many as four hexadecimal characters, which is the largest buffer needed to specify a 16-bit address or a byte count.

The sequence of characters echoed on the terminal following the carriage return, as well as the location of the

binary value, are dependent on the current state of the interpreter. After each carriage return, the state is incremented to ensure that the correct control path is executed for each of the three parameters collected. Finally, the last carriage return after the byte count specification sets the BLOCKKB flag and the XMITFILE flag. The BLOCKKB flag prevents any keyboard characters from appearing on the line during a file transfer. The XMITFILE flag tells the send module to begin sending the specified file.

Send Routine Structure

The send module, XmitLoop, is responsible for sending address, data, ACK, and NAK frames to the remote receive module. Figure 8 shows the flowchart for the program flow of the send routine. This routine operates in background mode, testing three flags to see if any work is pending. If the XMITACK flag is -1, a NAK frame is sent; if it is +1, an ACK frame is sent.

If the RECDACK flag is not zero, and the send routine is waiting for an ACK or a NAK, then a return is made

to the data transfer routine to complete the data or address frame transfer. (This will be explained in more detail later.) If the XMITFILE flag is non-zero, then file transfer begins.

As explained earlier, the address frame is sent first so that no buffering in the receiver is necessary in case of an address error. Once the address is correctly received and acknowledged, a data frame is sent. If the data frame is acknowledged, the next address and data frames are sent, and the process is repeated.

If a NAK frame is received, then the address frame received in error is retransmitted and verified before the data block is retransmitted. When sending either an address or a data frame, the send routine employs the same mechanism in waiting for an ACK or NAK. When the wait for an ACK or NAK signal is necessary, the send module XmitLoop calls itself by storing the return address on the stack and branching to the beginning of the routine. When the send routine finds that the RECDACK flag is set, control is returned to the proper location in the send routine via an RTS (return from subroutine) instruction. The RECDACK flag indicates whether a new frame should be sent or the old one retransmitted.

A retransmission index is maintained and decremented each time a frame retransmission is necessary, and no more than three retransmissions are allowed. (The number of retransmissions allowed is a parameter that is easily changed.) If more than three failures occur, an error message is typed on the sender's console and control returns to the transparent mode. When all of the file has been successfully transmitted, control returns to transparent mode and the keyboard is enabled.

In data frames, data bytes that happen to have the same hexadecimal value as the DLE code are doubled (repeated) so that a false end of frame is prevented; the receive routine drops the second DLE so that the data is received correctly. In the worst case, this has the effect of doubling the length of the frame.

Receive Routine Structure

The flowchart for the receive program, named LineInput, is shown in figure 9. This routine handles the in-

Text continued on page 286

ELIMINATE INTERACTING FLOPPIES, PRINTERS

and processors with these AC power centers that have spike suppressors and filtered AC sockets.

8 sockets, 3 pairs individually filtered, spike suppression



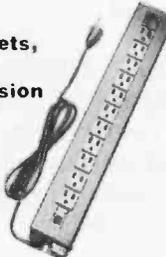
MFJ-1107
\$69⁹⁵

12 sockets, one filter for all, spike suppression



MFJ-1106
\$49⁹⁵

12 sockets, spike suppression



MFJ-1105
\$39⁹⁵

New MFJ multi-outlet AC power centers let you eliminate interaction of floppies, printers, memory, etc. caused by power line coupling, and eliminate power line spikes that can cause memory loss, errors, and erratic operation.

MFJ-1107, varistors (from each line to ground and line to line) suppress spikes.

8 sockets (4 pairs), all 3-prong, RFI pi-filters on each line for each of 3 pairs of sockets isolate equipment from each other and power line. Fourth pair is unswitched/unisolated.

Lighted power switch. Pop-Out fuse. 3-wire 6 foot cord, 15A/125VAC. 1875 watts total.

Rugged heavy-gauge aluminum case. Black. Easy mounting slots. 18"L x 2-3/4"W x 1-7/8"H.

MFJ-1106, similar to 1107 but 12 sockets (2 unswitched), one filter for all. has spike protection, lighted switch, fuse.

tection, lighted switch, fuse.

MFJ-1105, same as 1106, less RFI filter. Order from MFJ and try it — no obligation. If not delighted, return it within 30 days for refund (less shipping). One year unconditional guarantee.

Order today. Call toll free 800-647-1800. Charge VISA, MC or mail check, money order for amount as indicated above plus \$4.00 shipping each.

Eliminate spikes and interaction. order now.

CALL TOLL FREE ... 800-647-1800

Call 601-323-5869 for technical information, order/repair status. Also call 601-323-5869 outside continental USA and in Mississippi.

MFJ ENTERPRISES, INCORPORATED

Box 494, Mississippi State, MS 39762

Why The People Who Know Use FMS-80

FMS-80, a data base management system, is the most powerful DBM program available to the microcomputer industry. Written in assembly language, it offers these features:

- Operates on CP/M*, MP/M* or CDOS** systems.
- User Definable: Screen formatting with up to 255 screens per data file, report generator, and menus capable of calling other CP/M programs or FMS-80 programs.
- No restrictions to record size other than available RAM memory size.
- Instantaneous data record inquiry on indexed data records.
- Capable of selecting on any field or multiple fields with multiple selection criteria (fields do not have to be keyed).
- Mathematical manipulation of numeric data fields (add, subtract, multiply and divide).
- Capable of collecting information from multiple data files and generating a new data file or report.
- All menu driven.
- Capable of abstracting data from other programs written in other languages.
- Available now (off the shelf).

All these capabilities are available with the added plus of ease of programming.

See What Users of FMS-80 Have to Say:

Mike Ketcham, systems consultant and programmer for Management Information Systems: "FMS-80

allows me the flexibility of quickly creating programs for user applications. It is flexible, in that data can be entered in a form that the secretary recognizes and generates reports that the manager requires. Also, the user-definable menus allow me to actually generate a menu from which the user can select, creating a true turnkey system." Tom Niccoli, Partner, Computerland of Phoenix: "FMS-80 is flexible enough to acquire data from an application program that was previously written and allowed me to generate the reports that my customer needed. It closed the deal for me. Considering its capability, FMS-80 is one of the most cost-effective application programs available today."

If you're continuously asked to do applications programming, and you don't have the time to do it in Basic, consider FMS-80. For additional information on FMS-80, contact Systems Plus, 3975 East Bayshore, Palo Alto, CA 94303. Phone (415) 969-7047.



Systems Plus

*TM of Digital Research, Pacific Grove, CA
**TM of Cromemco, Sunnyvale, CA

Mike Ketcham, Management Information Systems, Belmont, CA

Listing 1: Software for data transfer between two 6800-based systems linked by a serial line. The software here consists primarily of a data-sending routine (labeled XmitLoop), a data-receiving routine (labeled LineInput), and a command interpreter (labeled IOInt). All numbers preceded by a dollar sign (\$) are hexadecimal numbers. Also, references to '0', '1', '2', and '3 are actually to the characters "0", "1", "2", and "3". These characters, when represented in ASCII, have values of hexadecimal 30, 31, 32, and 33 and are referred to in text and in flowcharts as such. Flowcharts 7 thru 9 correspond to the code given in this listing.

```

0090 dle      equ      $90      dle char
00A3 etx     equ      $83      etx char
00B2 stx     equ      $82      stx char
0007 bell    equ      7        bell char
001A ^X      equ      $18      control X
0006 ^F      equ      6        control F
0008 bs      equ      8        backspace
000D cr      equ      $d       carriage return
0018 IOPtr   equ      $18      I/O interrupt vector
F900 AciaCsr1 equ      $f900    Acia to terminal
F901 AciaData1 equ      $f901
F902 AciaCsr2 equ      $f902    Acia to modem
F903 AciaData2 equ      $f903
0050 SaveOpc equ      $50      place to save opc
0051 AciaState equ      $51    state of acia fsm
0054 SrcAddr equ      $54      ftp source address
0056 DestAddr equ      $56     ftp destination addr
0058 ByteCnt equ      $58      ftp byte count
005B RinVal  equ      $5b     place to save number
005D KbPtr   equ      $5d     ptr into KbBuff
005F KbBuff  equ      $5f     4 char buffer
0062 KbEnd   equ      $62     end of huffer
0063 ChkSum  equ      $63     xmit checksum, recv side
0065 RecdChk equ      $65     recd checksum, recv side
006A KbState equ      $6a     state of kb handler
006B RecdAck equ      $6b     flag - recd ack
006C XmitAck equ      $6c     flag - send ack
006D XmitFile equ      $6d     flag - send file
006F WaitFlag equ      $6e     flag - wait for ack/nack
0076 BlockKb equ      $76     flag - blocks kb activ
0075 SaveSum equ      $75     place to save checksum
0077 XChkSum equ      $77     xmitted checksum
0079 Address equ      $79     recv store address

1000                                org      $1000

                                * Entry point
1000 86 03      Start  lda a      #3          reset Acia's
1002 87 F900   sta a      AciaCsr1
1005 87 F902   sta a      AciaCsr2
1008 86 96     lda a      #$96       /64,8 bits, interr
100A 87 F900   sta a      AciaCsr1
100D 87 F902   sta a      AciaCsr2
1010 CE 110D   ldx      #InzAcia  set up acia2 entry
1013 DF 51     stx      AciaState
1015 CE 1107   ldx      #IOInt
1018 DF 18     stx      IOPtr
101A 86 06     lda a      #6          clear the flags
101C CE 026A   ldx      #KbState  start of area
101F 6F 00     inzloop  clr      x
1021 08        inx
1022 4A        dec a
1023 26 FA     bne      inzloop
1025 CE 005F   ldx      #KbBuff   inz the buffer ptr
1028 DF 5D     stx      KbPtr
102A 01        nop
102B 0E        cli

                                * Background routine - checks event entries
102C 96 6D     XmitLoop lda a      XmitFile  xmit file event?
102E 26 2A     bne      InzAddr
1030 CE 1267   ldx      #NackFrm  ptr to nack frame
1033 96 6C     lda a      XmitAck  xmit ack/nack event?
1035 26 0F     bne      GoAck
1037 D6 68     lda b      RecdAck  recd ack/nack event?

```

Listing 1 continued on page 272

TRS-80® MODEL III OWNERS

We think our disk system for expanding your capacity is just as good as theirs - and we know it costs much less . . .

COMPLETE SYSTEMS AND COMPONENTS*

TRS-80® MOD III SYSTEM

with 2
disk drives

SAVE \$500
OFF LIST PRICE

\$1,895

16K RAM, Model III Basic \$899

MTI DISK DRIVES for MODEL III

Internal Kits

Disk Drive 1 \$649
Disk Drive 2 \$279

External Add-on Kits

Disk Drive 3 \$379
Disk Drive 4 \$359

Model III DOS & Manual \$21.95

16K RAM Kit \$59

RS-232 Serial Interface \$95

PRINTERS

Anadex 9500 \$1,449

Microline 82 \$849

Microline 83 \$1,060

Centronics 779 \$1,069

Centronics 700 \$1,129

Base 2 \$649

Centronics 737 \$839

Epson MX-80 \$579

Malibu \$2,093

Daisy Wheel \$1,799

Save 5% Off with Purchase of MOD III System or Disk Drive



New low cost internal disk kit available to expand your storage capability. With this kit, now, you may expand your Model III computer up to four MTI 40 track disk drives, giving 175,000 bytes of storage per drive for a total of 700K.

The kit includes one 40 track disk drive, controller, power supply, cables, mounting hardware and installation documentation.

Manufacturer Direct
Price ONLY

\$649



MICROCOMPUTER TECHNOLOGY, INC.

3304 W. MACARTHUR, SANTA ANA, CA 92704

★ PHONE (714) 979-9923 ★ TELEX #678401TAB IRIN

*Uses MTI Memory, Disk Drives & Components

® TRS-80® IS A REGISTERED TRADEMARK
OF TANDY CORPORATION



ALL PRICES CASH DISCOUNTED
FREIGHT FOB FACTORY
ASK FOR FREE CATALOG

Listing 1 continued:

```

1039 27 F1          hea      XmitLoop
103B 97 68          sta a   RecdAck   clear the event
103D 96 6E          lda a   WaitFlag
103F 27 FB          beq     XmitLoop
1041 7F 006E        clr     WaitFlag   clear the flag
1044 17              tha     reg a is ack/nack flag
1045 39              rts     return to waiting routine

* Routine for sending Ack/Nack frame
1046 2B 03          GoAck   bmi     Skpldx   send nack?
1048 CE 126A        ldx     #AckFrm   send ack!
104B C6 07          Skpldx  lda b   #7         frame byte count
104D A6 00          FrmLoop lda a   x         get byte
104F BD 10EA        jsr     SendChar  send out
1052 08              inx
1053 5A              dec b
1054 26 F7          bne     FrmLoop
1056 D7 6C          sta b   XmitAck   clear the event
1058 20 D2          Fin4    bra     XmitLoop

* Routine for sending Address frame
105A 7F 006D        InzAddr clr     Xmitfile  clear flag
105D DE 58          ldx     ByteCnt   check for null
105F 27 51          beq     LastBlk
1061 C6 03          lda b   #3         retransmission index
1063 37              GoAddr  psh b   save it
1064 C6 30          lda b   #0         opcode byte
1066 8D 52          bsr     SendHdr   send dle, stx, opc
1068 96 56          lda a   DestAddr  send out addr bytes.
106A 8D 73          bsr     UpdtChk
106C 96 57          lda a   DestAddr+1
106E 8D 6F          bsr     UpdtChk
1070 8D 59          bsr     SendTl   send dle, etx, cc = wait

* there is a wait for ack/nack here
1072 33              pul b   get retrans index
1073 4D              tst a   check ack/nack flag
1074 2B 33          bmi     RetryBlk  branch if ack

* Routine for sending block of data
1076 37              GoFile  psh b   save retrans index
1077 C6 31          lda b   #1         opcode
1079 8D 3F          bsr     SendHdr   send dle, stx, opc
107B 5F 58          clr b   inz byte count index
107C 96 58          lda a   ByteCnt   chk upper byte
107E 26 02          bne     SkipLd
1080 D6 59          lda b   ByteCnt+1 < 256 bytes left
1082 DF 54          SkipLd  ldx     SrcAddr
1084 37              SendBytes psh h   save it
1085 A6 00          lda a   x         get byte
1087 33              pul b   restore
1088 8D 55          bsr     UpdtChk   update checksum, send
108A 81 9A          cmp a   #dle      check for dle
108C 26 02          bne     FinDoub
108E 8D 4F          bsr     UpdtChk   update checksum, send
1090 08          FinDoub inx
1091 5A              dec b   check byte count
1092 26 F0          bne     SendBytes
1094 8D 35          bsr     SendTl   send dle, etx, cc = wait

* there is a wait for ack/nack here
1096 33              pul b   get retrans index
1097 4D              tst a   check ack/nack flag
1098 2B 0F          bmi     RetryBlk  check for failure
109A 96 58          lda a   ByteCnt   check for done
109C 27 14          beq     LastBlk
109E 7A 005A        dec     ByteCnt   decrease by 256 bytes
10A1 7C 0056        inc     DestAddr  increase by 256 bytes
10A4 7C 0054        inc     SrcAddr   increase by 256 bytes
10A7 20 B1          bra     InzAddr
10A9 5A              RetryBlk dec b
10AA 26 B7          bne     GoAddr
10AC CE 126E        Error  ldx     #ErrorMsg print error msg
10AF BD 11B2        jsr     OutText

```

Listing 1 continued on page 274

Listing 1 continued:

```

10B2 86 07  LastBk  lda a    #bell    ring the bell
10B4 8D 41      nsr      SendTerm  send bell to term
10B6 D7 6F      sta b    BlockKb   unlock the kb
10B8 20 9E      Fin2    bra      Fin4     end of file xfer

* Subroutine which sends out dle, stx, and inz checksum
10BA 86 90      SendHdr  lda a    #dle     dle char
10BC 8D 2C      bsr     SendChar  send dle
10BE 4F          clr a
10BF 97 77      sta a    XChkSum  inz checksum
10C1 97 78      sta a    XChkSum+1
10C3 86 82      lda a    #stx
10C5 8D 18      bsr     UpdtChk  send stx
10C7 17          tba
10C8 8D 15      bsr     UpdtChk  send opcode
10CA 39          rts

* Subroutine which sends out dle, etx, ccl, cc2
* and sets up wait for ack/nack
10CB 86 90      SendT1   lda a    #dle
10CD 97 6E      sta a    waitFlag  indicate waiting ack/nack
10CF 8D 0E      bsr     UpdtChk  send out dle
10D1 86 83      lda a    #etx
10D3 8D 15      bsr     SendChar  send out etx
10D5 96 77      lda a    XChkSum
10D7 8D 11      bsr     SendChar  send high byte
10D9 96 78      lda a    XChkSum+1
10DB 8D 0D      bsr     SendChar  send low byte
10DD 20 D9      bra     Fin2     go to idle loop

10DF 36          UpdtChk  psh a
10E0 98 78      add a    XChkSum+1
10E2 24 43      bcc     SkpH
10E4 7C 0077    inc     XChkSum
10E7 97 78      SkpH    sta a    XChkSum+1
10E9 32          pul a

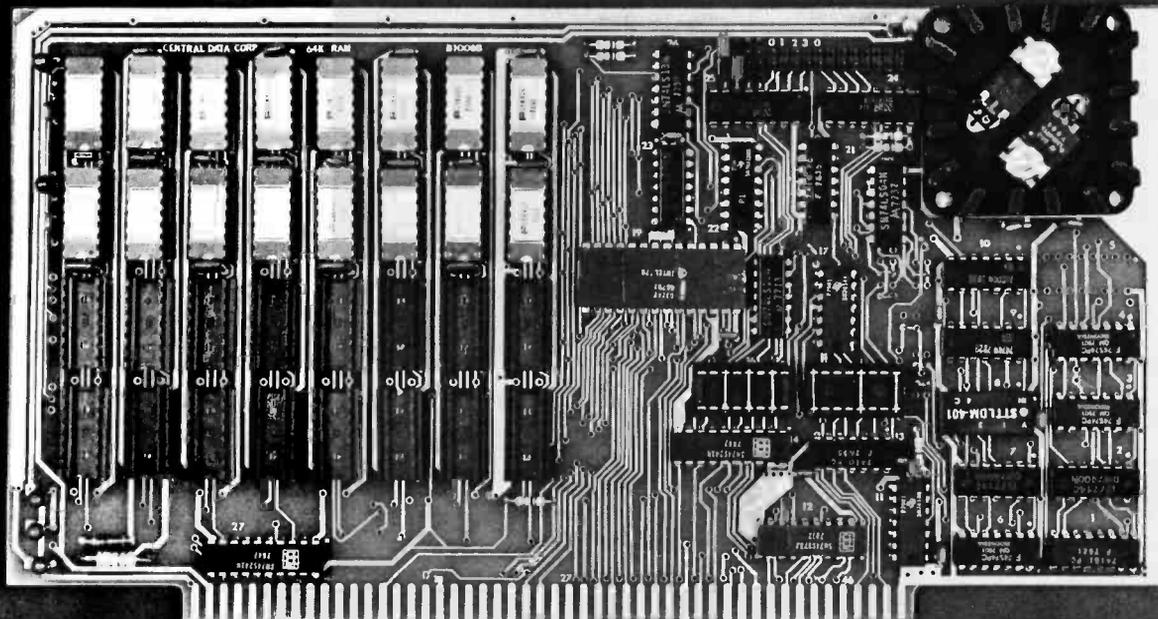
10EA 37          SendChar  psh b    save it
10EB F6 F902    lda b    AciaCsr2  get status
10ED C4 02      and b    #2       test for xmit ready
10EF 27 F9      beq     SendChar+1
10F2 47 F903    sta a    AciaData2
10F5 33          pul b    restore reg
10F6 39          rts

10F7 F6 F900    SendTerm  lda b    AciaCsr1  get status
10FA C4 02      and b    #2       test for transmit rdv
10FC 27 F9      beq     SendTerm  wait for ready
10FF 47 F901    sta a    AciaData1
1101 39          rts

* Entry point for the I/O interrupt
1102 B6 F902    IOInt    lda a    AciaCsr2  get status
1105 2A 47      bpl     KbInt    chk for acia interr
1107 B6 F903    Acia2Int  lda a    AciaData2  get line data
110A DE 51      ldx     AciaState
110C 6E 00      jmp     x        go to ACIA routine
110E B6 F901    KbInt    lda a    AciaData1  get kb data
1111 84 7F      and a    #57f    kill parity bit
1113 D6 6F      lda b    BlockKb   chk if sending file
1115 27 05      beq     ChkC1i
1117 86 07      OutBell  lda a    #bell
1119 8D DC      OutTerm  bsr     SendTerm  send char to term
111B 38          rti
111C D6 6A      ChkC1i  lda b    KbState
111E 26 13      bne     C1i
1120 81 06      cmp a    #^F
1122 27 05      beq     StartC1i
1124 8D D1      bsr     SendTerm  send char to term
1126 8D C2      bsr     SendChar
1128 38          rti
1129 CE 1278    StartC1i  idx     #SecTxt  output S!

```

Listing 1 continued on page 276



32K Board Pictured Above

Why Not the Best?

From The Dynamic RAM Company.

2MHz	4MHz
16K—\$249	\$259
32K—\$375	\$395
48K—\$500	\$530
64K—\$625	\$665

We have now been shipping our 2MHz dynamic RAM boards for over two years. Hundreds of 4MHz boards have been going out every month since early 1979. Our reliability is proven in the thousands of systems which contain our board. Many quality-minded systems houses across the country and overseas are using our boards for their equipment.

Our prices still beat all. Despite rising 16K memory chip prices (at least from reputable suppliers), Central Data continues to give you the best buy in memory today. Nobody offers a board with a capacity of 64K, assembled, tested, and guaranteed for a full year at the price we do.

Deselect around PROMs. Our boards have the important deselect feature which lets you overlap any fixed memory in your system with no interference.

Our features make the board easily used and expanded. You address our boards on 16K boundaries with mini-jumps (small shorting plugs that slide over wire-wrap pins) near the top of the board for easy access. If you want to expand your board after you have purchased it, all that you need to do is add memory. We can supply you with expansion packages (\$150-2MHz, \$160-4MHz) which include eight RAMs that you can depend on as well as two mini-jumps for addressing. And of course, our board **never** generates wait states.

Low power consumption keeps your computer running cool and reliable. The total power consumption of our 16K board is typically less than 4 watts (+8V @ 300ma, +16V @ 150ma and

-16V @ 20ma). Boards with additional memory typically increase power consumption only 1 watt per 16K!

Standard S-100 Interface. Our board is designed to interface with any standard S-100 CPU. All of the timing of the board is independent of the processor chip, and the board is set up for different processors by changing two plugs on the board.

Call or write us today. That will guarantee a fast response with more information on the board. Or make an order — you'll probably have the board in two weeks! **If you're interested, also ask for a catalog on our Z8000 16-bit processor board designed for the MULTIBUS.** All of these products are available to your local dealer, also.

Central Data Corporation, 713 Edgebrook Drive, PO Box 2530, Station A, Champaign, IL 61820. (217) 359-8010

Central Data

Listing 1 continued:

112C	8D	11B2		jsr	OutText	
112F	7C	006A		inc	KbState	
1132	3B			rti		return
1133	81	00	cli	cmp a	#cr	check for CR
1135	27	46		beq a	Convert	
1137	81	18		cmp a	#^X	check for ctrl x
1139	27	29		beq a	Cancel	
113B	81	0A		cmp a	#bs	check for backspace
113D	27	32		beq a	BackUp	
113F	36			psh a		save for display
1140	8v	3v		sub a	#\$30	check for valid hex char
1142	2B	1D		bmi	BadChar	
1144	81	09		cmp a	#9	
1146	2F	0A		hle	CharOK	
1148	81	31		cmp a	#\$31	
114A	2B	15		bmi	BadChar	
114C	81	36		cmp a	#\$36	
114E	2E	11		bgt	BadChar	
1150	8v	27		sub a	#\$27	
1152	DE	5D	CharOK	ldx	KbPtr	check for overflow
1154	8C	0063		cpx	#KbEnd+1	
1157	27	0A		beq	BadChar	
1159	A7	00		sta a	x	
115B	0A			inx		
115C	DF	5D		stx	KbPtr	
115E	32			pul a		get original char
115F	2v	8B		bra	OutTerm	echo for display
1161	32		BadChar	pul a		pull off stack
1162	2v	83		bra	OutBell	
1164	CE	1275	Cancel	ldx	#CRLF	output a cr, lf
1167	8D	49		bsr	OutText	
1169	97	6A		sta a	KbState	clr KbState
116B	CE	005F	InzPtr	ldx	#KbBuff	

Listing 1 continued on page 278

MARYMAC INDUSTRIES, INC.

To Place An Order
From Outside Texas
1-800-231-3680



Questions & Answers
& Orders
Texas 1-713-392-0747

Store #G-189

AUTHORIZED SALES CENTER

BRAND NEW IN CARTONS DELIVERED. Marymac Industries owns & operates Radio Shack® dealership in Katy, Texas. Warranties will be honored by all company owned Radio Shack® stores, & participating franchisees and dealer authorized sales centers. Save State Sales Tax. Texas Residents Add Only 5% Sales Tax. Open Mon.-Sat. 9-6. We pay freight and insurance. No extra charge for Master Charge & Visa. Call us for reference in or near your city. Ref: Farmers State Bank, Brookshire, Texas. Write or visit us at, 21969 Katy Fwy, Katy (Houston), Texas 77450.

WE OFFER ON REQUEST

Federal Express

Houston Intercontinental Airport
Delivery

U.P.S. BLUE

References from people who have
bought computers from us probably
in your city

ED McMANUS



In stock TRS-80 Model
II and III

No Tax on Out of Texas Shipments!

Save
10% 15%

OR MORE

Model III



In Stock

WE ALWAYS OFFER

NO extra charge for Master Charge
or Visa

We always pay the freight and
insurance

Toll free order number

Our capability to go to the giant Tandy
Computer warehouse 5 hours away,
in Ft. Worth, Texas, to keep you in
stock.

JOE McMANUS

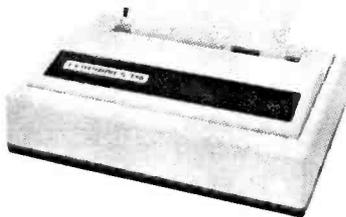


MODEL II



26-4002
64K 1 Drive
\$3440.00

- 26-4160 1 Drive EXP. \$1035.00
- 26-4161 2 Drive EXP. 1575.00
- 26-4162 3 Drive EXP. 2115.00
- 26-4501 Gen. Ledger. 180.00
- 26-4502 Inventory. 180.00
- 26-4503 Payroll. 360.00
- 26-4554 Acct. Rec. 180.00
- 26-4701 Fortran. 270.00
- 26-1157A Daisy Wheel. ... 2290.00
- 26-1158 Daisy Wheel II. ... 1799.00



CENTRONICS

- Fast 100 CPS Centronics
 730 Printer. 577.00
- Text Quality Centronics
 737 Printer. 737.00

Model II Cobol Compiler
\$360.00
Cobol Run Time Package
\$36.00

\$ DISCOUNT \$
TRS-80®
DEALER A301

MODEL III



- 26-1061 4K I. **\$630.00**
- 26-1062 16K III. 888.00
- 26-1063 32K III
- 2-Drives, RS232: 2225.00

COMPUTER SPECIALISTS

- 26-1155 Quick Printer II. \$187.00
- 26-1145 RS-232 Board. 84.00
- 26-1140 "O" K Interface. 249.00
- 26-1141 "16" K Interface. 359.00
- 26-1142 "32" K Interface. 469.00
- 26-1160 Mini Disk - Drive O. 419.00
- 26-1161 Mini Disk - Additional. 419.00
- 26-1154 Lineprinter II. 699.00
- 26-1165 Line Printer V. 1710.00
- 26-1159 Lineprinter IV. 859.00
- 26-1166 Line Printer VI. 1080.00
- 26-1563 Scripsit - Disk. 79.00
- 26-1566 Visicalc. 83.00
- 26-1562 Profile. 72.00

COLOR

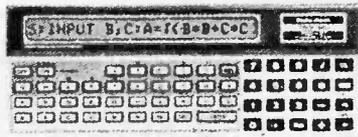


- 26-3001 4K. **\$360.00**
- 26-3002 16K. 540.00
- 26-3010 Color Video. 360.00
- 26-1206 Recorder. 54.00
- 26-3008 Joysticks. 22.50

**ALL OTHER R.S. SOFTWARE
 FURNITURE, STANDS, CABLES
 AND ACCESSORIES AT
 DISCOUNT FROM
 CATALOG PRICE.**

- Novation Cat Modem. . \$149.00
- CCA Data Management
 System. 72.00
- Adventure Games
 Games 1-9 each. 14.00

Pocket Computer



- 26-3501 1.9K P.C. \$225.00
- 26-3503 Cassette I/F. 45.00
- 14-812 Recorder. 72.00



**Acorn
 Software
 Products, Inc.**

GAMES:

- Alien Invasion. \$9.00
- Stock Market. 9.00
- Star Trek. 9.00
- Block Em. 9.00
- Ting-Tong. 9.00

UTILITIES:

- System Savers. 14.00

EDUCATION:

- Language Teacher. 18.00

**FREE: COMPUTER CATALOG
 UPON REQUEST**

1-800-841-0860 Toll Free Order Entry

MICRO MANAGEMENT SYSTEMS, INC.

No Taxes on Out Of
 State Shipments

Immediate Shipment
 From Stock on Most Items

DOWNTOWN PLAZA SHOPPING CENTER
 115 C SECOND AVE. S.W.
 CAIRO, GEORGIA 31728

(912) 377-7120 Ga. Phone No.

R.S. 90 Day Limited Warranty
 F-48 Form Provided

Largest Inventory
 In the S.E. U.S.A.

*TRS-80 is a registered trademark of the Tandy Corp.

Listing 1 continued:

```

116E DF 5D          stx      KbPtr      inz ptr
1170 3B            rti              return
1171 DE 5D      Backup ldx      KbPtr      check for underflow
1173 8C 005F      cpx      #KbBuff
1176 27 9F        bea      OutBell
1178 09           dex              decr KbPtr
1179 DF 5D          stx      KbPtr
117B 20 9C        bra      OutTerm
117D CE 005F      Convert ldx      #KbBuff  point at buffer
1180 8D 3A        bsr      Byte       get a byte
1182 97 5B        sta a    BinVal    put in ms byte
1184 8D 36        bsr      Byte       get a byte
1186 97 5C        sta a    BinVal+1
1188 DE 5B        ldx      BinVal    get binary number
118A 96 6A        lda a    KbState   check fsm state
118C 81 01        cmp a    #1
118E 26 07        bne      Try2
1190 DF 54          stx      SrcAddr
1192 CE 127D      ldx      #DestTxt  display D:
1195 20 09        bra      DispText
1197 81 02      Try2    cmp a    #2
1199 26 0C        bne      Try3
119B DF 56          stx      DestAddr
119D CE 1282      ldx      #BCntTxt  display #:
11A0 8D 10      DispText bsr      OutText
11A2 7C 006A      inc      KbState
11A5 20 C4        bra      InzPtr
11A7 DF 58      Try3    stx      ByteCnt   save byte count
11A9 7F 006A      clr      KbState
11AC 97 6D        sta a    XmitFile  set send file event
11AE 97 6F        sta a    BlockKb   lock the kb
11B0 20 B9        bra      InzPtr

11B2 A6 00      OutText lda a    x           get char
11B4 27 13      bea      Retnb
    
```

Listing 1 continued on page 280

Big Savings On Atari & PET!

No Risk - No Deposit On Phone
Orders - Shipped Same Day You
Call^o - C.O.D. or Credit Card

Please Call Between 11AM & 6PM
(Eastern Standard Time)
(800) 233-8950

* On all in stock units



Atari® 800™
List \$1080
only
\$759



commodore

4032N.....	\$1090	CBM 2022 Printer....	675
4032B.....	1090	CBM 4040 Drive.....	1090
8032.....	1499	CBM 8050 Drive.....	1420
		CBM C2N Drive	87
NEW -		PET-IEEE Cable	37
VIC - 20	\$299	IEEE-IEEE Cable	46

400 8K	419	CXL4104 Mailing List.....	\$17
400 16K	449	CX4107 Biorhythm.....	13
410 Recorder	62	CXL4007 Music Composer	45
815 Disk	1199	CX4110 Typing	20
810 Disk	489	CX4101 An Invitation to Programming	17
822 Printer	359	CXL4015 TeleLink™	20
825 Printer	779	CXL4004 Basketball	\$30
830 Modem	159	CX4105 Blackjack	13
850 Interface Module	179	CXL4009 Chess	30
CX852 8K RAM	94	CXL4011 Star Raiders™	45
CX853 RAM	149	CX4111 Space Invaders	18
CX70 Light Pen	64	CXL4006 Super Breakout™	30
CX30 Paddle	18	CXL4010 3-D Tic-Tac-Toe	30
CX40 Joystick	18	CXL4005 Video Easel™	30
CXB100 Blank Diskettes (5/box) ..	22		

Software

WordPro 3 (40 col.)	\$186
WordPro 4 (80 col.)	279
WordPro 4 Plus (80 col.)	339
Visicalc - Apple	122
Visicalc - Atari	163
Visicalc - PET	163
Commodore Tax Package	399

Disks

Sycom 5 1/4" Single Density Box of 10	\$29
Maxell 5 1/4" Floppy- MD1 Single Density Box of 10	34
MD2 Double Density Box of 10	44

Printers

Trendcom 200	489
Epson MX-80	539
Commodore Tally 8024 ...	1679

Microtek - for Atari

Microtek 16K RAM ...	99.95
Microtek 32K RAM ...	189.95

To Order:

Phone orders invited (800 number is for order desk only). Or send check or money order. Equipment shipped UPS collect. Pennsylvania residents add 6% sales tax. Add 3% for Visa or MC. Equipment is subject to price change and availability without notice.

Computer Mail Order 501 E. Third St. Williamsport, PA 17701

(717) 323-7921

16 BIT 8086 MICRO SYSTEM

Tec - 86™

Basic - 86™

CP/M - 86™

IEEE S-100 Bus — Available Now

Complete system up and operating
8086 System with Dual Floppy Disks

Available Now for only \$3990

CP/M-86™ only \$250

Basic - 86™ only \$350

CP/M - 86
TEC - 86
BASIC - 86



Tec-86 / 8086 System
\$3990

Complete 8086 System for CP/M-86™
CP/M-86 Available Now - \$250 • IEEE 696 S-100
Compatible • 5 MHz 8086 CPU (Optional 4 or 8
MHz) • Vectored Interrupts • 24 Parallel I/O lines
(three 8 bit ports) • Two RS-232 Ports • Baud
rates from 50 to 19200 baud • Independent baud
rate generator for each serial port • 32 Kilobytes of
static RAM (Expandable) • ROM boot for CP/M-
86™ • Dual 8-inch Shugart floppy disks with
controller • Attractive, all metal desk top enclosure

Optional 64K Dynamic RAM - Available Soon
Basic-86™ Available Now



Data Acquisition Systems and
Video Digitization Systems Available
23414 Greenlawn • Cleveland, OH 44122

TECMAR, INC.
(216) 382-7599

Basic-86™ registered TradeMark - Microsoft

CP/M™ registered TradeMark - Digital Research

Listing 1 continued:

```

11B6 BD 10F7      jsr      SendTerm  send char to term
11B9 08           inx
11BA 20 F6       bra      OutText

11BC A6 00      Byte   lda a      x
11BE 08           inx
11BF 48           asl a
11C0 48           asl a
11C1 48           asl a
11C2 48           asl a
11C3 36           psh a
11C4 A6 00      lda a      x
11C6 08           inx
11C7 33           pul b
11C8 18           aba
11C9 39           rts

* Routine which handles incoming ACIA characters
11CA 8D 124F    LineInput jsr      GetByte  get next char
11CD 81 90      InzAcia  cmp a      #dle  check for dle char
11CF 27 05      beq      FrameSt
11D1 8D 10F7    Out      jsr      SendTerm  send char to term
11D4 20 F4      bra      LineInput
11D6 8D 77      FrameSt bsr      GetByte
11D8 81 82      cmp a      #stx  check for stx char
11DA 26 6D      bne      ErrNack
11DC 5F         clr b
11DD 07 63      sta b      ChkSum
11DF 07 64      sta b      ChkSum+1  zero the checksum
11E1 8D 6C      bsr      GetByte
11E3 97 50      sta a      SaveOpc  save opcode
11E5 81 30      cmp a      #0    check for addr frame
11E7 27 0E      beq
11E9 81 31      cmp a      #1    check for data frame

```

Listing 1 continued on page 282

ON THE HORIZON.™

A COMPILER for North Star BASIC. Not a compiler/interpreter like CBASIC or PASCAL, but a TRUE COMPILER:

COMSTAR

by
Ashley

outputs *relocatable machine code* for 8080/8085/Z80 processors; totally operational on 8080 systems. Includes a sophisticated MACRO ASSEMBLER, text editor, linking loaders, and a console command processor to "force feed" commands to DOS from a disk file. COMSTAR protects your BASIC source code; programs run 2-5 times faster. Operates on North Star double or quad systems. Versions available for DOS at 100H or 2000H — compiled programs may put DOS anywhere.

COMSTAR — THE COMPLETE COMPILER: \$400

* Immediate Availability *

CSE 64K — \$579

200 ns access — runs at 4MHz with no wait states on S-100. Memory masking: Phantom, and/or any 2K pokeout for monitors, etc. Works in North Star, Cromemco, SDS, etc. Specify manufacturer of processor. Dealer pricing available.

Assembled and Tested: \$579

Letter
Go

For productivity, LetterGo beats ALL other word processing systems on micros.

LetterGo encompasses all standard word processing features — full screen editing, text-wrap around, with full bidirection scroll, variable char/line, lines/page, line spacing, justification, margins, indentation, page numbering, char spacing, titles, footers; LetterGo elevates word processing to a higher order, by providing centering, boldface, underline, super- and sub-scripting. Written for Z80 (8080/8085 available), North Star DOS version includes file utilities such as COMpact built in. Runs on TVI, ADM-3A, Soroc, ADDS, Microterm, Hazeltine, and more. Diablo and NEC versions, too.

LetterGo—THE program to professionalize your word processing: \$495

To Order:

Send check or money order to:
Professional Hardware
Distributors, Box 5584, Arlington,
Virginia 22205

VISA and MASTERCARD accepted. Please include account number and expiration date. For all orders, add 1.5% of the total order for shipping — we will adjust the difference.

PHD is a division of: DATEK Systems, Inc., 4786 Lee Highway, Arlington, VA 22207 (703) 243-3770

©North Star Computers

**Important New Salary Data
If You Are A Full-Time Programmer,
Software Analyst, or Systems Designer**

Is Your Income Keeping Pace With the Computer Salary Boom?

**To find out,
call today for
our new 1981
Computer
Salary
Survey ...
It's FREE!**

Salaries of computer professionals have risen this year by as much as 20%. Is yours keeping pace? How does your current salary compare with those of other professionals at your level of responsibility and experience? Is your income growth keeping up with inflation? Are you making as much money as you should be—or *could* be? Is your career heading in the right direction?

Now you can easily find out, simply by calling Source



Edp and asking for your copy of our just-released, **1981 Computer Salary Survey and Career Planning Guide**. It's yours, *free!*

National salary averages for 1981 are shown for each of 48 categories including programming, software, systems design, data communications, mini/micro systems, data base, EDP auditing, computer marketing, management and many others—at various levels of experience.

The Survey also defines each level of responsibility, shows you how to establish career goals, develop a plan of action, evaluate your progress, take corrective action when necessary and in general, keep your career growth on the best possible course.

This is a career tool every computer professional should have, *especially* if you have most of your career ahead of you.

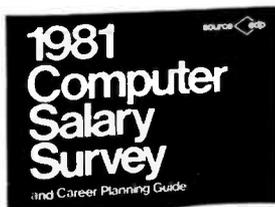
The 1981 Computer Salary Survey and Career Planning Guide has been compiled by Source Edp, North America's largest recruiting firm devoted exclusively to the computer profession. Since 1966, our annual Survey has helped thousands of computer professionals make the best decisions for their future. And now, at the threshold of sweeping changes in the industry, this new Survey can be of particular importance to you.

Call for your free copy of the 1981 edition today—in strict confidence, and with no obligation whatsoever to use our services.

source edp

North America's largest recruiting firm devoted exclusively to the computer professional. Client organizations assume our charges.

Offices nationwide. Consult the telephone white pages.



**For Your FREE 1981
Computer Salary Survey,
Call Mike Parr Today.
Our Toll-Free Number is
1-800-821-7700, Ext. 330
(Missouri residents, please call
1-800-892-7655, Ext. 330)**

If unable to call, write
Source Edp, Department B1
Suite 1100
100 South Wacker Drive
Chicago, Illinois 60606

(When writing, please be sure to indicate home address and current position title.)

Listing 1 continued:

```

11E8 27 43      bea      DataFrm
11ED 81 32      cmp a    #2      check for ack frame
11EF 27 0E      bea      VerChk
11F1 81 33      cmp a    #3      check for nack frame
11F3 27 0A      bea      VerChk
11F5 20 52      bra     ErrNack  bad frame
11F7 8D 56      bsr     GetByte  get upper addr byte
11F9 97 79      sta a    Address
11FB 8D 52      bsr     GetByte  get lower addr byte
11FD 97 7A      sta a    Address+1
11FF 8D 4E      bsr     GetByte  get dle
1201 8D 4C      bsr     GetByte  get etx
1203 DE 63      verify  ldx     ChkSum  save the checksum
1205 DF 75      stx     SaveSum
1207 8D 46      bsr     GetByte  get upper checksum
1209 97 65      sta a    RecdChk
120B 8D 42      bsr     GetByte  get lower checksum
120D 97 66      sta a    RecdChk+1
120F C6 01      lda b    #1      1 => Ack
1211 DE 65      ldx     RecdChk
1213 9C 75      cpx     SaveSum
1215 27 01      bea     SkpCrt
1217 50      neg b    =1 => Nack
1218 96 52      bsr     SaveOpc  get opcode
121A 84 02      and a    #2      ignore bit 0
121C 27 0E      bea     SendAck
121E 5D      tst b
121F 28 47      bmi     SetRAck  error => recd Nack
1221 96 50      lda a    SaveOpc  get opcode
1223 81 32      cmp a    #2      check for recd Ack
1225 27 01      bea     SetRAck
1227 50      neg b    =1 => recd Nack
* RecdAck: 0 => nop, 1 => recd Ack, -1 => recd Nack
1228 D7 6B      SetRAck sta b    RecdAck
122A 20 9E      Fin3   bra     LineInput

```

Listing 1 continued on page 284

Combine accurate flight characteristics with the best in animation graphics and you'll have SubLOGIC's

A2-FS1 Flight Simulator for the Apple II on cassette or disk!

SubLOGIC's A2-FS1 is the smooth, realistic simulator that gives you a real-time, 3-D, out-of-the-cockpit view of flight.

Thanks to fast animation and accurate representation of flight, the non-pilot can now learn basic flight control, including take-offs and landings! And experienced pilots will recognize how thoroughly they can explore the aircraft's characteristics.

Once you've acquired flight proficiency, you can engage in the exciting British Ace 3-D Aerial Battle Game included in the package. Destroy the enemy's fuel depot while evading enemy fighters.

Computer and aviation experts call the A2-FS1 a marvel of modern technology. You'll simply call it *fantastic!*

Special Features:

- 3 frame-per-second flicker free animation
- Keyboard or joystick input

\$25⁰⁰

on cassette, usable on all systems (16K memory required)

\$33⁵⁰

on disk, usable on DOS 3.2, DOS 3.3, or Language System (32K memory required)

See your dealer or order direct. For direct order, include \$1.25 and specify UPS or first class mail. Illinois residents add 5% sales tax. Visa and Mastercard accepted.

Present cassette users may send back their cassette (but not the manual), along with \$10 (first class shipping included), and receive the disk version.



subLOGIC

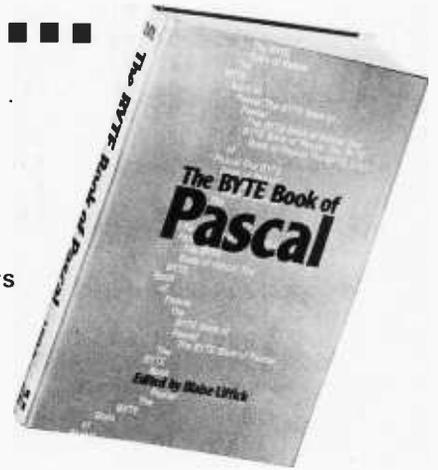
Communications Corp.
Box V, Savoy, IL 61874
(217) 359-8482
Telex: 206995

Pascal from beginning to...

The BYTE Book of Pascal

Edited by Blaise W. Liffick

This newly reprinted edition, compiled from articles, language forums, and letters from BYTE Magazine, provides a comprehensive introduction to Pascal. In addition this book contains important software, including two versions of a Pascal compiler—one written in BASIC and the other in 8080 assembly language; a p-code interpreter written in both Pascal and 8080 assembly languages; a chess playing program; and an APL interpreter written in Pascal. \$25.00
Hardcover pp. 342 ISBN 0-07-037823-1



Beginner's Guide for the UCSD Pascal System

Now in its 3rd printing, written by the originator of the UCSD Pascal System, this highly informative book is an orientation guide to the UCSD Pascal System. For the novice, this book steps through the System, bringing the user to a sophisticated level of expertise. For the experienced, the guide is an invaluable reference tool for creating advanced applications. The UCSD Pascal Software Systems, available from SofTech Microsystems Inc, 9494 Black Mountain Road, San Diego CA 92126, is a complete, general-purpose software package for users of microcomputers and minicomputers. The package offers several interesting features including:

- Programs which may be run without alteration on the General Automation or DEC PDP-11 minicomputers, or on an 8080, 8085, Z80, 6502, 6800, or 9900 based microcomputers.
- Ease of use on a small, single-user computer with display screen and one or more floppy disk drives.
- A powerful Pascal compiler which supports interactive applications, strings, direct access disks, and separately compiled modules.
- A complete collection of development software: operating system, file handler, screen oriented text editor, link editor, etc.

\$11.95
ISBN 0-07-006745-7

**Beginner's
Guide
for the UCSD
Pascal
System**

by Kenneth L. Bowles

Toll Free # 1-800-258-5420



Please send

- _____ copies of *The BYTE Book of Pascal*
 _____ copies of *Beginner's Guide for the UCSD Pascal System*

Name _____ Title _____ Company _____

Street _____ City _____ State/Province _____ Code _____

- Check enclosed in the amount of \$ _____
 Bill Visa Bill Master Charge
 Card No. _____ Exp. Date _____
 Add 75¢ per book to cover postage and handling.

**BYTE
FILES**

70 Main Street, Peterborough, NH 03458

.....
end

Listing 1 continued:

```

122C D7 6C      SendAck      sta b      XmitAck
* XmitAck: 0 => nop, 1 => xmit Ack, -1 => xmit Nack
122E 20 9A      DataFrm     bra        LineInput
1230 8D 1D      DataFrm     bsr        GetByte
1232 81 90      DataFrm     cmp a      #dle      check for doubled dle
1234 27 09      DataFrm     beq        ChkDble
1236 DE 79      OkDble      ldx        Address
1238 A7 00      OkDble      sta a      x          store byte
123A 08 00      OkDble      inx
123B DF 79      OkDble      stx        Address
123D 20 F1      OkDble      bra        DataFrm
123F 8D 0E      ChkDble     bsr        GetByte      throw away first dle
1241 81 90      ChkDble     cmp a      #dle
1243 27 F1      ChkDble     beq        OkDble
1245 81 83      ChkDble     cmp a      #etx      check for frame end
1247 27 BA      ChkDble     beq        Verify      frame error
1249 86 FF      ErrNack     lda a      #-1          send Nack event
124B 97 6C      ErrNack     sta a      XmitAck
124D 20 DB      ErrNack     bra        Fin3

* Exit routine which saves the return address,
* updates the checksum, and does rti
124F 30 00      GetByte     tax
1250 EF 00      GetByte     ldx        x          get entry point
1252 DF 51      GetByte     stx        AciaState save return address
1254 31 00      GetByte     ins
1255 31 00      GetByte     ins          get off stack
1256 98 64      GetByte     add a      ChkSum+1
1258 24 03      GetByte     bcc        SkpUpper
125A 7C 0063    GetByte     inc        ChkSum
125D 97 64      SkpUpper    sta a      ChkSum+1
125F 3B 00      SkpUpper    rti          return

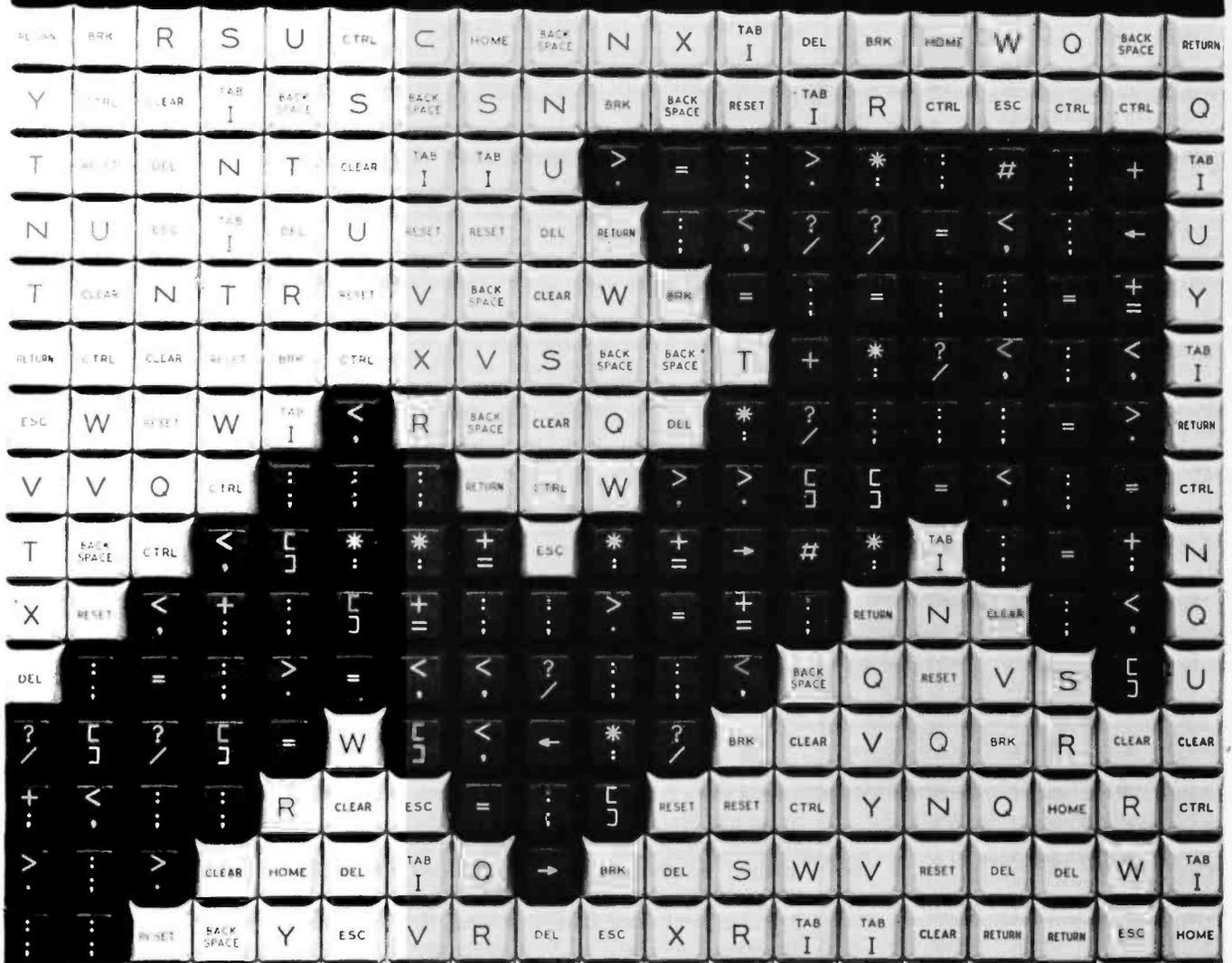
1260 90 00      AckFrm     fcb        dle, stx, '2, dle, etx, 1, $44
1261 82 00      AckFrm
1262 32 00      AckFrm
1263 90 00      AckFrm
1264 83 00      AckFrm
1265 01 00      AckFrm
1266 44 00      AckFrm

1267 90 00      NackFrm    fcb        dle, stx, '3, dle, etx, 1, $45
1268 82 00      NackFrm
1269 33 00      NackFrm
126A 90 00      NackFrm
126B 83 00      NackFrm
126C 01 00      NackFrm
126D 45 00      NackFrm

126E 27 00      ErrorMsg   fcc        / Failed/
126F 46 00      ErrorMsg
1270 61 00      ErrorMsg
1271 69 00      ErrorMsg
1272 6C 00      ErrorMsg
1273 65 00      ErrorMsg
1274 64 00      ErrorMsg
1275 0D 00      CRLF       fcb        $d, $a, 0
1276 0A 00      CRLF
1277 00 00      CRLF
1278 20 00      SrcTxt     fcc        / S: /
1279 53 00      SrcTxt
127A 3A 00      SrcTxt
127B 20 00      SrcTxt
127C 00 00      SrcTxt     fcb        0
127D 20 00      DestTxt    fcc        / D: /
127E 44 00      DestTxt
127F 3A 00      DestTxt
1280 20 00      DestTxt
1281 00 00      DestTxt     fcb        0
1282 20 00      BCntTxt    fcc        / #: /
1283 23 00      BCntTxt
1284 3A 00      BCntTxt
1285 20 00      BCntTxt
1286 00 00      BCntTxt     fcb        0
end

```

KEYS TO PRODUCTIVITY



If you plan, make, use, or buy computer systems or services, you can't afford to miss the upcoming **National Computer Conference**, McCormick Place, Chicago, May 4-7.

The theme of this year's conference is "Keys to Productivity", how to use computers and computer services to help increase output and control costs.

Come see the latest in new equipment and money-saving techniques at over 300 exhibits. Take your pick of over 100 technical sessions and 21 Professional Development Seminars. Enjoy the Personal Computing Festival, now a part of the main conference.

Save time. Save money. Pre-register now for the most dynamic NCC ever. You can:

- Avoid long registration lines
- Save \$15 on the full 4-day program
- Secure preferential housing and discount travel.

For Conference Information, call or write **National Computer Conference c/o AFIPS, P.O. Box 9658, 1815 N. Lynn Street, Arlington, VA 22209, (703) 558-3610.**

For discount air fares, airline reservations, hotel and show information, or to pre-register, call toll-free (800) 556-6882.



Z8000

**MICRO PRICE for MINI POWER
MICRO-MINI™ matches Series I by IBM
DELIVERING CURRENT ORDERS**

You cannot buy a more powerful micro:

- **Power:** 1 to 32 independent users
- **Memory:** directly addresses to 16 Meg!
- **Mapping:** efficient memory management
- **Disk:** 2M to more than 250M
- **Speed:** throughput 10 times Z80
- **Files:** simultaneous access
- **Communication:** inter-user via terminals
- **Security:** all files password protected
- **Options:** expandable in the field
- **Bus:** Intel Multibus™ compatible
- **Languages:** Pascal, BASIC, COBOL, FORTRAN

SYSTEM I\$3509

Z8001 CPU board with on-board ROM monitor
32K dynamic RAM
I/O board: 8 serial ports
Back plane: 15-slots, Multibus™ compatible
Case: switching power, fans, cage, fixtures

SYSTEM II\$6659

Z8001 CPU with memory management circuitry
64K dynamic RAM
I/O board: 8 serial ports
FDC board: for 4 floppies, sgl/dbl density
ZMOS: multi-user/-tasking operating system
Back plane: 15-slots, Multibus™ compatible
Case: switching power, fans, cage, fixtures
Disks: dual floppies (ss: sgl/dbl density)
CRT: Dialogue 80™ interactive/edit terminal
Call for further system specifications.



AMPEX Dialogue 80™

Dialogue 80™ fully-featured video terminal:

- Full ASCII with numeric and edit keypads
- Elegant case with detachable keyboard
- Display 24 lines with 25th status line
- 20 user programmable function keys
- 2 pages display memory (4 optional)
- 11 graphics and 21 control codes
- 10 modes including block, protect, program
- Transparent mode displays control codes

Dialogue 80™\$1045

Dialogue 80™ with phone coupler.....1194

Applications: word processing, data entry, interactive programming, data base inquiry/response/update, transaction processing, whether on-site or remote. For our system or for yours, this interactive terminal is the perfect match.

Prices: Prepaid or Purchase Order Net 10.
Prices subject to change without notice.
Warranty: 120 day minimum on all systems.
Interfacing cables free with all systems.
10% down fixes price, guarantees priority.
MasterCard and VISA cards accepted.

(312) 684-3183
COMPUTEX
MICROCOMPUTER SYSTEMS
5710 Drexel, Chicago, IL 60637

Text continued from page 268:

put from the serial line; it detects frames, parses them, and performs the appropriate action. The state of the receive program is saved whenever calls to GETBYTE are made. (It is conceptually easier to imagine that a call to GETBYTE results in a wait followed by a return with the next input byte from the line. Actually, a call to GETBYTE results in the storing of the return address in ACIASTATE and the execution of a return from interrupt instruction. The next line input interrupt then causes a branch to the address in ACIASTATE, which reenters the receive routine at the right place to process the next incoming byte.)

Incoming bytes are first checked sequentially for the presence of DLE bytes. If a byte is not a DLE, it is printed on the local terminal. Otherwise, the DLE signals the beginning of a frame, and the STX and opcode bytes are received and checked.

An opcode of hexadecimal 30 implies that the next 2 bytes are to be stored in ADDRESS, high-order byte first. The checksum is then tested. If it is correct, the XMITACK flag is set to 1; otherwise, the XMITACK is set to -1. The send module will eventually notice this work request and issue either an ACK or a NAK frame.

An opcode of hexadecimal 31 implies a data frame. Since the start address has already been verified in the address frame, data bytes are stored in their proper memory locations as they arrive. When a DLE DLE is detected, only one DLE is stored. If, however, a DLE ETX is detected (denoting an end of frame), the checksum is verified and and XMITACK flag is set accordingly.

An opcode of hexadecimal 32 implies receipt of an ACK frame, and an opcode of hexadecimal 33 implies receipt of a NAK frame. Both are verified for accuracy by comparing the computed checksum to the received checksum, and the RECDACK flag is set accordingly. This informs the send module whether the next address or data frame may or may not be sent.

At the end of each frame, control returns to the beginning of the receive program so that the next frame (or stream of keyboard characters) may be properly interpreted.

Debugging

Debugging is best accomplished if the code can be separated into modules that can be tested independently. As indicated earlier, there are three major modules: the command interpreter, the send routine, and the receive routine. I have found the following order to be the easiest way to debug the program routines:

- the transparent mode routine
- the receive routine
- the command interpreter
- the send routine

The computer was connected to itself, as described earlier, for testing purposes; this was done by connecting the transmit line of the send routine to the receive line of the receive routine. In this way, I was able to confine bugs to only one machine.

Proper operation of the transparent mode code is verified by the double echo on the terminal. Each character typed in is echoed on the console from the send routine. The character is then sent on the line, where it is received by the receive routine and again typed on the same console. When two separate computers are connected, of course, only one character is typed on each console.

The receive routine can be debugged independently by keying in protocol frames on the keyboard and observing what the receiver does with them. Normally, the DLE, STX, and ETX characters are defined with the high-order bit on, which precludes their generation by the keyboard. (This is to ensure that keyboards cannot accidentally send a protocol frame.) During debugging, however, the value of the DLE, STX, and ETX bytes can be changed to keyboard-generated characters, thereby allowing frame synthesis through the keyboard for debugging purposes only.

The send routine must be disabled during this stage of debugging by changing the BNE INZADOR at hexadecimal location 1045 to BRA XMITLOOP. This ensures that the XMITACK flag from the receive module does not cause an ACK or NAK to be sent, thus clearing the flag.

First, an acknowledge frame is

FREE & EASY

... that's our new catalog, filled with super buys on computers, peripherals, accessories and supplies. It's free and it makes buying easy for you. Just ask for it!



APPLE ACCESSORIES

Sanyo Monitor 9" B/W	\$169.
NEC Monitor 12" GN	229.
LOBO Disk II/Contoller DOS 3.3	499.
LOBO Disk II	399.
SUPERTERM 80 Col. Card	329.
Z80 Soft Card	295.
H.S. Serial Card	179.
COMM. Card	179.
CLOCK Calendar Card	225.
ROM Plus Card/KB Filter	175.
HAYES Micromodem	319.
SUPERTalker	249.
PARALLEL Printer Card	149.

SOFTWARE

VISICALC	119.00
DESKTOP Plan II	169.00
PERS Filing Syst	80.00
ADDRESS Book	40.00
SUPER Text II	125.00
CCA Data Mgmt	85.00



MODEMS

UDS 103 LP, direct	\$169.00
NOVATION CAT, acoustic	159.00
D-CAT, direct	169.00
LEXICON LX-11, acoustic	147.00
HAYES Micromodem, S100	349.00

\$100 CORNER

Boards Xitan ZPU (Z80)	\$129.
SMB-2 I/O	199.
D-16K Dynamic	129.
D-32K Dynamic	199.
Mainframes Xitan 8 Slot	\$199.
CCS 12 Slot	349.
NNC 19 Slot	590.
Computers NNC System 80-1MB	\$3,995.
NNC System 80W-8.4MB	6,995.

Z-80 SOFTWARE

	Cassette	Disk
8K Basic	\$50.	
Super Basic	\$95.	\$99.
Disk Basic		\$159.
ZAPPLE Text Ed.	\$35.	\$69.
Z-Tel Text Ed.	\$50.	
Text Output Proc	\$50.	
Macro Assembler	\$50.	\$69.
Z-Bug		\$89.
Micro Z-BUG		\$69.
LINKER		\$69.
Fortran IV		\$249.

PRINTER SALE

DIABLO 630 RO

30 cps letter quality, plastic or metal Daisy wheel
List \$2,711.00 \$2,395.00

TYPRINTER 221 Word Processing W/KEYBOARD

20 cps computer printer and typewriter in one. Non volatile memory up to 16K. Auto error correction. 10, 12 and 15 pitch letter quality characters. Proportional spacing works with most word processing software.
List \$2,850.00 \$2,450.00

ESCON CONVERSION FOR IBM SELECTRIC

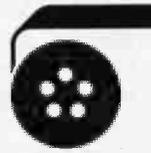
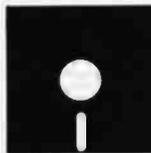
Complete with micro processor controller and power supply. Standard serial, parallel and IEEE versions available.
List \$599.00 \$539.00

PRINT ELEMENTS

NEC Thimbles	\$16.00
Plastic Daisy Wheels	
for Qume, Diablo, Starwriter	6.00
Metal Daisy Wheels	56.00
IBM Selectric Elements	17.00

RIBBONS

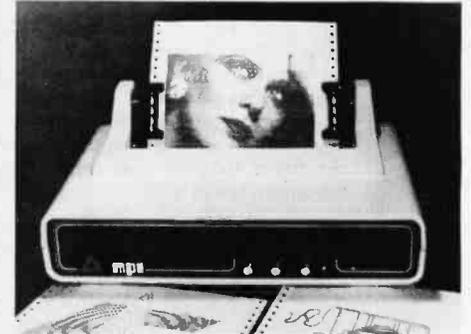
NEC	\$71.00/Doz.
QUME	54.00/Doz.
DIABLO	54.00/Doz.
ANADIX	144.00/6 ea.
ANACOM/QUANTEX	192.00/Doz
TI/DEC/TTY	50.00/Doz.



MAGNETIC MEDIA

Premium Quality At Bargain Prices

5 1/4" Diskettes, all Formats,	
100% Certified with hub rings, box of 10	
Single sided, single density	\$22.50
Single sided, double density	24.50
Double sided, double density	32.50
8" DISKETTES, ALL FORMATS	
100% CERTIFIED	
Single sided, single density	\$26.00
SSSD Error Free	27.00
Single sided, double density	34.50
Double sided, double density	40.00
3M DATA CARTRIDGES, 1/4"	
Regular	\$18.15/ea.
Regular Error Free	20.65
Mini	15.25
DIGITAL PHILLIPS CASSETTES, 1/4"	
For Most Systems	\$3.60



MPI 88 G Matrix

High resolution dot-addressable graphics for Apple. Enhanced "correspondence quality" printing. Tractor and Friction feed. Serial and Parallel Input. 100 cps Bidirectional printing, 80, 96, and 132 column widths!
List \$799.00 \$599.00

ANADIX DP 9500/9501

200 cps Matrix, high density dot addressable graphics serial and parallel input, up to 2K buffer!
List \$1,650.00 \$1,395.00

TI 820, RO Full ASCII

150 cps Matrix, wide carriage, data processing workhorse.
List \$1,995 \$1,695.00

ANACOM 150

Heavy duty 150 cps Matrix 15" carriage, low cost replacement for TI 820.
List \$1,350.00 \$1,095.00

QUANTEX 6000 MATRIX

Heavy duty 150 cps 15" carriage.
List \$1,495.00 \$1,195.00

NEC - SPINWRITER

55 cps Bidirectional, letter quality
5510 RO List \$3,055.00 \$2,595.00

C. ITOH - STARWRITER RO

25 cps Low cost Daisy Wheel
List \$1,895 \$1,695.00

QUME SPRINT 5/45 RO

45 cps Daisy Wheel, High Quality
List \$3,137.00 \$2,595.00

TO PLACE YOUR ORDER CALL:

TELEPHONE (714) 744-7314
TELEX 697120

or write to:

PALOMAR

Computer Products

910-105 W. San Marcos Blvd., San Marcos, CA 92069
TERMS OF SALE: Cash, check, money order, bank wire transfer, credit card or purchase orders from qualified firms and institutions. Please include telephone number with order and expiration date on credit card orders. California residents add 6% sales tax. Advertised prices are for prepaid orders F.O.B. shipping point. Add 3% for shipping in U.S. Pricing and availability subject to change without notice.

GOOD IDEA!

You can buy at wholesale prices through a commercial buying firm and save more than buying mail order. The fee is one quarter of what they save you off list—an incentive for them to save you more. Minimum fee of \$75.

READ
THIS

COMPARE
THESE

	Whse.	Fee
COMPUTERS		
Alpha Micro 10MEG	\$11,204	\$1,243
Altos 8000-2	3,150	358
Altos 8000-5	4,193	449
Archives 64K QD	4,450	512
Cromemco System 3	5,357	659
Cromemco System 2 w/128K	4,345	535
Dynabyte 5400-A2 641L 1 MEG	5,132	641
Dynabyte 5400-B2 64K 2 MEG	5,929	691
Dynabyte DB811 64K	2,278	280
Superbrain 64K DD	2,250	261
CRT'S		
ADDS R20	550	111
DEC VT 100	1,305	130
Hazeltine 1500	795	107
IBM 3101 Model 10	1,140	60
Lear Siegler ADM 3A +	710	58
Leedex 13" Color Monitor	350	25
NEC 12" Monitor	190	18
Televideo TVI 920C	670	80
Visual 200	765	107
PRINTERS		
Anadex 9501	1,150	125
Centronics 737	650	86
Diablo 1650 R/O	2,195	400
DIP 82	499	49
Epson MX80	450	45
IDS Paper Tiger 460 G	1,020	94
NEC 5510 w/Tractor	2,360	164
Qume 5/45 RO	2,035	215
TI 810 Basic	1,355	135
SOFTWARE		
Word Star	223	68
Magic Wand	200	50
Spell Guard	Call	
Pearl III	350	88

NOTE

Access to over 500 software and hardware manufacturers. Call for other prices!

The Purchasing Agent

1635 School Street, Suite 301
Moraga, CA 94556
(415) 376-9020
International Telex 470851

Prices subject to change without notice.

keyed in to test the receive routine's response. The RECDACK byte, as a result, should be set to a value of +1. Next, a NAK frame is keyed, which should get the RECDACK byte to -1. If these received frames do not result in the proper setting of the flags, then either the receive routine is faulty, or the frame was keyed incorrectly.

After a proper address frame is typed, the XMITACK flag should be set to 1; otherwise, it should be set to -1. Also, a proper address frame should put the address types in the 2-byte variable ADDRESS.

Finally, frames of varying length and content should be typed in, and memory should be checked to ensure that the data has been properly stored. Of course, the keyboard cannot generate bytes with the high-order bit on, but this should not affect the debugging process. A proper data frame should set the XMITACK flag to 1, while a bad frame should set it to -1.

The command interpreter is debugged next by typing a control-F character and noticing that an "S:" is typed on the console. Typing in four hexadecimal characters and a carriage return should result in a "D:" being typed on the console. The command interpreter checks for valid hexadecimal characters, which in this implementation are lowercase "0" thru "9" and "a" thru "f." Either typing in a bad character, or typing more than five characters, results in the ringing of the terminal's bell.

After the destination address is keyed, a "#:" should be typed on the console. When the byte count and a carriage return are typed, the user should cause system reset and go to the computer's monitor program (in my case, a Motorola MIKBUG). Locations SRCADDR, DESTADDR, and BYTECNT should contain the proper values of the three parameters just typed in. Also, the XMITFILE flag should be nonzero. If any of the above information is not correct, the command interpreter has errors and must be debugged.

The debugging of the send routine is the last and most difficult task. The patch introduced to disable the send routine must be deleted and the original code restored. The command interpreter is then used to set up the addresses and a byte count; a carriage return is struck to initiate the send

routine. Normally, the send routine will send out an address frame and wait for the RECVDACK flag to indicate proper receipt of the frame. It will then send a data frame and again wait for the RECVDACK flag. Since the transmit line is connected to the receive line during these tests, a more complicated interaction occurs.

The interaction is as follows—the sender issues an address frame and the receiver, in turn, sets the XMITACK flag. The sender sees the XMITACK and sends an ACK frame, and the receiver receives the ACK and sets the RECVDACK flag. The sender, noticing the RECVDACK flag, sends a data frame. Errors result in up to three retransmissions before the file transfer is aborted and the computer returns to transparent mode. This sequence of events can be verified by disabling various portions of code and watching the flags change using a debugging routine (there is usually one in the computer's monitor program).

Once the software routines have been independently debugged as described above, there should be few problems when a final test is made with two computers linked by a serial line.

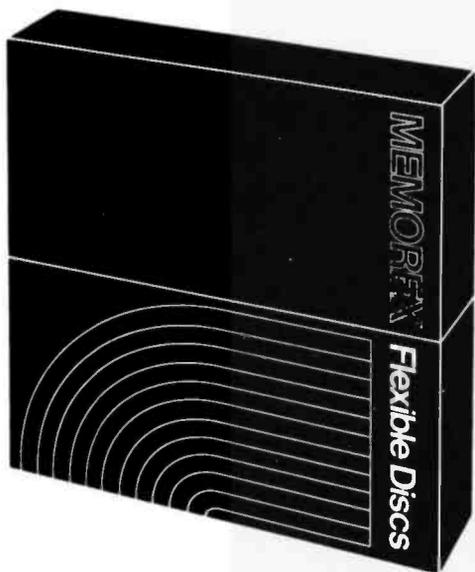
Final Notes

Reliable data transmission between two computers over a noisy channel is a primary concern of communication engineers, who have developed a spectrum of elaborate protocols to ensure that errors are detected and corrected. The simple data link described here is not overly robust. For example, the computer will "hang up" waiting for a valid response when an ACK or a NAK is received in error and discarded. One solution is to include a timeout interrupt that causes the send routine to retransmit its data if an ACK or NAK is not received within a certain period of time. Although the routines shown here were written with simplicity and minimal software in mind, the reader is encouraged to add this feature.

The protocol presented here is computer independent and could just as well be implemented in the machine language of any microprocessor. As long as there is agreement on the electrical interface and on the data-transfer protocol, a computer can pass data of any kind to any other computer. ■

MEMOREX

**SUPERB QUALITY AT
UNBEATABLE PRICES.
THAT'S MEMOREX
DISCS FROM PACIFIC
EXCHANGES**

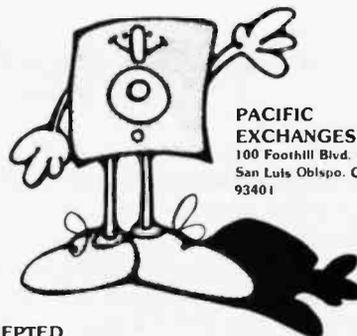


For Data Reliability—
Memorex
Flexible
Discs

CALL FREE FOR PRICES & INFORMATION

(800)235-4137

In California, (805)543-1037



DEALER INQUIRIES INVITED



C.O.D.'s ACCEPTED

Three-Dimensional Computer Graphics, Part 2

Franklin C Crow
Department of Computer
and Information Service
Ohio State University
2036 Neil Ave Mall
Columbus OH 43210

Last month, in Part 1, we examined almost every algorithm needed to display three-dimensional line drawings that represent solid objects modeled by polygons. I attempted to keep the procedures concise, at the occasional sacrifice of clarity or efficiency.

Listing 1 contains a complete Pascal program that incorporates the individual graphics procedures presented in Part 1. I have used this program with the Heath/Zenith H-19 video terminal (which has limited semigraphics) and the UCSD (University of California, San Diego) Pascal system. I have also used it (very satisfactorily) with a 500-line raster graphics display and a Pascal interpreter running under the UNIX operating system on a DEC (Digital Equipment Corporation) VAX 11/780 computer.

The program includes facilities for all of the basic functions necessary for three-dimensional representation:

- acquisition of machine-readable data
- transformation to the proper perspective
- scaling
- elimination of hidden lines and faces

In presenting this program, I have assumed that your display system can draw lines, as most systems that are capable of full graphics provide appropriate software. However, scan-conversion software is included to support the Heath/Zenith H-19 video terminal, and the routines Moveto and Drawto can be easily modified

for any other raster display.

As designers continue to simplify the use of personal computers, the

area of three-dimensional graphics software will be the next to receive significant attention. ■

Listing 1: Complete UCSD Pascal three-dimensional graphics program that incorporates the ideas and procedures put forth in Part 1 (see March 1981 BYTE, page 54).

```
Program HideLine;

const DotsAcross = 79;
      DotsDown = 47;
      MaxPts = 200;
      MaxPols = 200;
      MaxVtx = 800;
      MaxSides = 8; (* maximum sides on a polygon *)

type counter = 0..MaxVtx;
Point = record X,Y,Z : real end;
Vertex = 0..MaxPts;
Polygon = record NumVtx : Vertex; Start : counter; end;
OnePoly = array [1..MaxSides] of Point;

Polygons = array [1..MaxPols] of Polygon; (* original polygons *)
Vertices = array [1..MaxVtx] of Vertex; (* original vertices *)
OutPolys = array [1..MaxPols] of Polygon; (* displayed polygons *)
OutVtces = array [1..MaxVtx] of Point; (* displayed points *)
EyeSpace : Matrix; (* eye space transform *)
Window : OnePoly; (* display window *)
EyePt, CntrInt : Point; (* eyepoint and center of interest *)
ScreenScale, ScreenCtr : Point;
ScreenX, ScreenY : real;
Screen : packed array [0..DotsAcross, 0..DotsDown] of boolean;
NumPols, NumVtces, NumPts, WindowSize, I : counter;
NumDisplay, NumVtxOut : counter;
CmdChar : char;
FileName : string;
Done : boolean;

(* ++++++ GetPlanes ++++++ *)
procedure GetPlanes( var Poly : OnePoly; NumPts : counter );
var I, LstI : counter;
    ImpPoly : OnePoly;

begin (* compute plane equation coefficients for polygon edges *)
  LstI := NumPts;
  for I:=1 to NumPts do
  begin
  with Poly[I] do
  begin
    ImpPoly[I].X := Y * Poly[LstI].Z - Z * Poly[LstI].Y;
    ImpPoly[I].Y := Z * Poly[LstI].X - X * Poly[LstI].Z;
    ImpPoly[I].Z := X * Poly[LstI].Y - Y * Poly[LstI].X;
  end;
  LstI := I;
  end; (* for loop *)
  for I:=1 to NumPts do (* copy back to input *)
  with ImpPoly[I] do
  begin Poly[I].X:=X; Poly[I].Y:=Y; Poly[I].Z:=Z; end;
  end; (* GetPlanes *)

(* ++++++ GetScreenScale ++++++ *)
procedure GetScreenScale; (* get window to screen scale factor *)
var I : counter;
```

Listing 1 continued on page 292

AUTOMATED EQUIPMENT INCORPORATED



18430 Ward, Fountain Valley, CA 92708

Call Toll-Free for latest low prices!
1-800-854-7635 Outside CA
714-963-1414 Inside CA
1-800-854-7635 Outside Cont. USA
 Prices change daily to meet competition.



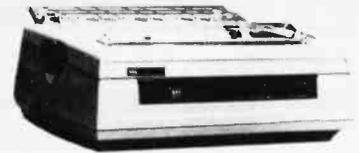
TERMINALS

TELEVIDEO 912 B	\$665
TELEVIDEO 912 C	665
TELEVIDEO 920 B	945
TELEVIDEO 920 C	715
SOROC IQ-120	675
ZENITH A-19	735
HAZELTINE 1500	850
TELEVIDEO 950	CALL



NORTHSTAR

HRZ-1D-32K	\$1975
HRZ-2D-32K	2270
HRZ-1Q-32K	2240
HRZ-2Q-32K	2650
ADDITIONAL 16K RAM	365
ADDITIONAL 32K RAM	475
HARD DISK SYSTEM	3900
SPECIAL MEMORY CONFIGURATIONS AVAILABLE, INCLUDING SYSTEMS GROUP.	



PRINTERS

NEC 5510 (TRACT., RIB., THIM) ...	\$2540
NEC 5515 (TRACT., RIB., THIM) ...	2600
NEC 5520 (TRACT., RIB., THIM) ...	2900
NEC 5530 (TRACT., RIB., THIM) ...	2540
MALIBU	1800
TI-810	1495
TI-820	1625
EPSON MX 80	CALL
EPSON MX 70	CALL
ANADEX DP-9500/9501	CALL

VIP's customarily need top quality and service within stringent budgetary limits. naturally, they call A.E.I.

Item: A.E.I. tests virtually every* item sold, before shipping.

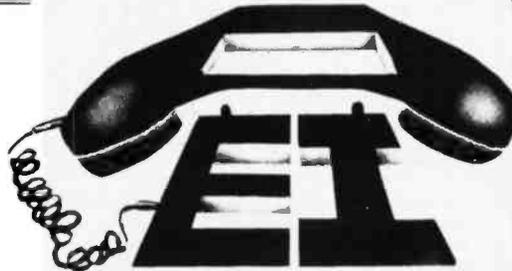
Item: A.E.I. initializes every piece of software, and makes a copy. If you have a problem, A.E.I. can check to locate the problem by using the in-house duplicate, saving you time.

Item: A.E.I. has in-house expertise on every item offered.

Item: A.E.I. prices are competitive with the lowest, no-service, no in-house expertise dealer.

40% OF ALL A.E.I. SALES ARE TO PUBLIC AND SEMI-PUBLIC INSTITUTIONS.

A partial list** of A.E.I. customers who purchased during the last quarter of 1980 includes: University of Nebraska, Univer-



ity of Virginia, U.S. Dept. of Interior, University of Kentucky, University of California, Massachusetts Institute of Technology, U.S. Air Force, Naval Air Development Center, Brown University, University of Oregon, University of Utah, Ohio State University, University of Southern California, California State Dept. of Water Resources, University of Michigan, and Princeton University.

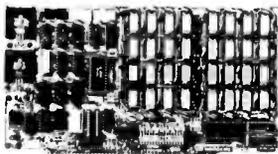
In the private sector, an equal number of major national organizations purchased during the same period.

You can call A.E.I. too!

VIP's Call A.E.I.

*With our normal fast shipping, we have time to test expedited shipment may preclude testing.

**A.E.I. does not wish to imply that any of these fine organizations endorse A.E.I. merely that A.E.I. is proud to have them as customers.



S.S.M.	KIT	ASM
CB2 Z80 CPU	\$200	\$265
VB1C VIDEO	140	190
VB2 VIDEO	155	210
VB3 VIDEO	375	440
IO4 INTERFACE	165	225
SB1 SYNTHESIZER	195	270
MEASUREMENT SYSTEMS MEMORY		
DM3200 32K 4MHZ	480	
DM6400 64K 4MHZ	595	
DMB3200 32K 4MHZ BANK SELECT ..	630	
DMB6400 64K 4MHZ BANK SELECT ..	745	

DYNABYTE SYSTEMS ALSO AVAILABLE—CALL FOR THE EXCITING NEWS ABOUT NEW COMPETITIVE PRICING!

WE WILL TRY TO BEAT ANY ADVERTISED PRICE.

TERMS: All prices listed are cash discounted and subject to change. COD's are 2% additional. Universities and well-rated firms Net-10.

SHIPPING: ADDITIONAL IN ALL CASES.

TECHNICAL ASSISTANCE:

WE TRY TO HELP INTERFACE AND TROUBLESHOOT—CALL (714) 963-1414.

Open Monday-Friday, 8:00 a.m.-5:00 p.m.

Dealer Inquiries Invited.



MORROW

DECISION 1 BASIC	\$1550
DISCUS-1 2 DRIVE	1550
DISCUS 2D 1 DRIVE	935
DISCUS 2D 2 DRIVE	1550
DISCUS 2+2 1 DRIVE	1250
DISCUS 2+2 2 DRIVE	2190
DISC JOCKEY 2D	350
DISCUS M26 HARD DISC	3925
ADDITIONAL HARD DISC	3685
DISCUS M10	2990

MISCELLANEOUS

NEC THIMBLES	\$16
NEC RIBBONS	7
RS2332 CABLE 5'	20
RS 232 CABLE 10"	25
LEDEX MONITOR	145
NOVATION CAT	145

SOFTWARE

WORDSTAR	\$320
MAILMERGE	100
DATASTAR	250
N.S. PASCAL	295
MAGIC WAND	290
C BASIC	100

GRAHAM-DORIAN

JOB COSTING	\$700
INVENTORY	475
CASH REG.	475
APARTMENT	475
MEDICAL	700

ADDITIONAL SOFTWARE DISCOUNTS WITH SYSTEM PURCHASE

DISCS—BOX OF 10

VERBATUM 5 1/4 SIDE	\$27
VERBATUM 5 1/4 2 SIDE	45
VERBATUM 8 1 SIDE	35
VERBATUM 8 2 SIDE	55
OTHERS	CALL
PLASTIC STORAGE BOXES	3

OUR SYSTEMS WORK!

All systems normally tested and configured in our repair facility before delivery. Service contracts available. Prompt repairs and warranties.

Circle 188 on inquiry card.

SPECTACULAR OFFERS

BASF "FLEXYDISK"
Superior Quality data storage medium. Certified and guaranteed 100% error free.



SINGLE SIDED-SINGLE DENSITY

5 1/4" or 8" Diskettes 10/\$24
5 1/4" or 8" Vinyl Storage Pages 10/\$5

MAXELL-DISKETTES
The best quality diskette money can buy. Approved by Shugart and IBM.



Sold only in boxes of 10

5", 1 side \$3.30
8", 1-side \$4.25
5", 2-side \$3.90
8", 2-side \$5.60

ALL MAXELL DISKETTES ARE DOUBLE DENSITY

LIBRARY CASE
3-ring binder album. Protects your valuable programs on disks Fully enclosed and protected on all sides. Similar to Kas-sette storage box.



Library 3-Ring Binder \$6.50
5 1/4" Mini Kas - sette/10 \$2.49
8" Kas-sette/10 \$2.99

DISKETTE DRIVE HEAD CLEANING KITS
Prevent head crashes and insure efficient, error-free operation.



5 1/4" or 8" \$19.50

SFD CASSETTES
C-10 Cassettes 10/\$7
(All cassettes include box & labels)
Get 8 cassettes, C-10 sonic and Cassette/8 library album for only \$8.00
(As illustrated)



HARDHOLE
Reinforcing ring of tough mylar protects disk from damage



8" Applicator \$4 5 1/4" Applicator \$3
50/8" Hardholes \$8 5 1/4" Hardholes \$6

VISA • MASTERCHARGE • MONEY ORDERS
CERTIFIED CHECK • FOR PERSONAL CHECKS
ALLOW TWO WEEKS • C.O.D. REQUIRES A 10%
DEPOSIT • CAL. RES. ADD 6% SALES TAX
MIN \$2 SHIPPING & HANDLING • MINIMUM
ORDER \$10 • SATISFACTION GUARANTEED
OR FULL REFUND
Write for our free catalog

ABM PRODUCTS

631 B ST.
SAN DIEGO, CA 92101
(714)235-6602

Listing 1 continued:

```

MaxX, MinX, MaxY, MinY : real;

begin
MaxX:=0.0; MinX:=0.0; MaxY:=0.0; MinY:=0.0; (* window must include Z-axis
for I:=1 to WindowSize do
with Window[I] do
begin
if X/Z > MaxX then MaxX := X/Z;
if X/Z < MinX then MinX := X/Z;
if Y/Z > MaxY then MaxY := Y/Z;
if Y/Z < MinY then MinY := Y/Z;
end;
MaxX := MaxX - MinX;      MaxY := MaxY - MinY;
if MaxY > (0.75 * MaxX) (* standard display is 3 units high by 4 wide *)
then ScreenScale.Z := (MaxY * 4 / 3 )
else ScreenScale.Z := MaxX;
ScreenScale.X := DotsAcross / ScreenScale.Z;
ScreenScale.Y := ( DotsDown * 4 / 3 ) / ScreenScale.Z;
end; (* GetScreenScale *)

(* ++++++ Initialize ++++++ *)
procedure Initialize; (* set default parameter values *)
begin
Done := false;
NumPols := 0;
NumDisplay := 0;
NumVtces := 0;
NumPts := 0;
with EyePt do begin X:=-5.0; Y:=-5.0; Z:=3.0; end;
with CntrInt do begin X:=0.0; Y:=0.0; Z:=0.0; end;

WindowSize := 4;
with Window[1] do begin X:=-4.0; Y:=-3.0; Z:=16.0; end;
with Window[2] do begin X:=-4.0; Y:= 3.0; Z:=16.0; end;
with Window[3] do begin X:= 4.0; Y:= 3.0; Z:=16.0; end;
with Window[4] do begin X:= 4.0; Y:=-3.0; Z:=16.0; end;
GetScreenScale;
GetPlanes( Window, WindowSize );
with ScreenCtr do begin X:=DotsAcross/2; Y:=DotsDown/2; end;
end; (* Initialize *)

(* ++++++ Start ++++++ *)
procedure Start;
var I, J : counter;
begin (* clear screen *)
for I := 0 to DotsAcross do
for J := 0 to DotsDown do Screen[ I, J ] := false;
end; (* start *)

(* ++++++ Finish ++++++ *)
procedure Finish; (* display output for Zenith H-19 terminal *)
var I, J : counter;
begin
write(chr(27), 'f'); (* put terminal into graphics mode *)
write(chr(27), 'p'); (* put terminal into reverse video *)
write(chr(27), 'w'); (* no wraparound at end of line *)
J := DotsDown;
while J > 0 do
begin
for I := 0 to DotsAcross do
if Screen[I, J] and Screen[I, J-1] then write('q')
else if Screen[I, J-1] then write('l')
else if Screen[I, J] then write('o')
else write(' ');
if J > 1 then J := J - 2 (* count down by twos *)
else J := 0;
if J > 0 then writeln; (* CR/LF unless last line *)
end;
readln; (* await <CR> before continuing (preserves screen) *)
write(chr(27), 'G'); (* exit graphics mode *)
write(chr(27), 'q'); (* exit reverse video *)
end; (* Finish *)

(* ++++++ Moveto ++++++ *)
procedure Moveto( X, Y : real );
begin
ScreenX := X;      ScreenY := Y;
end; (* Moveto *)

(* ++++++ Drawto ++++++ *)
procedure Drawto( X, Y : real );
var I : counter;
Dx, Dy, Length, StepX, StepY, Xpos, Ypos : real;

begin (* Drawto *)
Dx := X - ScreenX;      Dy := Y - ScreenY;
if abs(Dx) > abs(Dy) then Length := abs(Dx) else Length := abs(Dy);
if Length < 1.0 then Length := 1.0; (* catch zero-length lines *)

```

Are important letters and reports
leaving your office with spelling errors?

SpELLGUARDTM can proofread 10,000 words in one minute.*

SPELLGUARD is a revolutionary new computer program that finds spelling mistakes and typographical errors in documents prepared with CP/M¹ or CDOS² compatible word processors and text editors.

In less than one minute, SPELLGUARD proofreads 20 pages of text (10,000 words) and identifies all misspelled or mis-typed words based on its 20,000-word dictionary. After proofreading, SPELLGUARD first provides an alphabetized list of the words identified as potential errors. The operator judges each word as correct or incorrect. Correct words may be added to the dictionary. SPELLGUARD *automatically* marks incorrect words in the text with a special character. The operator can then use the word processor to easily find and correct them in the document.

SPELLGUARD is Easy to Use

- proofreading capabilities are mastered in a few minutes.
- comprehensive user's manual contains step-by-step examples of all SPELLGUARD features.

SPELLGUARD is Powerful

- text files to 85 pages (CP/M 1.4), and 2,800 pages (CP/M 2.0). includes a 20,000-word, expandable dictionary.
- contains powerful commands to construct customized dictionaries for special areas, e.g., medicine, real estate, law, insurance, engineering.

SPELLGUARD is Reliable

- thoroughly tested in actual use with free one-year maintenance service.
- 30-day money-back limited warranty.
- includes computer program for software updates and maintenance.

Minimum System Requirements: 8080/85, Z80 CPU with 32K memory; CP/M¹ 1.4 (dictionaries to 256K bytes), CP/M¹ 2.0 or later (dictionaries to 4 MB), or CDOS; word processor or text editor compatible with SPELLGUARD (currently several excellent new CP/M word processors, and WordStar², WordMaster², Magic Wand², Electric Pencil², and ED).

Trademarks: ¹Digital Research (registered), ²MicroPro Int'l Corp., ³Small Business Applications, ⁴Michael Shroyer Software, ⁵Cromemco.

*Time estimates based on 4Mhz 8085 with 48K memory, CP/M 2.1 double density 8" floppy drive, 10,000-word text file.

The price of SPELLGUARD includes rapid turnaround and delivery by UPS or airmail. Sales will be made only if the purchasers' word processor is compatible with SPELLGUARD. Software license agreement is required.

- Send me a free, detailed description and latest diskette format availability.
- Send me SPELLGUARD at \$295.00. (Manual and diskette(s). Formats: 8" CP/M single density Shugart compatible, and 5 1/4" Northstar double.)
- Send me _____ copies of the SPELLGUARD manual at \$20.00 each. (Airmail, credited toward purchase.)
- Send COD (add \$10.00 handling). California residents add 6% tax. Add \$10.00 for foreign shipment.

Check enclosed for \$ _____
(Certified check, COD, and money order shipped immediately.)

NAME _____

ORGANIZATION _____

ADDRESS _____

CITY _____

STATE _____

PHONE _____

WORD PROCESSOR _____

COMPUTER SYSTEM _____

DISK SIZE _____ DISK FORMAT _____

Checks payable to ISA
Box 2797, Menlo Park, CA 94025.

(Dealer inquiries invited.)



INNOVATIVE SOFTWARE APPLICATIONS
Box 2797, Menlo Park, California 94025 415-326-0805

**STATE-OF-THE-ART
SOFTWARE**

SOFTWARE DEVELOPMENT TOOLS FOR INDUSTRY

CP/M CROSS-ASSEMBLERS

Fast, comprehensive cross-assemblers to run under CP/M.* Extensive pseudo-ops include full listing control, nested conditionals, mnemonic synonyms, and inclusion of external source files. Generate object file, assembly listing, and symbol table from source code for nine popular microprocessor families.

XASM05	6805
XASM09	6809
XASM18	1802
XASM48	8048
XASM51	8051
XASM65	6502
XASM68	6800/6801
XASM F8	F8/3870
XASM400	COPS400

Assemblers \$200.00 each
Manual only \$25.00

8048 DEVELOPMENT PACKAGE

Now you can use the 8048 family of single-chip microcomputers without buying expensive equipment. Develop 8048 software with the XASM48 cross-assembler. Then plug our EPR-48 board into your S-100 system to program the 8748 EPROM version. (Similar packages for 8051 and TMS9940E coming soon.)

8048 Development Package ... \$574.00
EPR-48 alone \$449.00

PROM EMULATOR BOARD

Debug dedicated systems quickly. Our PSB-100 PROM Emulator is an S-100 board with up to 8K of RAM. Cable with 24-pin plug replaces PROM(s) in your target system for instant program testing.

PSB-100 PROM Emulator .. \$395.00 w/
1K RAM
\$565.00 w/
8K RAM



*Trademark of Digital Research

804 south state st.
dover, delaware/19901/302-734-0151

Visa and Mastercharge accepted. We ship on 8" single-density. Ask us about other formats.
OEM AND DEALER INQUIRIES INVITED.

Listing 1 continued:

```

StepX := Dx / Length;      StepY := Dy / Length;
Xpos := ScreenX;          Ypos := ScreenY;

for I := 0 to trunc(Length) do
begin
Screen[round(Xpos), round(Ypos)] := true;
Xpos := Xpos + StepX;      Ypos := Ypos + StepY;
end;
ScreenX := X;              ScreenY := Y;
end;      (* Drawto *)

(* ++++++ ReadObject ++++++ *)
procedure ReadObject( FileName : string );      (* read in object from disk *)
var PtsObj, PclsObj, PtsPol, I, J : counters;
Xpos, Ypos, Zpos : reals;
ObjFile : file of char;

begin
write(⟨position for ⟨,FileName,⟨ X Y Z : ⟩⟩); readln(Xpos, Ypos, Zpos);
reset(ObjFile, FileName);      (* open object file *)
readln(ObjFile, PtsObj, PclsObj);
for I:=1 to PtsObj do with Points[I+NumPts] do
begin
readln(ObjFile, J, X, Y, Z);
X := X + Xpos; Y := Y + Ypos; Z := Z + Zpos;
end;
for J:=1 to PclsObj do
begin
read(ObjFile, PtsPol);      (* read polygon vertex pointers *)
for J := 1 to PtsPol do
begin
read(ObjFile, Vertices[J+NumVtces]);
Vertices[J+NumVtces] := Vertices[J+NumVtces] + NumPts;
end;
readln(ObjFile);      (* read past end of line *)
with Polygons[I+NumPcls] do
begin
Start := NumVtces;
NumVtx := PtsPol;
end;
NumVtces := NumVtces + PtsPol;
end;
NumPts := NumPts + PtsObj;
NumPcls := NumPcls + PclsObj;
end;      (* ReadObject *)

(* ++++++ MakePicture ++++++ *)
procedure MakePicture;      (* transform and clip, then display polygons *)
var I, J, NumClip : counters;
TmpPoly : OnePoly;

(* ++++++ DotProd ++++++ *)
function DotProd( Pt1, Pt2 : Point ) : real;
begin
DotProd := Pt1.X * Pt2.X + Pt1.Y * Pt2.Y + Pt1.Z * Pt2.Z ;
end;      (* DotProd *)

(* ++++++ Ident ++++++ *)
procedure Ident( var Mtx : Matrix );      (* initialize matrix *)
var I, J : counters;
begin
for I:=1 to 4 do
for J:=1 to 4 do
if I = J then Mtx[I, J] := 1.0 else Mtx[I, J] := 0.0;
end;      (* Ident *)

(* ++++++ MatrixMult ++++++ *)
procedure MatrixMult( Mtx1, Mtx2 : Matrix; var Result : Matrix );
var I, J, K : counters;
begin
for I:=1 to 4 do
for J:=1 to 4 do
begin
Result[I, J] := 0.0;
for K:=1 to 4 do
Result[I, J] := Result[I, J] + Mtx1[I, K]*Mtx2[K, J];
end;
end;
end;      (* MatrixMult *)

(* ++++++ Transform ++++++ *)
procedure Transform( Pt : Point; Mtx : Matrix; var NewPt : Point );
begin
NewPt.X := Pt.X*Mtx[1, 1] + Pt.Y*Mtx[1, 2] + Pt.Z*Mtx[1, 3] + Mtx[1, 4];
NewPt.Y := Pt.X*Mtx[2, 1] + Pt.Y*Mtx[2, 2] + Pt.Z*Mtx[2, 3] + Mtx[2, 4];
NewPt.Z := Pt.X*Mtx[3, 1] + Pt.Y*Mtx[3, 2] + Pt.Z*Mtx[3, 3] + Mtx[3, 4];
end;      (* Transform *)

```

Listing 1 continued on page 296

MULTI-USER OASIS HAS THE FEATURES PROS DEMAND. READ WHY.

Computer experts (the pros) usually have big computer experience. That's why when they shop system software for Z80 micros, they look for the big system features they're used to. And that's why they like Multi-User OASIS. You will too.

DATA INTEGRITY: FILE & AUTOMATIC RECORD LOCKING

The biggest challenge for any multi-user system is co-ordinating requests from several users to change the same record at the same time.

Without proper co-ordination, the confusion and problems of inaccurate or even destroyed data can be staggering.

Our File and Automatic Record Locking features solve these problems.

For example: normally all users can view a particular record at the same time. But, if that record is being updated by one user, automatic record locking will deny all other users access to the record until the up-date is completed. So records are always accurate, up-to-date and integrity is assured.

Pros demand file & automatic record locking. OASIS has it.

SYSTEM SECURITY: LOGON, PASSWORD & USER ACCOUNTING

Controlling who gets on your system and what they do once they're on it is the essence of system security.

(THEN COMPARE.)

Without this control, unauthorized users could access your programs and data and do what they like. A frightening prospect isn't it?

And multi-users can multiply the problem.

But with the Logon, Password and Privilege Level features of Multi-User OASIS, a system manager can specify for each user which programs and files may be accessed—and for what purpose.

Security is further enhanced by User Accounting—a feature that lets you keep a history of which user has been logged on, when and for how long.

Pros insist on these security features. OASIS has them.

EFFICIENCY: RE-ENTRANT BASIC

A multi-user system is often not even practical on computers limited to 64K memory.

OASIS Re-entrant BASIC makes it practical.

How? Because all users use a single run-time BASIC module, to execute their compiled programs, less

memory is needed. Even if you have more than 64K, your pay-off is cost saving and more efficient use of all the memory you have available—because it services more users.

Sound like a pro feature? It is. And OASIS has it.

AND LOTS MORE...

Multi-User OASIS supports as many as 16 terminals and can run in as little as 56K memory. Or, with bank switching, as much as 784K.

Multi-Tasking lets each user run more than one job at the same time.

And there's our BASIC—a compiler, interpreter and debugger all in one. An OASIS exclusive.

Still more: Editor; Hard & Floppy Disk Support; Keyed (ISAM), Direct & Sequential Files; Mail-Box; Scheduler; Spooler; all from OASIS.

Our documentation is recognized as some of the best, most extensive, in the industry. And, of course, there's plenty of application software.

Put it all together and it's easy to see why the real pros like OASIS. Join them. Send your order today.

OASIS IS AVAILABLE FOR SYSTEMS: Altos; CompuCorp; Cromemco; Delta Products; Digital Group; Digital Microsystems; Dynabyte; Godbout; IBC; Index; Intersystems; North Star; Onyx; SD Systems; TRS 80 Mod II; Vector Graphic; Vormex.

CONTROLLERS: Bell Controls; Cameo; Corvus; Konan; Micromation; Micropolis; TARBELL; Teletek; Thinkertoys; X Comp.

Write for complete, free Application Software Directory.

PLEASE SEND ME:

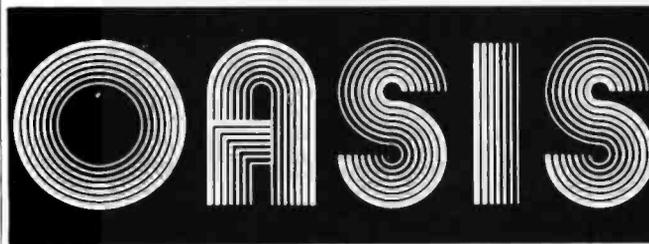
Product	Price with Manual	Manual Only
OPERATING SYSTEM (Includes: EXEC Language; File Management; User Accounting; Device Drivers; Print Spooler; General Text Editor; etc.) SINGLE-USER MULTI-USER	\$150 350	\$17.50 17.50
BASIC COMPILER/INTERPRETER/DEBUGGER	100	15.00
RE-ENTRANT BASIC COMPILER/INTERPRETER/DEBUGGER	150	15.00
DEVELOPMENT PACKAGE (Macro Assembler; Linkage Editor; Debugger)	150	25.00
TEXT EDITOR & SCRIPT PROCESSOR	150	15.00
DIAGNOSTIC & CONVERSION UTILITIES (Memory Test; Assembly Language; Converters; File Recovery; Disk Test; File Copy from other OS, etc.)	100	15.00
COMMUNICATIONS PACKAGE (Terminal Emulator; File Send & Receive)	100	15.00
PACKAGE PRICE (All of Above) SINGLE-USER MULTI-USER	500 850	60.00 60.00
FILE SORT	100	15.00
COBOL-ANSI '74	750	35.00

Order OASIS from:
Phase One Systems, Inc.
7700 Edgewater Drive, Suite 830
Oakland, CA 94621

Telephone (415) 562-8085
TWX 910-366-7139

NAME _____
STREET (NO BOX =) _____
CITY _____
STATE _____ ZIP _____

AMOUNT \$ _____
(Attach system description; add \$3 for shipping; California residents add sales tax)
 Check enclosed VISA
 UPS C.O.D. Mastercharge
Card Number _____
Expiration Date _____
Signature _____



MAKES MICROS RUN LIKE MINIS

MBC Systems, Inc.

(203) 342-2747



NORTH STAR HORIZON:

HRZ-2-32K-D-Factory ASMS\$2275
 HRZ-2-32K-Q-Factory ASMS\$2675
 64K DD or Q Also Available
 HDS-18-F.....\$4449
 Northword DQ.....\$ 359
 INFO-Manager.....\$ 365
 Mail Manager.....\$ 269
 General Ledger.....\$ 775
 ACC. REC. OR ACC. PAY..\$ 445
 Word Star.....\$ 350
 Medical-Dental SYS....\$2500



COMMODORE (PET):

2001-32K-BorN Keyboard \$1090
 16K Also in Stock...\$899!!!
 8032 (80 Column Screen)\$1599
 2040 Dual Floppy Drive \$1090
 8050 Dual Floppy (1MEG)\$1599
 2022 Tractor Printer...\$ 749
 Word PRO IV.....\$ 290
 VISICALC.....\$ 195
 APPLE II PLUS Call For Price!
 ATARI 800.....\$ 849
 TI 99/4 Console&Monitor.. \$990
 INTERTEC SUPERBRAIN:
 32K RAM.....\$2595
 64K RAM.....\$2695

PRINTERS

Letter Quality:
 NEC 5510 or 5530.....\$2550
 NEC 5520 KSR.....\$2950
 DIABLO 630.....\$2390
 C.I.TOH.....\$1690
 Dot Matrix:
 CENTRONICS 730.....\$ 599
 " " 737-1.....\$ 799
 " " 799.....\$ 999
 EPSON MX-80.....\$ 599
 PAPER TIGER 460G.....\$1250
 BASE II MST.....\$ 649

DISPLAY TERMINALS

HAZELTINE 1420.....\$ 949
 " " 1500.....\$ 999
 INTERTUBE III.....\$ 775
 TELEVIDEO 920C.....\$ 849

Since 1977 complete sales and service. Most items in stock, prices are subject to change. Visa and Master Charge welcome. Most items shipped by UPS.

MBC Systems, Inc.

Multi Business Computer Systems, Inc.
 28 MARLBOROUGH STREET
 PORTLAND, CONN. 06480

(203)342-2747 TWX 710-428-6345
 M-F 9-6 SAT.9:30-3:00

Listing 1 continued:

```
(* ++++++ GetEyeSpace ++++++ *)
procedure GetEyeSpace( EyePt, CntrInt : Point );
var   Mtx : Matrix;
      C1,C2 : Point;
      Hypotenuse,CosA,SinA : real;

begin
  Ident(EyeSpace);      (* load eyepoint translation *)
  with EyePt do
    begin EyeSpace[1,4]:=-X; EyeSpace[2,4]:=-Y; EyeSpace[3,4]:=-Z; end;
  Transform( CntrInt, EyeSpace, C1 ); (* translate ctr. of interest *)

  Ident(Mtx);          (* load rotation about Z-axis *)
  with C1 do Hypotenuse := sqrt( X*X + Y*Y );
  if Hypotenuse > 0.0 then
    begin
      CosA := C1.Y / Hypotenuse;      SinA := C1.X / Hypotenuse;
      Mtx[1,1] := CosA;      Mtx[2,1] := SinA;
      Mtx[1,2] := -SinA;     Mtx[2,2] := CosA;
      MatrixMult( EyeSpace, Mtx, EyeSpace );
    end;
  Transform( CntrInt, EyeSpace, C2 ); (* rotate ctr. of interest *)

  Ident(Mtx);          (* load rotation about X-axis *)
  with C2 do Hypotenuse := sqrt( Y*Y + Z*Z );
  if Hypotenuse > 0.0 then
    begin
      CosA := C2.Y / Hypotenuse;      SinA := -C2.Z / Hypotenuse;
      Mtx[2,2] := CosA;      Mtx[3,2] := SinA;
      Mtx[2,3] := -SinA;     Mtx[3,3] := CosA;
      MatrixMult( EyeSpace, Mtx, EyeSpace );
    end;

  Ident(Mtx);          (* load switch between Y and Z axes *)
  Mtx[2,2] := 0.0;      Mtx[3,3] := 0.0;
  Mtx[2,3] := 1.0;     Mtx[3,2] := 1.0;
  MatrixMult( EyeSpace, Mtx, EyeSpace );
  end; (* GetEyeSpace *)

(* ++++++ MakeDisplayable ++++++ *)
procedure MakeDisplayable( var Pt : Point ); (* take to screen space *)
begin
  Pt.X := ScreenScale.X * Pt.X / Pt.Z + ScreenCtr.X;
  Pt.Y := ScreenScale.Y * Pt.Y / Pt.Z + ScreenCtr.Y;
end; (* MakeDisplayable *)

(* ++++++ FacesEye ++++++ *)
function FacesEye( Poly : OnePoly ) : boolean;

var   TmpPt : Point;
      TmpPoly : OnePoly;

begin
  with Poly[2] do
    begin TmpPt.X:=X; TmpPt.Y:=Y; TmpPt.Z:=Z; end;
  TmpPoly[1].X := Poly[1].X - Poly[2].X;
  TmpPoly[1].Y := Poly[1].Y - Poly[2].Y;
  TmpPoly[1].Z := Poly[1].Z - Poly[2].Z;
  TmpPoly[2].X := Poly[3].X - Poly[2].X;
  TmpPoly[2].Y := Poly[3].Y - Poly[2].Y;
  TmpPoly[2].Z := Poly[3].Z - Poly[2].Z;
  GetPlanes( TmpPoly, 2 );
  if DotProd( TmpPt, TmpPoly[1] ) <= 0.0
    then FacesEye := false
    else FacesEye := true;
end; (* FacesEye *)

(* ++++++ ClipIn ++++++ *)
procedure ClipIn( var Poly : OnePoly; var NumPts : counter);
var   I,J,LstJ; TmpPts : counter;
      D1,D2,A : real;
      TmpPoly : OnePoly;

begin
  for I:=1 to WindowSize do (* for each window edge *)
    if NumPts > 0 then
      begin
        D1 := DotProd( Poly[NumPts], Window[I] );
        LstJ := NumPts;
        TmpPts := 0;
        for J:=1 to NumPts do (* for each polygon edge *)
          begin
            if D1 > 0.0 then (* is leading vertex inside? *)
              begin
                TmpPts := TmpPts + 1;
                with TmpPoly[TmpPts] do
                  begin (* copy leading vertex *)
                    X:=Poly[LstJ].X; Y:=Poly[LstJ].Y; Z:=Poly[LstJ].Z;
                  end;
                end;
              end;
            end;
          end;
        end;
      end;
  end;
end; (* ClipIn *)
```

Listing 1 continued on page 298

PMC-80 Expanded



Use all standard peripherals and existing software

When you buy PMC-80 you get hardware and software compatibility with the most popular microcomputer system in the world—that means thousands of disk and cassette based programs and all kinds of peripherals are instantly available!

PMC-80 has configurations that give the computer enthusiast a way to grow from a STARTER system in affordable increments. Begin at a low \$675 for the basic 16K level II system and grow to the complete 48K memory system pictured above with two floppy disks for less than \$3000.

FASTLOAD option inputs short programs as fast as "disk" from ordinary,

standard format cassettes. Fast, reliable and economical!

PMC-80 COMMUNICATOR option provides interface to modems and parallel port printers. Take your pick of peripherals for communication with electronic bulletin boards and low cost timeshare services via phone lines from your home or business.

PMC-80 EXPANDER option provides the most powerful configuration with a total of 48K memory, provision for 4 mini-floppies, printer interface, RS-232C communications interface, plus a slot for the popular S-100 boards.

Sold through computer stores.

Personal Micro Computers, Inc.

475 Ellis Street, Mountain View, CA 94043

(415) 962-0220

**A MICROPROCESSOR
TRAINING SYSTEM FOR:
EDUCATION
INDUSTRY
BUSINESS**

AND MORE!

**THE
Omnibyte
Trainer 1™**

MC6800/6809 BASED

- On Board RAM/ROM
- Hex Key Pad & Function Keys
- 8 Character Display
- Serial/Parallel Interface
- KC Standard Cassette Interface
- TBUG™ Monitor
- Comprehensive Teaching Documentation

AND MUCH MORE...

THE OMNIBYTE TRAINER IS DESIGNED TO LEAD YOU FROM BASICS TO A FULL UNDERSTANDING OF MICROPROCESSORS!

Expands into a full development system; or stand alone in a variety of applications

(312) 231-6880



245 W. ROOSEVELT RD.
BLD. 1-5
WEST CHICAGO, IL 60185

**Omnibyte
Corporation**

Listing 1 continued:

```

    end; (* if leading vertex inside *)
D2 := DotProd( Poly[LJ], Window[L] );
if D1 * D2 < 0.0 then (* does edge straddle window? *)
begin
  A := D1 / (D1 - D2);
  ImpPts := ImpPts + 1;
  with ImpPoly[ImpPts] do
  begin
    X := A * Poly[LJ].X + (1.0 - A) * Poly[LstJ].X;
    Y := A * Poly[LJ].Y + (1.0 - A) * Poly[LstJ].Y;
    Z := A * Poly[LJ].Z + (1.0 - A) * Poly[LstJ].Z;
  end;
  end;
  LstJ := J;
  D1 := D2;
end; (* NumPts loop *)
for J:=1 to ImpPts do (* copy polygon back to input *)
  with ImpPoly[J] do
  begin Poly[J].X:=X; Poly[J].Y:=Y; Poly[J].Z:=Z; end;
NumPts := ImpPts;
end; (* WindowSize loop *)
end; (* ClipIn *)

(* ++++++ InsertSort ++++++ *)
procedure InsertSort( Poly : OnePoly; NumPts : counter );
var I,J,K : counter;
    AvDepth : real;
begin (* binary insertion sort on average depth *)
  AvDepth := 0.0;
  for I:=1 to NumPts do
    with Poly[I] do (* store and find average depth *)
    begin
      OutVtces[NumVtxOut+1].X := X;
      OutVtces[NumVtxOut+1].Y := Y;
      OutVtces[NumVtxOut+1].Z := Z;
      AvDepth := AvDepth + Z;
    end;
  AvDepth := AvDepth / NumPts;
  OutVtces[NumVtxOut+1].Z := AvDepth;
  J := 0; (* initialize for insertion search *)
  I := (NumDisplay + 1) div 2;
  K := NumDisplay;
  while (J <> I) do (* binary search for insertion point *)
    if AvDepth < OutVtces[ OutPolys[I].Start ].Z
    then begin K := I; I := ( I + J ) div 2; end
    else begin J := I; I := ( I + K + 1 ) div 2; end;
  for J:=NumDisplay downto I+1 do
  begin
    OutPolys[J+1].Start := OutPolys[J].Start;
    OutPolys[J+1].NumVtx:= OutPolys[J].NumVtx;
  end;
  OutPolys[I+1].Start := NumVtxOut + 1;
  OutPolys[I+1].NumVtx:= NumPts;
  NumVtxOut := NumVtxOut + NumPts + 1;
  NumDisplay := NumDisplay + 1;
end; (* InsertSort *)

(* ++++++ ClipOut ++++++ *)
procedure ClipOut( Poly : OnePoly; var NumPts : Vertex; Place : counter);
var I,LstI,NumDrawn : counter;
    Pt1,Pt2 : Point;
    Drawn : boolean;
begin (* ++++++ ClipAfter ++++++ *)
  procedure ClipAfter( Index : counter; Pt1,Pt2 : Point);
  var I : counter;
      D1,D2,A : real;
      Out : boolean;
      Pts : Point;
  begin (* recursively check polygons for overlap with input edge *)
    if Index < Place (* is polygon closer than edge? *)
    then with OutPolys[Index] do
    begin
      I := Start + NumVtx;
      Out := false;
      repeat (* for each polygon edge *)
        D1 := DotProd( Pt1, OutVtces[I] );
        D2 := DotProd( Pt2, OutVtces[I] );
        if (D1 <= 0.0) and (D2 <= 0.0)
        then begin (* both points visible *)
          Out := true;
          ClipAfter( Index+1, Pt1, Pt2 );
        end
        else if D1 * D2 < 0.0
        then begin (* one point visible *)
          A := D1 / (D1 - D2);

```

Listing 1 continued on page 300

Nestar Is Growing a Local Network for You.

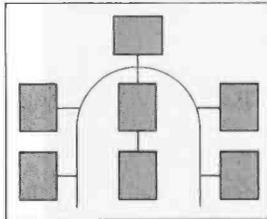
Centralized data processing is under pressure. Managers compete for computer time and complain about the lengthy justification process for new applications. Individual users at their terminals are frustrated by unacceptable response times. When the system goes down, everybody's DP-dependent work grinds to a halt.

High Productivity

Nestar's Cluster/One, Model A is a local network of Apple* computers that lets people get on with productive work instead of waiting in line. Since every user station is a computer in itself, response time is fast, and downtime problems are restricted to single individuals. The net result: productivity grows as your network grows.

More for Less

Nestar's Cluster/One is a true local network, not merely a limited function shared disk system. This means your company enjoys the benefits of shared data, station-to-station communication (including electronic mail), and the reduced costs of shared peripherals. Since Cluster/One is



microcomputer-based, its cost-per-station is dramatically lower than other systems with similar capabilities, including mini-based systems. And the more people on the network, the greater your savings!

We're Growing Our List of Applications

Cluster/One is working right now — in banking, manufacturing, the travel industry, schools, and many other institutions and businesses. Software for the application you have in mind may also exist right now — literally thousands of programs have been written for Apple.

Plant One Now!

We're ready to ship immediately. So if you're working on the problems of DP overload, consider the Cluster/One from Nestar. It's a solution that grows on you. For more information, contact us at: Nestar Systems, Inc., 2585 East Bayshore Road, Palo Alto, CA 94303, 415/493-2223

NESTAR

* Apple is a registered trademark of Apple Computers, Inc.

Circle 195 on inquiry card.



MTI stocks 'em all for faster delivery.

No hidden charges. Prices include delivery.
Ask about our "QED" discounts.
VISA and MasterCard orders accepted.

VIDEO TERMINALS

VT100 DECscope.....	\$ 1635
VT132 DECscope.....	1995
ADM-3A (dumb terminal)	795
ADM-3A+ (dumb terminal)	875
ADM-5 (dumb terminal)	945
ADM-31 (2 page buffer)	1185
ADM-42 (8 page buffer avail.)	2035
1410 (Hazeltime dumb terminal)	825
1420 (dumb terminal)	895
1421 (Consul 580 & ADM-3A comp.)	850
1500 (dumb terminal)	1045
1510 (buffered)	1145
1520 (buffered printer port)	1395
1552 (VT52 compatible)	1250

GRAPHICS TERMINALS

VT100 with graphics pkg.	3160
ADM-3A with graphics pkg.	1995
ADM-3A+ with graphics pkg.	2075

300 BAUD TELEPRINTERS

LA34-DA DECwriter IV	1045
LA34-AA DECwriter IV	1125
LA36 DECwriter II	1295
Teletype 4310	1045
Teletype 4320	1195
Diablo 630 RO	2295
Diablo 1640 KSR	2775
Diablo 1650 KSR	2835
TI 743 (portable)	1190
TI 745 (port/built-in coupler)	1485
TI 763 (port/bubble memory)	2545
TI 765 (port/bubble/b.i. coupler)	2595

600 BAUD TELEPRINTERS

TI 825 RO impact	1450
TI 825 KSR impact	1570
TI 825 RO Pkg.	1625
TI 825 KSR Pkg.	1795

1200 BAUD TELEPRINTERS

LA 120 RO (forms pkg.)	2295
LA 120-AA DECwriter III (forms pkg.)	2350
LA 180 DECprinter I	1695
TI 783 (portable)	1645
TI 785 (port/built-in coupler)	2270
TI 787 (port/internal modem)	2595
TI 810 RO impact	1760
TI 810 RO Pkg.	1950
TI 820 KSR impact	2025
TI 820 RO	1850
TI 820 KSR Pkg.	2195
TI 820 RO Pkg.	2025

2400 BAUD

Dataproducts M200 (2400 baud)	2595
-------------------------------------	------

DATAPRODUCTS LINE PRINTERS

8300 (300 LPM band)	5535
8600 (600 LPM band)	6861
2230 (300 LPM drum)	7723
2260 (600 LPM drum)	9614
2290 (900 LPM drum)	12655

ACOUSTIC COUPLERS

A/J A242-A (300 baud orig.)	242
A/J 247 (300 baud orig.)	315
A/J AD342 (300 baud orig./ans.)	395
A/J 1234 (Vadic compatible)	895
A/J 1245 (300/1200 Bell comp.)	695

MODEMS

GDC 103A3 (300 baud Bell)	395
GDC 202S/T (1200 baud Bell)	565
GDC 212-A (300/1200 baud Bell)	850
A/J 1256 (Vadic compatible)	825
A/J 1257 (triple modem w/phone)	975

CASSETTE STORAGE SYSTEMS

Techtran 816 (store/forward)	1050
Techtran 817 (store/for/speed up)	1295
Techtran 818 (editing)	1795
Techtran 822 (dual)	2295
MFE 5000 (editing)	1495

FLOPPY DISK SYSTEMS

Techtran 950 (store/forward)	1395
Techtran 951 (editing)	1995



Applications Specialists & Distributors
Great Neck, New York/Cleveland, Ohio.

N.Y.: 516/482-3500 & 212/895-7177
800/645-8016, Ohio: 216/464-6688

Listing 1 continued:

```

Pt3.X := A * Pt2.X + (1.0-A) * Pt1.X;
Pt3.Y := A * Pt2.Y + (1.0-A) * Pt1.Y;
Pt3.Z := A * Pt2.Z + (1.0-A) * Pt1.Z;
if B1 < 0.0
then begin (* Pt1 visible *)
  ClipAfter( Index+1,Pt1,Pt3 );
  with Pt3 do
    begin Pt1.X:=X; Pt1.Y:=Y; Pt1.Z:=Z; end;
end
else begin (* Pt2 visible *)
  ClipAfter( Index+1,Pt3,Pt2 );
  with Pt3 do
    begin Pt2.X:=X; Pt2.Y:=Y; Pt2.Z:=Z; end;
end;
end; (* one point visible *)

I := I-1;
until Out or (J = Start); (* all visible or edges exhausted *)
end
else begin (* reached end of list of closer polygons *)
  MakeDisplayable( P1 ); MakeDisplayable( P2 );
  MoveTo( P1.X,P1.Y ); DrawTo( P2.X,P2.Y );
  Drawn := true; (* mark as displayed *)
end;
end; (* ClipAfter *)

(* ClipOut procedure body *)
begin (* clip each poly edge by all closer polys, draw whats left *)
  NumDrawn := 0;
  LstI := NumPts;
  for I:=1 to NumPts do
    begin
      with Poly[LstI] do begin Pt1.X:=X; Pt1.Y:=Y; Pt1.Z:=Z; end;
      with Poly[I] do begin Pt2.X:=X; Pt2.Y:=Y; Pt2.Z:=Z; end;
      Drawn := false;
      ClipAfter( I,Pt1,Pt2 ); (* check closer polys, then display *)
      if Drawn then NumDrawn := NumDrawn + 1;
      LstI := I;
    end; (* for loop *)
  if NumDrawn = 0 then NumPts := 0; (* mark as hidden *)
end; (* ClipOut *)

begin (* MakePicture procedure body *)
  GetEyeSpace( EyePt,CntrInt ); (* get eyespace matrix *)
  NumDisplay := 0; NumVtxOut := 0; (* set output counters *)
  for I:=1 to NumPols do
    with Polygons[I] do
      begin
        for J:=1 to NumVtx do (* get polygon *)
          begin
            with PointIn Vertices[ Start + J ] do
              begin TmpPoly[J].X:=X; TmpPoly[J].Y:=Y; TmpPoly[J].Z:=Z; end;
            Transform( TmpPoly[J],EyeSpace,TmpPoly[J] ); (* transform *)
            end;
          if FacesEye( TmpPoly ) then
            begin
              NumClip := NumVtx; (* protect original data *)
              ClipIn( TmpPoly,NumClip ); (* clip to view window *)
              if NumClip > 0 then InsertSort( TmpPoly,NumClip );
                (* store in sorted order for display *)
            end;
          end; (* loop for each polygon *)
        (* display surviving polygons, clipping each by closer polygons *)
        Start; (* initialize and clear display *)
        for I:=1 to NumDisplay do
          with OutPolys[I] do
            begin
              for J:=1 to NumVtx do
                with OutVtxes[ Start + J ] do
                  begin TmpPoly[J].X:=X; TmpPoly[J].Y:=Y; TmpPoly[J].Z:=Z; end;
                ClipOut( TmpPoly,NumVtx,I ); (* clip and display *)
                if NumVtx > 0 then
                  begin
                    GetPlanes( TmpPoly,NumVtx ); (* convert to planes *)
                    for J:=1 to NumVtx do (* copy back for later clipping *)
                      with OutVtxes[ Start + J ] do
                        begin X:=TmpPoly[J].X; Y:=TmpPoly[J].Y; Z:=TmpPoly[J].Z;
                        end;
                    end;
                  end; (* for loop (i to NumDisplay) *)
                Finish; (* finalize picture *)
                end; (* MakePicture *)

begin (* main program *)
  Initialize; (* set up default view parameters *)
  while not Done do

```

Listing 1 continued on page 302

Move Up to Tarbell



The Serious Business Machine

Do you have a small computer system that operates with mini-floppies and has limited storage capacity? Then it's time to move up to the Tarbell Empire Series System. Tarbell starts where small systems leave off, providing storage from 1 to 20 megabytes. This means Tarbell is capable of growing right along with your business. (It also makes sense to start with Tarbell if you're a first-time computer buyer.)

Tarbell is the serious general purpose business machine, backed by years of experience with disk systems. It gives you word processing, inventory control with bill of materials, mailing lists — all in addition to accounting applications: general ledger, payables, receivables, payroll with cost accounting and order entry. Whatever your need may be, Tarbell can provide the working software that gets the job done.

With the Tarbell System you get a Z80 4 Mhz CPU with memory management, timer and full interrupt capability, 2 RS-232 serial ports with handshaking, 64 K bytes of random-access memory, double density floppy disk interface, 2 double density floppy disk drives, cabinet, power supply, and cables.

The software includes: CP/M™ 2.2 disk operating system, Tarbell Disk BASIC, Tarbell Database System, and all manuals and documentation.

Tarbell also offers the MP/M™ Multi-User Operating System and 4 additional RS-232 serial ports.

The Tarbell Empire Series is delivered assembled, tested, and with a FULL six-month warranty on parts and labor.

And when you need even more mass storage, Tarbell also has a hard disk that's system-compatible and provides easy back-up.

If your business is growing or you need more than a few hundred K bytes — it's time to move up to Tarbell. Call your local Tarbell dealer for competitive prices.

Tarbell
Electronics

The One-Stop Shopping Service

950 Dovlen Place, Suite B
Carson, CA 90746
(213) 538-4251

CP/M and MP/M are trademarks of Digital Research

Listing 1 continued:

```

begin
writeIn("read object, eyepoint, center of interest, start over,
      / window, picture, quit] ");
readIn(CmdChar);
case CmdChar of
  /r : begin write("file name : "); readIn(FileName);
        ReadObject(FileName);
        end;
  /e : begin write("eyepoint, X Y Z : ");
        with EyePt do readIn( X,Y,Z );
        end;
  /c : begin write("center of interest, X Y Z : ");
        with CntrInt do readIn( X,Y,Z );
        end;
  /s : begin NumPols := 0;   NumPts := 0;
        end;
  /w : begin write("display window : how many sides? ");
        readIn(WindowSize);
        for I:=1 to WindowSize do
          begin
            write("X Y Z : ");
            with Window[I] do readIn(X,Y,Z);
            end;
          GetScreenScale; (* get window to screen scale *)
          GetPlanes( Window,WindowSize ); (* get clipping planes *)
        end;
  /p : MakePicture;
  /q : Done := true;
end; (* case statement *)
end; (* while loop *)
end. (* main program *)

```

BYTE's Bugs

Adventurous Bugs

As expected, many people called our offices with questions about the two Adventure programs in the December 1980 BYTE, "Pirate's Adventure" (by Scott Adams, page 192) and "Lost Dutchman's Gold" (by Bob Liddil and Teri Li, page 268). Although the authors found only two errors *per se*, the following notes are in order:

In listing 2 of "Pirate's Adventure," page 210, line 1240 says:

```

1240 IF D <> -1 THEN
      1330 ELSE INPUT
      "READY DATA TAPE.
      HIT ENTER"; K$

```

while line 1330, the last line given in the listing, says simply:

```

1330 REM

```

According to Scott Adams, the listing is correct as stands, because D is set to -1 in line 20 of listing 2 (page 202) to denote a cassette-based program. The lines following line 1330 were deleted by Scott from an earlier version of the program, because they referred to disk commands only. Thus, the variable D should retain the value -1 throughout this program, thereby preventing a branch from line 1240 to line 1330.

There is an error in "Pirate's Adventure," but it affects you only if you tried to combine listings 1 and 2 into a single program for a 32 K-byte TRS-80 (as suggested in column 2 of page 212). The problem occurs when statements in what used to be listing 2 try to read the data directly from the DATA statements that used to be in listing 1. The full directions are:

1. Delete lines 6510 to 6790 of listing 1.
2. Append the remaining DATA statements from listing 1 to the end of listing 2, changing all occurrences after line 1240 of INPUT#D to READ.
3. In listing 2, change line 1280 to:

```

1280 FOR X=0 TO
CL:FOR Y=0 TO
1:READ CA(X,Y):NEXT
Y,X

```

4. In listing 2, change line 1290 to:

```

1290 FOR X=0 TO
NL:FOR Y=0 TO
1:READ NV$(X,Y):NEXT
Y,X

```

In the listing for "Lost Dutchman's Gold," the lack of a closing quote at the end of line 36 (page 268) caused some confusion. However, the program will run without the quote, so that is not a problem. One occurrence of the invisible Control-D that editor Gregg Williams missed mentioning is on line 4130 (page 280), just before the first letter in the word DELETE.

The error in "Lost Dutchman's Gold" is in the last line of line 1287 (page 274). Change the part that reads "7\$(J,3)" to read "O\$(J,3)"—the character before the dollar sign is capital O.

Thanks to Bob Liddil, Scott Adams, and several other BYTE readers for calling these problems to our attention. ■



Photo 1: Jon Swanson, BYTE drafting editor, finds a bug (shown in right hand) at the entrance to the Lost Dutchman Mine.

NEW LOCATION

1198 E. Willow Street
Signal Hill, CA 90806

Toll Free (800) 421-7701 Outside Calif.
(213) 595-6431 Inside Calif.

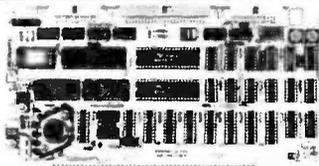
ORDERING INFO

Name, address, phone
Ship By: UPS or Mail
Shipping Chrg. Add \$2.50 up to
5 lbs. (UPS Blue)
U.S. Mail Add \$1.50 (U.S. Only)
(\$25.00 Minimum Order)

TERMS

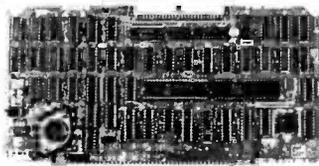
We Accept Cash, Check, Money
Orders, Visa & Master Charge
(U.S. Funds Only)
Tax: 6% Calif. Res.
COD's & Terms Available on
Approval (School PO's Accepted)

MICROBYTE S-100 BOARDS



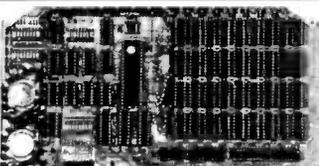
Z-80AII-O \$349.00
Assembled & Tested
Optional Monitor Program \$50.00

- A complete single board Z80A CPU with serial/parallel interface
- Fully compatible with the proposed IEEE S-100 Bus Standard
- Z80A CPU (latest version of the Z80)
- 15K instructions—super-set of and upward compatible from the 8080's instructions
- Up to 4K of on board Eprom with optional 2.0 Mbit program — 1K(2708) 2K(2716) or 4K(2732)
- Full vectored interrupt capability — 8 bit with 16K(1) or 4K(2)32)
- 2MHz or 4MHz operation is jumper selectable
- Jumperable auto-wait state insertion for extending I/O MREQ, IORQ, and/or on board ROM
- Dual RS-232 serial I/O ports using the Z80A-DART with individual baud rate selection from 50-19,200 baud
- Up to 24 bit parallel I/O port—fully programmable intel 8255A



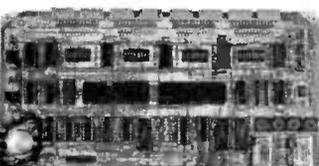
Disc Controller \$389.00
Assembled & Tested
CPM Available (Optional)

- DMA to within 16M byte of memory
- State-of-the-art NEC785 LSI Controller
- IEEE S100 compatible
- DMA arbitration allows use of multiple boards within a system
- Full data recovery for totally reliable operation
- 15/30 pin comp. switched at mid disc for reliable double density operation
- Supports up to four floppy drives
- On/Off/Power/Reset capacitors drives to avoid damaging files
- Drive detect/Time Out/deselect/Drive not in use
- Single or double sided operation
- Single density/double density operation
- 5 standard drives
- Separate VCC battery for data recovery to eliminate possible noise problems



64K RAM Board
Assembled & Tested Call for Price

- Fully S100 bus compatible
- 64K x 8 bit dynamic RAM
- Low power:
 - 8VDC @ 700 ma
 - 16VDC @ 100 ma
 - 16VDC @ 25 ma
- Built-in parity with LED indicator and vector interrupt
- Memory addressable in four 16K banks
- 1600vdi vetex
- Gold contacts for high reliability
- 72 hour Burn in
- Memory mapped dual DIP switches
- Built-in programmable write-protect
- Programmable control port for parity and bank control
- Alpha Micro Compatible



I/O Board \$289.00
Assembled & Tested

- Quad RS 232C Serial Ports, One 20mA Current Loop Port
- Fully IEEE S-100 Bus Compatible
- Asynchronous Communications with Z80A-DART or Synchronous Communications with Z80A-DART
- Full Set of Modem Control Signals, including B (Ring Indicator)
- Easily Configurable to Any Type of Terminal Interface
- I/O Servicing Circuits:
 - (1) Parity (2) Bus Vector
 - (3) Bus Mode 2 Vector
- Off-Board Interrupt Darts Chem Capability
- Special Receive Conditions:
 - (1) Framing Error (2) Parity Error
 - (3) Receiver Overrun Error
- Baud Rates Selected Individually from 50 Baud to 300K Baud
- 72 Hour Burn in

ATARI 800 (NEW 16K VERSION)

- COMPUTER CONSOLE • OPERATORS MANUAL
 - ATARI BASIC 8K RAM • RF MODULATOR
 - 57 FULL STROKE • POWER SUPPLY
 - ALPHANUMERIC KEYS • ADDED OPTIONS
 - PLUS 4 FUNCTION KEYS • JOYSTICKS
 - INVITATION TO PRO. • EDUCATION ROM
 - GRAMMING CASSETTE (NO CHARGE)
- CALL FOR PRICE
10% OFF SOFTWARE WITH PURCHASE

ATARI OPTIONAL ACCESSORIES

MODEL #	DESCRIPTION	PRICE
810	Disk Drive System	\$ 499.00
815	Disk Drive System	\$1199.00
820	40-col. Dot Matrix Printer	\$ 349.00
822	40-col. Thermal Printer	\$ 349.00
825	80-col. Dot Matrix Printer	\$ 750.00
830	Acoustic Modem	\$ 159.00
850	Interface Module	\$ 175.00
CX853	16K RAM Module	\$ 140.00
410	Cassette Recorder	\$ 60.00

ATARI SOFTWARE & ACCESSORIES

Description	Price	Description	Price
Basketball	\$30.00	Space Invaders	\$15.95
Super Breakout	\$30.00	Kingdom	\$12.95
Chess	\$30.00	Blackjack	\$12.95
Video Easel	\$30.00	Biorhythm	\$12.95
3-D Tic Tac Toe	\$30.00	Graph It	\$15.95
Star Raiders	\$42.00	Energy Czar	\$12.95
Music Composer	\$42.00	Mailing List	\$16.95
Educational Sys. ROM	\$19.95	Statistics I	\$16.95
Assembler/Editor	\$45.00	Paddle Controls	\$17.95
Telelink I	\$19.95	Joysticks (pair)	\$17.95

QUME DT-8 DISK DRIVE

- Double-sided/Single-Double Density
- IBM-compatible/1.2 Mbytes/Disk
- Fast — 3 ms. Track to Track
- 154 Tracks/Daisy Chain 4 Drives
- ISO Standard Write Protect
- Programmable Door Lock

DISK DRIVES

SA801R
8" Single-Sided
Single/Double
Density

CALL FOR PRICE & DELIVERY

NEW 16K RAM MODULE

FOR ATARI 800
COMPUTER SYSTEMS

\$99.95 ea.
Mfg. by asap

S.D. SYSTEMS

EXPANDORAM I
2MHz DYNAMIC
RAM BOARD
KITS

16K \$249.00
32K \$275.00
48K \$299.00
64K \$325.00

EXPANDORAM II
4 MHz DYNAMIC
RAM BOARD
KITS

16K \$260.00
32K \$285.00
48K \$310.00
64K \$335.00

SBC-100 KIT
2.5 MHz/Z-80 CPU
WITH SERIAL & PARALLEL
I/O PORTS

\$299.00

SBC-200 KIT
4 MHz/Z-80 CPU
WITH SERIAL & PARALLEL
I/O PORTS

\$325.00

VDB-8024 KIT
80x24 I/O MAPPED VIDEO BOARD
WITH KEYBOARD I/O

\$380.00

VERSAFLOPPY I KIT \$250.00
DISK CONTROLLER FOR
8" & 5 1/4" DRIVES
S-100 BUS COMPATIBLE

VERSAFLOPPY II KIT \$350.00
NEW DOUBLE DENSITY
DISK CONTROLLER FOR
8" & 5 1/4" DRIVES

PROM-100 KIT \$210.00
S-100/EPROM PROGRAMMER
FOR 2708, 2716, 2732, 2758 &
2516(TI)

ALL BOARDS ARE AVAILABLE
(ASSEMBLED & TESTED)
CALL FOR PRICE & DELIVERY

(SYSTEM SOFTWARE)
AVAILABLE UPON REQUEST

CALIFORNIA COMPUTER®

- 2016 16K STATIC RAM BRD.
- 2032 32K STATIC RAM BRD.
- 2065 64K DYNAMIC RAM BD
- 2116 16K STATIC RAM BD.
- 2200 MAINFRAME
- 2400 MINI-8100S
- 2422 DISK CONTROLLER
- 2501 MOTHERBOARD
- 2710 4-PORT SERIAL I/O
- 2718 2 SER. PORT & 2 PAR.
- 2720 4-PORT PARALLEL I/O
- 2802 6502 CPU BOARD
- 2810 Z-80 CPU BOARD
- 5400 MINI-8100
- 5416 THE-8100

4116's (200 NS)

(APPLE, TRS-80, HEATH, ETC.)
8 for \$26.00

16-49 pcs. 3.00
50-99 pcs. 2.85
100-499 pcs. 2.60
500 Up 2.40

2114 L-2/200 NS

1-16 \$3.60 ea.
17-49 \$3.40 ea.
50-99 \$3.25 ea.
100-499 \$3.00 ea.
500 Up \$2.85 ea.

COMPONENTS

74LS240	1.35 ea.
74LS241	1.25 ea.
74LS244	1.25 ea.
74LS373	1.50 ea.
74LS374	1.50 ea.
8T245	1.50 ea.

MICROPROCESSORS

8080A 2.50
Z80A 10.00
Z80 CTC 8.95

2708/450 NS

\$5.50 ea.
or
8/\$42.00

2716/5 VOLT

\$8.75 ea.
450 NS.
Major Mfg.

REGULATORS

320T5	.80
320T12	.80
340T5	.70
340T12	.75
78L12	.25

RS-232 CONNECTORS

DB25P DB25S	
1-9	2.90 3.80
10-24	2.75 3.70
25 Up	2.40 3.60

Data Phone Hood 1.00

LO-PRO SOCKETS

14 PIN	.10 .09
16 PIN	.12 .11
18 PIN	.15 .13
20 PIN	.23 .21
24 PIN	.26 .24
28 PIN	.30 .28
40 PIN	.40 .38

(BURNDY/TIN SOLDERTAIL)

MONITORS

AMDEK 100
12" B&W \$129.00
SANYO VM5012
12" B&W \$260.00
AMDEK
13" Color \$375.00
IN STOCK

MODEMS

NOVATION CAT
300 BAUD, AUTO
ANSWER/ACUSTIC
\$149.00 ea.
NOVATION D-CAT
300 BAUD/DIRECT
CONNECT
\$169.00 ea.
(OPTIONAL RS232
CABLE \$22.00)

CAPACITORS

.1 @ 12 Volt
Ceramic
9¢ ea.
or
100/\$8.00

DISKETTES

Verbatim 5 1/4" (soft)	Part #	Price Box of 10
Scotch 5 1/4" (soft)	MD525-01	\$26.50
Scotch 5 1/4" (10-sec)	744-0	\$33.00
Scotch 5 1/4" (16-sec)	744-16	\$33.00
Memorex 5 1/4" (soft)	3421	\$24.00
Scotch 8" DS (soft)	743-0	\$49.95
Maxell 8" DS/DD	FD-2D	\$65.00

CONNECTORS

100 PIN IMSAI
GOLD/S-100
SOLDERTAIL
\$2.40 ea.
or
10/\$2.25 ea.

MAIN/FRAME & DISK DRIVE CABINETS from INTEGRAND

MODEL X5 — Desktop Mainframe — 5 Cards — Small Power Supply
Cabinet size: 9.4" x 16" x 7.5" h. Cabinet painted dove grey, front panel is black. No optional color! 5-position motherboard, 5 connectors installed, card cage with all guides. Reset switch on front panel. Power switch, 4 DB25 cutouts, 16 power mounting holes, 70CFM fan, EMI filter, 6" power cord, fine fuse, and clamped flat cable exit on rear panel. Pkx 5 power supply (+8@10A, +16@1.5A, -16@1.5A). Power supply is a removable module.

MODEL 7000 — Horizontal Desktop Disk/Cover — 2 Eight Inch Drives — Drives Horizontal \$250
Cabinet size: 20" w x 23" d x 7.5" h. Cabinet painted dove grey, front panel is black. Mounting for 2 eight-inch Shugart SABDR Floppy Disk Drives (or mechanical equivalent). Drive mounting brackets supplied. Drives not supplied. 70CFM fan, 6" three-wire line cord, power switch, line fuse, EMI filter and clamped flat cable exit on rear panel. P794 power supply; +5@4A, +24@5A—6A peak, -5@.75A. All voltages regulated. Power supply is a removable module.

MODEL 8000 — Desktop Main/Frame — 15 Cards — Standard Power Supply \$255
Cabinet size: 17" w x 20.5" d x 7.5" h. Cabinet painted dove grey, front panel is black (other color schemes optional). 15-position IEEE compatible motherboard (will accept T801 terminator kit, optional), card cage with all guides. Reset switch on front panel. Power switch, 8 DB25 cutouts, 2 power mounting holes, 70CFM fan, EMI filter, 6" power cord, line fuse, and clamped flat cable exit on rear panel. P800 power supply (+5@5A, +16@3A, -16@3A). Power supply is a removable module. Motherboard connectors optional.

MODEL 7000S — Vertical Desktop Disk/Cover — 2 Eight Inch Drives — Drives Vertical \$250
Cabinet size: 13.5" w x 23" d x 11" h. Cabinet painted dove grey, front panel is black. Mounting for 2 eight-inch Shugart SABDR Floppy Disk Drives (or mechanical equivalent). Drive mounting brackets supplied. Drives not supplied. 70CFM fan, 6" three-wire line cord, power switch, line fuse, EMI filter and clamped flat cable exit on rear panel. P794 power supply; +5@4A, +24@5A—6A peak, -5@.75A. All voltages regulated. Power supply is a removable module.

Technical Forum

An ADM-3 Emulator for the Hazeltine 1500

Charles Shoemaker
2725 E Maplewood Ave
Littleton CO 80121

All Hazeltine 1500 owners seem to agree on two things: it is a very nice terminal; and they are frustrated that a good deal of the software available that uses cursor control has been written for the Lear Siegler ADM-3 terminal; consequently, it will not run properly on the 1500.

In my particular case, the problem came to a head as I was attempting to modify for my terminal a graphics game written in 8080 assembly language. Some of the cursor-movement control was not at all obvious, and I wasn't really willing to take the time to follow the entire structure of the program through just to play a simple game.

This, coupled with the fact that I'd have to do the same (disassembling system software where no source code is provided) for every program written for the ADM-3, led me to write this routine.

This routine is a patch to my CP/M operating system BIOS (I/O driver module). It can be placed in ROM (read-only memory) or programmable memory, but, if it is placed in ROM, the two temporary locations, MODE and Y, will have to be relocated somewhere in programmable memory. The routine is entered with the ASCII (American Standard Code for Information Interchange) character to be sent contained in the C register and the parity bit low. It assumes that the output status has been checked and that the output port is ready for a character. Registers A and C are altered on exit. Since this routine needs to send as many as four characters (I will explain that in a moment), there's a subroutine to wait for output status, which will have to be customized for other systems.

If the character to be sent comes in another register, the MOV instructions to and from C (and the PUSH B and POP B instructions, if the register is B) can be easily altered. For example, if the program sends the character in A, the following routine can be used:

```
PUSH B
MOV C,A
CALL EMULATOR
POP B
RET
```

Note that in the 8080 instruction set, the PUSH B and POP B instructions also do the same to C.

The code is twisty, and a little bit devious, as described below. I first attempted to fit it into 128 bytes, so that it would fit in one disk sector. Unfortunately, I didn't quite make it. Users with Z80 processors can take advantage of

Order from
the No 1 Dealer
in the Country!
TOLL FREE

1(800) 421-0347

Commodore

Call for latest price on:



- CBM 8000 Business computer
- CBM 2001 Business computer
- CBM 2001 PET
- CBM 2022 Printer
- CBM 2023 Printer
- CBM2040 Dual Drive Floppy Disk
- CBM 8050 Dual Drive Floppy Disk

- CBM Modem (300 Baud)
- CBM Voice Synthesizer

apple II & II plus



16K-Call
32K-Call
48K-Call
toll free

apple III is here

Call today and be the first to have the most powerful professional computer in its class!



ATARI 825 Printer..\$799



atari 800



Everything that 400 has plus Basic Language Cartridge. 16K memory (expandable to 48K). Only \$798.

FREE Bonus 8K Memory Module good till 12/31/80.
Atari Program Recorder. Only \$68.95
Atari Expansion Memory. 8K \$89.95
16K \$159.

* apple II inventory control system

The first truly professional system that can tackle up to 8,100 items, transaction register/audit trail, inventory status report, re-order report, keeps track of purchase orders automatically, will handle multiple departments or divisions, fast data retrieval. Minimum hardware requirements: Apple II Plus with 48K, one disk drive and 80 column printer. Available also for the new DOS 3.3.

dysan diskettes



- 8" (Box of 10) 374/0/1 sgl side/sgl density \$4.50 ea.
- 374/0/1D sgl side/dbl den \$6.95 ea.
- 5" (Box of 5) 104/11 sgl sector, 107/11 10 sectors, 105/11 16 sectors \$4.50 ea.



Micromodem 100 Call.
Micromodem II Only \$325

In California Call (213) 996-2252



MICRO BUSINESS WORLD™
15818 Hawthorne Blvd.,
Lawndale, CA 90260

U.S. and International Dealer
Inquiries invited.

Introducing The NEC Personal Computer



Here is THE computer from NEC. Centronics and RS232 interfaces are standard. Up to 64 K (RAM). SEND FOR PRICE AND INFO., OR CALL TOLL FREE!

monitors

9" Black and white. Only \$185.
Also available in Sanyo

12" Black and white.
15" Black and white.

TRS-80*

All TRS-80 Compatible Hardware and Software. Call us and tell us what you need! TRS-80 is a trademark of Tandy Corp.

print wheels and thimbles

Huge selection for Qume, Diablo, NEC. Plastic or metal.
Call 1-800-421-0347.

apple cards

- Hi-Speed Serial Interface Call
- Communications Interface Call
- Parallel Printer Interface Call
- Centronics Printer Interface Call
- Hobby/Prototype Call
- Integer Basic Firmware Call
- Applesoft Firmware Call

NEC



Letter quality high speed printer, bi-directional, high resolution plotting, graphics.

RO with Tractor Feed \$2865.
KSR with Tractor Feed \$2995.

- Paper Tiger (1P440) \$949. With Graphics
- Anadex DP9500 \$1449
- DP8000 \$849.
- Epson MX 80 \$645.



DATA SYSTEMS
Smart Video Terminal

\$795



THE HP-85!

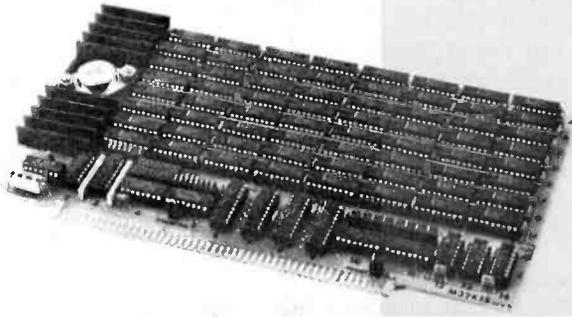
The HP-85 is a powerful BASIC language computer complete with keyboard, CRT display, printer, and tape drive—all in one compact unit.

16K RAM
Set of 4 \$39.95

Prices subject to change without notice. Please allow ample time for checks to clear. Please add 2% for shipping and handling. California residents please add 6% sales tax. Sorry, no COD.

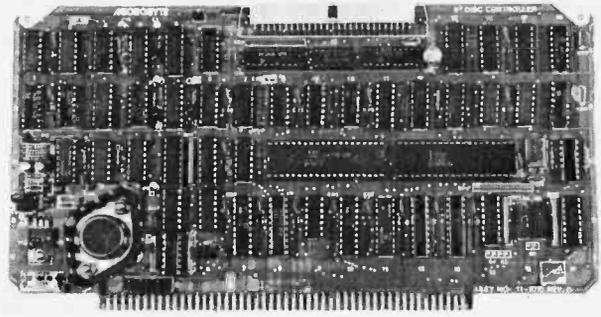
Immediate response to your orders

MICROBYTE INTRODUCES MORE PROFIT FOR YOUR BOTTOM LINE



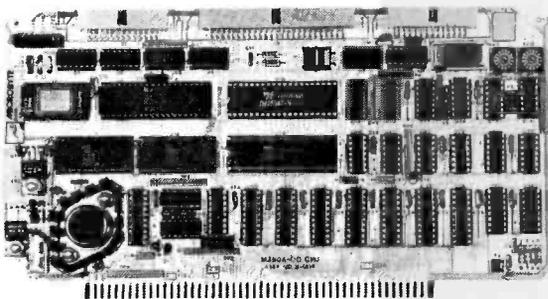
32K STATIC MEMORY BOARD

- Fully S100 bus compatible, IMSAI, SOL, ALTAIR, ALPHA MICRO
- Uses Intel low-power 2141L-4 4Kx1 Static RAM
- 2 MHz or 4 MHz operation
- Gold contacts for higher reliability
- Thermally designed heat sink (board operating temperature 0-70 °C)
- Commercially designed power bus; 7 ground bus bars; 0.1 uf decoupling capacitors
- Fully tri-state buffered
- Inputs fully low-power Shottky Schmitt Trigger buffered on all address and data lines
- Phantom is jumper selectable to pin 67
- Each 4K bank addressable to any 4K slot within a 64K boundary
- 4K hardware or software selectable
- One on-board 8-bit output port enables or disables the 32K in 4K blocks
- Selectable port address
- 4K banks can be selected or disabled on power on clear or reset
- Will operate with or without front panel
- Compatible with Alpha Micro, with extended memory management for selection beyond 64K
- No DMA restriction
- Low power consumption 800mA
- Fully warranted for 120 days from date of shipment



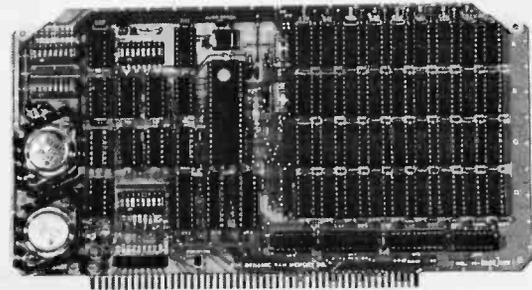
DISK CONTROLLER

- DMA to within 16M byte of memory
- State-of-the-art NEC765 LSI Controller
- IEEE-S100 compatible
- DMA arbitration allows use of multiple boards within a system
- PLL data recovery for totally reliable operation
- Write pre-comp switched at mid-disc for reliable double density operation
- Supports up to four (4) drives
- Power On, Power Off or Reset deselects drives to avoid damaging files
- Drive deselect Time Out, deselect drives not in use
- Single or double sided operation
- Single density/double density operation
- 8" standard drives
- Separate V_{CC} supply for data recovery to eliminate possible noise problems



Z-80A I/O

- A complete single board Z-80A CPU with serial/parallel interface
- Fully compatible with the proposed IEEE S-100 Bus Standard
- Z-80A CPU (4MHz version of the Z-80)
- 158 instructions—superset of and upward compatible from the 8080's 78 instructions
- Up to 4K of on board Eprom with optional Z-80 monitor program — 1K(2708), 2K(2716) or 4K(2732)
- Full vectored interrupt capability
- 2MHz or 4MHz operation is jumper selectable
- Selectable auto-wait state insertion for extending M1*, MREQ*, IORQ* and/or on board ROM
- Dual RS-232 serial I/O ports using the Z80A-DART with individual baud rate selection (16 baud rates from 50-19,200 baud)
- Up to 24 bit parallel I/O port—fully programmable Intel 8255A
- Up to 8 separate counter/timers using 2 Z-80A CTC



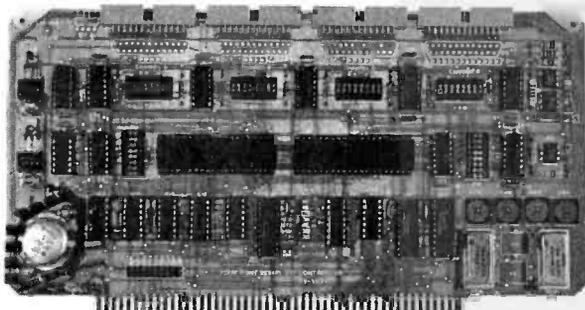
64K DYNAMIC RAM BOARD

- Fully S-100 bus compatible/Alpha Micro compatible
- 64K x 8 bit dynamic RAM
- Low power: + 8VDC @ 700 ma
+ 16VDC @ 100 ma
- 16VDC @ 25 ma
- Built-in-parity with LED indicator and vector interrupt
- Memory addressable in four 16K banks
- Hidden refresh
- Gold contacts for high reliability
- 72-hour Burn-in
- Memory mapped via DIP switch
- Built-in programmable write-protect
- Programmable control port for parity and bank control

MICROBYTE has the products — from memory boards to complete S-100 systems, and we offer the rest of the value cluster — call today for the whole story on how you can become a Microbyte dealer.

4 PORT I/O

- Quad RS-232C Serial Ports, One 20mA Current Loop Port
- Fully IEEE S-100 Bus Compatible
- Asynchronous Communications with Z80A-Dart(TM) or Synchronous Communications with Z80A-SIO/0(TM)
- Full Set of Modem Control Signals, including RI (Ring Indicator)
- Easily Configurable to Any Type of Terminal Interface
- I/O Servicing Environments: (1) Polled; (2) Bus Vector; (3) Z80 Mode 2 Vector
- Off-Board Interrupt Daisy Chain Capability
- Special Receive Conditions: (1) Framing Error; (2) Parity Error; (3) Receiver Overrun Error
- Baud Rates Selected Individually from 50 Baud to 300K Baud
- 72 Hour Burn-In



MICROBYTE 1198 E. Willow St., Signal Hill, CA 90806 • (213) 595-8571

DISCOUNT SOFTWARE

Ad #12 out our new items.

CP/M users: specify disk systems and formats. Most formats available.

DISK WITH MANUAL ONLY

- CP/M®**
- ARTIFICIAL INTELLIGENCE**
- Medical \$449/\$40
 - Dental \$449/\$40
- COMPLETE BUS. SYSTEM**
- Creator \$269/\$25
 - Reporter \$169/\$20
 - Both \$399/\$45
- COMPUTER CONTROL**
- Fabs \$159/\$20
 - UltraSort II \$159/\$25
- COMPUTER PATHWAYS**
- Pearl (level 1) \$ 99/\$25
 - Pearl (level 2) \$299/\$40
 - Pearl (level 3) \$549/\$65
- DIGITAL RESEARCH**
- CP/M 2.2**
- NorthStar \$149/\$25
 - TRS-80 Model II (P&T) \$159/\$35
 - Micropolis \$169/\$25
 - Cromemco \$189/\$25
 - PL/I-80 \$459/\$35
 - BT-80 \$179/\$25
 - Mac \$ 85/\$15
 - Sid \$ 65/\$15
 - Z-Sid \$ 95/\$15
 - Tex \$ 70/\$15
 - DeSpool \$ 50/\$10
- DYNAMIC MICRO-PROCESSOR ASSOC.**
- Ascom \$109/\$15
 - CBS \$369/\$45
 - DMA-DOS \$179/\$35
- GRAHAM-DORIAN**
- General Ledger \$729/\$40
 - Acct Receivable \$729/\$40
 - Acct Payable \$729/\$40
 - Job Costing \$729/\$40
 - Payroll \$493/\$40
 - Inventory \$493/\$40
 - Cash Register \$493/\$40
 - Apartment Mgt. \$493/\$40
- KEY BITS**
- String/80 \$ 84/\$20
 - String/80 (source) \$279/\$na
 - WordSearch \$179/\$25
- MICRO-AP**
- S-Basic \$269/\$25
 - Selector III \$269/\$25
 - Selector IV \$469/\$35
- MICRO DATA BASE SYSTEMS**
- HDBS \$269/\$35
 - MDBS \$795/\$40
 - DRS or QRS or RTL \$269/\$35
 - MDBS PKG \$1295/\$60
- MICROPRO**
- WordStar \$324/\$60
 - Customization Notes \$ 89/\$na
 - Mail-Merge \$114/\$25
 - WordStar/Mail-Merge \$434/\$85
 - DataStar \$249/\$60
 - WordMaster \$119/\$40
 - SuperSort I \$199/\$40
- MICROSOFT**
- Basic-80 \$294/\$30
 - Basic Compiler \$329/\$30
 - Fortran-80 \$349/\$30
 - Cobol-80 \$574/\$30
 - Macro-80 \$144/\$20
 - Edit-80 \$ 84/\$20
 - MuSimp/MuMath \$224/\$25
 - MuLisp-80 \$174/\$20
- ORGANIC SOFTWARE**
- TextWriter III \$111/\$20
 - DateBook \$269/\$25
- OSBORNE**
- General Ledger \$ 59/\$20
 - Acct Rec/Acct Pay \$ 59/\$20
 - Payroll w/Cost \$ 59/\$20
 - All 3 \$129/\$57
 - All 3 + CBASIC-2 \$199/\$71

- PEACHTREE®**
- General Ledger \$399/\$40
 - Acct Receivable \$399/\$40
 - Acct Payable \$399/\$40
 - Payroll \$399/\$40
 - Inventory \$399/\$40
 - Property Mgt \$799/\$40
 - CPA Client Write-up \$799/\$40
 - Mailing Address \$349/\$40
- SOFTWARE WORKS**
- Adapt \$ 69/\$na
 - Ratfor \$ 86/\$na
- SOHO GROUP**
- MatchMaker \$ 97/\$20
 - WorkSheet \$177/\$20
- STRUCTURED SYSTEMS**
- GL or AR or AP or Pay \$599/\$40
 - Inventory Control \$449/\$40
 - Analyst \$199/\$25
 - QSort \$ 89/\$20
- SUPERSOFT**
- Forth (8080 or Z80) \$149/\$25
 - Diagnotic II \$ 84/\$20
 - Other less 10%
- TCS**
- GL or AR or AP or Pay \$ 79/\$25
 - All 4 \$269/\$99
- WHITESMITHS**
- "C" Compiler \$600/\$30
 - Pascal (incl "C") \$750/\$45
- "DATA BASE"**
- FMS-80 \$649/\$45
 - dBASE II \$629/\$50
 - Condor \$599/\$30
 - T.I.M. \$329/\$35
- "PASCAL"**
- Pascal/MT+ \$429/\$30
 - Pascal/Z \$349/\$30
 - Pascal/UCSD \$299/\$30
 - Pascal/M \$149/\$20
- "WORD PROCESSING"**
- SpellGuard \$249/\$25
 - Spell Binder \$349/\$45
 - Magic Wand \$289/\$45
- "OTHER GOODIES"**
- Tiny "C" \$ 89/\$50
 - Tiny "C" Compiler \$229/\$50
 - CBASIC-2 \$ 89/\$15
 - Nevada Cobol \$129/\$25
 - MicroStat \$224/\$15
 - Vedit \$ 99/\$15
 - Prof Time Bill (Asyst) \$549/\$40
 - ESQ-1 \$1349/\$50
 - MiniModel \$449/\$50
 - StatPak \$449/\$40
 - Micro B+ \$229/\$40
- APPLE II®**
- MICROSOFT**
- Softcard \$292
 - Fortran \$179
 - Cobol \$574
- PERSONAL SOFTWARE**
- Viscalc \$122
 - CCA Data Mgr \$ 84
 - Desktop/Plan \$ 84
 - Zork \$ 34
- PEACHTREE®**
- General Ledger \$224/\$40
 - Acct Receivable \$224/\$40
 - Acct Payable \$224/\$40
 - Payroll \$224/\$40
 - Inventory \$224/\$40
- "OTHER GOODIES"**
- Super-Text II \$127
 - Data Factory \$129
 - DB Master \$159
 - Ledger Plus \$549
 - Charles Mann less 15%
 - STC less 15%

ORDERS ONLY—CALL TOLL FREE VISA • MASTERCHARGE

1-800-854-2003 ext. 823 • Calif. 1-800-522-1500 ext. 823

Overseas—add \$10 plus additional postage • Add \$2.50 postage and handling per each item • California residents add 6% sales tax • Allow 2 weeks on checks, C.O.D. ok • Prices subject to change without notice. All items subject to availability • ®—Mfgs. Trademark.

THE DISCOUNT SOFTWARE GROUP

6520 Selma Avenue, #309 • Los Angeles, CA 90028 • (213) 666-7677

Technical Forum

their relative-jump capabilities and easily crunch it into 128 bytes.

How It Works

On the ADM-3, cursor up, cursor right, home, and clear screen are simple control codes: 11, 12, 30, and 26 in decimal, respectively. The control codes for the two terminals are shown in table 1. These codes are converted in the routine called NORM (see listing 1). Noncontrol characters are shunted to be transmitted directly at the label

Listing 1: The Lear Siegler ADM-3 emulator for the Hazeltine 1500. For a detailed explanation of the program, see the accompanying text.

	ORG	7FR4H	;	FIX CPM OUTCH ROUTINE TO JUMP HERE
	JMP	ENTRY		
	ORG	8000H	;	PUT AFTER BIOS
ENTRY:	LDA	MODE	;	ARE WE IN THE MIDDLE OF SOMETHING?
	ORA	A		
	MOV	A,C	;	GET CHARACTER TO SEND, FOR COMPARES
	JZ	NDRM	;	ORDINARY
	JPE	XY	;	IF JUMP TAKEN, NORH CONTAINS EITHER 3 OR 255
	CFI	'='	;	MIDDLE OF XY ADDRESS SEQUENCE
	MVI	A,0	;	PRESET ERROR CONDITION
	STA	MODE		
	JNZ	ZAF	;	SOMETHING'S WRONG--PRINT IT AND GIVE UP
	MVI	A,3	;	FIX UP
	STA	MODE	;	TELL US NEXT TIME
	RET		;	AND BACK
NDRM:	CFI	30	;	TEST FOR HOME CHARACTER
	JC	NTHOME		
	JNZ	ZAF	;	NOT A CONTROL CHARACTER--SEND IT
	MVI	C,18	;	GET HAZEL'S HOME CHARACTER
	JMF	SFELC	;	DO IT
NTHOME:	CPI	11	;	IS IT UP--CURSOR?
	JZ	SFELC-1	;	QUICK TRICK
	CPI	12	;	IS IT RIGHT--CURSOR?
	JNZ	NTRGHT	;	NO---
	MVI	A,16	;	HAZEL'S RIGHT-CURSOR
	JMP	ZAF		
NTRGHT:	CPI	27	;	IS IT ESCAPE--ADDRESS CURSOR?
	JNZ	NTESC		
	MVI	A,1	;	TELL US NEXT TIME THROUGH.
	STA	MODE		
	RET			
NTESC:	CFI	26	;	IS IT CLEAR SCREEN?
	JNZ	OUTCH	;	NO, MUST BE SOME OTHER CONTROL CHARACTER
	INR	C	;	MAKE 28, HAZEL'S CLEAR SCREEN CHARACTER
	INR	C		
SPECL:	MVI	A,126	;	GET HER ATTENTION
	CALL	ZAF	;	SEND THE FIRST CHARACTER RIGHT AWAY
OUTCH:	MOV	A,C	;	RETRIEVE ORIGINAL CHARACTER
	FUSH	FSW	;	STOW IT AWAY
	IN	10H	;	GOTTA CHECK STATUS
	ANI	2		
	JZ	OUTCH+2		
	FOP	FSW	;	GET IT BACK
ZAF:	OUT	11H	;	SEND IT
	RET		;	FINALLY, RETURN TO CALLER
XY:			;	WE KNOW WE HAVE 'ESC' '=' SEQUENCE
	JM	FINAL	;	SEE IF THIS IS X OR Y CHARACTER
			;	TAKE THE JUMP IF THIS IS X
	MOV	A,C	;	JUST GET Y CHARACTER
	STA	Y	;	AND SAVE IT
	MVI	A,OFFH	;	LET US KNOW WHAT TO DO NEXT TIME
	STA	MODE		
	RET		;	AND BACK
FINAL:	FUSH	B	;	SAVE X CHARACTER A MINUTE
	MVI	C,17	;	GET HAZEL'S ATTENTION
	CALL	SPECL		
	FOP	B	;	GET'M BACK
	MOV	A,C	;	GET X COORDINATE
	SUI	32	;	GET RID OF ADM-3 BIAS
	CPI	31	;	FIX HAZEL'S BIAS
	JNC	SENDX	;	OK AS IS
	ADI	96	;	HAZEL LIKES THIS BETTER
SENDX:	CALL	OUTCH+1	;	SEND X
	XRA	A	;	FIX MODE UP--BACK TO NORMAL
	STA	MODE		
	LDA	Y	;	ADM-3 BIAS OK FOR HAZEL
	JMP	OUTCH+1	;	SEND IT AND GO HOME
MODE:	DB	0		
Y:	DB	0		
	END			

A>

dBASE™ II vs. the Bilge Pumps.

by Hal Pawluk

We all know that bilge pumps suck.

And by now, we've found out—the hard way—that a lot of software seems to work the same way.

So I got pretty excited when I ran across **dBASE II**, an assembly-language relational Database Management System for CP/M. It works! And even a rank beginner like myself got it up and running the first time I sat down with it.

If you're looking for software to deal with your data, too, here are some tips that will help:



Tip #1: Database Management vs. File Handling:

Any list or collection of data is, loosely, a data base, but most of those "data base management" articles in the buzzbooks are really about file handling programs for specific applications. A real Database Management System gives you data and program independence (no reprogramming when data changes), eliminates data duplication and makes it easy to turn data into information.

Tip #2: Assembly Language vs. BASIC:

This one's easy: if you're setting up a DBMS, you're going to be doing a lot of sorting, and Basic sorts are s-l-o-w. Run a benchmark on a Basic system like S*-IV against a relational DBMS like **dBASE II** and you'll see what I mean. (But watch it: I've also seen one extremely slow assembly-language file management system.)

Tip #3: Relational vs. Hierarchal & Network DBMS.

CODASYL-like hierarchal and network systems, around since the 1960's, are being phased out on the big machines so why get stuck with an old-fashioned system for your micro? A relational DBMS like **dBASE II** eliminates the pre-defined sets, pointers and complex data structures of a CODASYL-type DBMS. And you don't need to be a programmer to use it.

dBASE II vs. everything else.

dBASE II really impressed me.

Written in assembly language (with no

need for a host language), it handles up to 65,000 records (up to 32 fields and 1000 bytes each), stores numeric data as packed strings so there are no round-off errors, has a super-fast multiple-key sort, and supports ISAM based on B* trees.

You can use it interactively with English-like commands (DISPLAY 10 PRODUCTS), or program it

(so when you've set up the formats, your secretary can do the work). Its report generator and user-definable full screen operations mean that you can even use your existing forms.

And if all this makes your mouth water, but you've already got all your data on a disk, that's okay: **dBASE II** reads your ASCII files and adds the data to its own database.

Right now, I'm using **dBASE II** with my word processor for budgeting, scheduling and preparing reports for my clients.

Next come job costing, time billing and accounting.

An Unheard-of Money-Back Guarantee.

dBASE II is the first software I've seen with a full money-back guarantee.

To check it out, just send \$700 (plus tax in California) to Ashton-Tate, 3600 Wilshire Blvd., Suite 1510, Los Angeles, CA 90010. (213) 666-4409. Test **dBASE II** doing your jobs on your computer for 30 days. If, for some strange reason, you don't want to keep it, send it back and they'll refund your money.

No questions asked.

They know you don't need your bilge pumped.

Ashton-Tate

©Ashton-Tate 1980

CROSS-COMPILE FORTH !

Nautilus Systems' Forth Cross-compiler is now in use by individuals, universities, and major companies around the world.

USES:

- To produce a modified or tailored version of Forth on a host computer.
- To produce Forth systems for computers that have none.
- To produce applications that use the minimum required nucleus code.
- To do all the above in a ROM/RAM environment.

FEATURES:

- Written entirely in high level fig-Forth.
- Automatic forward reference to any word or label.
- Cross-compiler to any location in the host for any base address in the target.
- Cross-compiler to any screen in the host for any base address in the target.
- Cross-compiler vocabularies.
- Can produce headerless code.
- Can produce romable code.
- Load map that shows address, type of symbol and name. The map appears in readable column format, and page width and length are selectable.
- A comprehensive list of undefined symbols is produced showing undefined CFAs, DOES> pointers, labels and words on a vocabulary-by-vocabulary basis.

MACHINE READABLE VERSIONS FOR THE FOLLOWING SYSTEMS:

TRS-80	APPLE	H-89
NORTHSTAR	CP/M	LSI-11

Each includes an executable version of fig-FORTH model 1.0, Cross-compiler, cross-compileable source, utilities, and documentation.
(This program is not intended for newcomers to FORTH)

Price \$150.00 (Includes shipping). Calif. residents please add sales tax.

NAUTILUS SYSTEMS

P.O. BOX 1098 SANTA CRUZ, CA. 95061

FOR THE SERIOUS FORTH USER

TRS-80 is a trademark of Radio Shack, a division of Tandy Corp.
APPLE is a trademark of Apple Computers Inc.
CP/M is a trademark of Digital Research.
LSI-11 is a trademark of Digital Equipment Corp.

COPYRIGHT © 1981 NAUTILUS SYSTEMS

HOST → TARGET

Technical Forum

Action	ADM-3	H-1500
Cursor Up	11 (Control-K)	126, 12 (~, Control-L)
Cursor Down	10 (line feed)	10 (line feed)
Cursor Left	8 (backspace)	8 (backspace)
Cursor Right	12 (Control-L)	16 (Control-P)
Clear Screen	26 (Control-Z)	126, 28 (~, Control-shift-L)
Cursor Home	30 (Control-shift-N)	126, 18 (~, Control-R)

Table 1: The control codes for the Lear Siegler ADM-3 and the Hazeltine 1500 terminals. The numbers are the decimal values for the ASCII codes shown in parentheses.

ZAP. The control codes are detected with a series of compare operations, and the proper code for the Hazeltine placed in the C register. The Hazeltine's 126 function-lead-in code is sent, if necessary, by the jump to SPECL. Other control codes (carriage return, line feed, backspace, etc) fall through and are sent unchanged.

The two-coordinate direct cursor addressing is more complicated. For both terminals, X is the horizontal position, from 0 thru 79, and Y is vertical, from 0 thru 23. The ADM-3 must receive the sequence ESC (ASCII 27), "=" (ASCII 61), Y+32, and X+32. The H-1500 requires the tilde (~, ASCII 126), ASCII 17, then X, then Y+32. In addition, if X is in the range 0 thru 31, then 96 should be added, although the terminal will accept 0 thru 31.

The routine collects all four characters from the host software, then sends the Hazeltine control sequence. Since the emulator is called four times before it can complete the direct-cursor addressing sequence, we need some way to know where we are in the sequence and what action needs to be taken in each case. The temporary byte, MODE, is the key to what happens. Its four states are as follows:

- MODE=0: We are not in the middle of a direct-cursor-address sequence. NORM gets control. If NORM detects ESC, it sets MODE to 1 and returns.
- MODE=1: ESC has been detected. If "=" is the current character, MODE is set to 3 and the routine returns. Otherwise, MODE is reset to 0 and the character is sent.
- MODE=3: This character is the Y coordinate. The byte is stored in variable Y, and MODE is set to 255.
- MODE=255: The byte to be sent is the X coordinate. The byte is processed for the Hazeltine and the lead-in and control bytes are sent. X is recovered and sent, then Y is recovered. No processing for the 1500 is needed here. MODE is reset to 0 and Y is transmitted.

These values for MODE were chosen so that a four-way branch could be taken from one test, the ORA A instruction at the top of the routine. The zero flag is tested first, and the jump-on-zero instruction branches to NORM. The 1 condition is separated by the JPE, as it is the only condition with odd parity. The 3 and 255 are differentiated with the sign flag.

The kind of multiway branching I've used here is worth a little study. It could be useful in a number of applications. ■

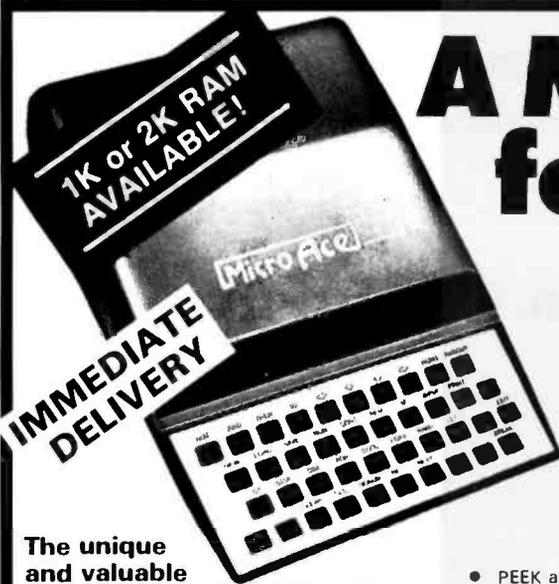
A Microcomputer for everyone at a Micro Price

The **MicroAce** - a new generation of miniature computers
A COMPLETE COMPUTER for \$149.00 for 1K Kit



Post and Packing FREE

(Add 6% Tax for Shipments inside California)



The unique and valuable components of the MicroAce

The MicroAce is not just another personal computer. Quite apart from its exceptionally low price, the MicroAce has two uniquely advanced components: the powerful BASIC interpreter, and the simple teach yourself BASIC manual.

The unique versatile BASIC interpreter offers remarkable programming advantages:

- **Unique 'one-touch' key word entry: the MicroAce eliminates a great deal of tiresome typing. Key words (RUN, PRINT, LIST, etc.) have their own single-key entry.**
- Unique syntax check. Only lines with correct syntax are accepted into programs. A cursor identifies errors immediately. This prevents entry of long and complicated programs with faults only discovered when you try to run them.
- Excellent string-handling capability takes up to 26 string variables of any length. All strings can undergo all relational tests (e.g. comparison). The MicroAce also has string input to request a line of text when necessary. Strings do not need to be dimensioned.
- Up to 26 single dimension arrays.
- FOR/NEXT loops nested up to 26.
- Variable names of any length.
- BASIC language also handles full Boolean arithmetic, conditional expressions, etc.
- Exceptionally powerful edit facilities, allows modification of existing program lines.
- Randomise function, useful for games and secret codes, as well as more serious applications
- Timer under program control.

- PEEK and POKE enable entry of machine code instructions, USR causes jump to a user's machine language sub-routine.
- High-resolution graphics with 22 standard graphic symbols.
- All characters printable in reverse under program control.
- Lines of unlimited length.

'Excellent value' indeed!

For just \$149.00 (including handling charge) you get everything you need to build a personal computer at home... PCB, with IC sockets for all ICs; case; leads for direct connection to a cassette recorder and television (black and white or color); everything!

Yet the MicroAce really is a complete, powerful, full-facility computer, matching or surpassing other personal computers at several times the price.

The MicroAce is programmed in BASIC, and you can use it to do quite literally anything, from playing chess to managing a business.

The MicroAce is pleasantly straightforward to assemble, using a fine-tipped soldering iron. It immediately proves what a good job you've done: connect it to your TV ... link it to the mains adaptor ... and you're ready to go.

Fewer chips, compact design, volume production-more power per Dollar!

The MicroAce owes its remarkable low price to its remarkable design: the whole system is packed on to fewer, newer, more powerful and advanced LSI chips. A single SUPER ROM, for instance, contains the BASIC interpreter, the character set, operating system, and monitor. And the MicroAce 1K byte

RAM (expandable to 2K on board) is roughly equivalent to 4K bytes in a conventional computer typically storing 100 lines of BASIC. (Key words occupy only a single byte.)

The display shows 32 characters by 24 lines. And Benchmark tests show that the MicroAce is faster than all other personal computers.

No other personal computer offers this unique combination of high capability and low price.

The MicroAce teach-yourself BASIC manual.

If the features of the BASIC interpreter mean little to you - don't worry. They're all explained in the specially-written book *free* with every kit! The book makes learning easy, exciting and enjoyable, and represents a complete course in BASIC programming from first principles to complex programs. (Available separately - purchase price refunded if you buy a MicroAce later.)

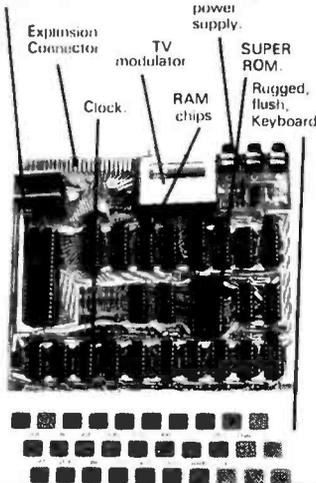
A hardware manual is also included with every kit.

The MicroAce Kit:
\$149.00 with 1K COMPLETE
\$169.00 with 2K

Demand for the MicroAce is very high: use the coupon to order today for the earliest possible delivery. All orders will be despatched in strict rotation. If you are unsuccessful in constructing your kit, we will repair it for a fee of \$20.00, post and packing FREE. Of course, you may return your MicroAce as received within 14 days for a full refund. We want you to be satisfied beyond all doubt - and we have no doubt that you will be.

Z80 A microprocessor chip, widely recognised as the best ever made.

Sockets for TV, cassette recorder, power supply.



Your MicroAce kit contains...

- Printed circuit board, with IC sockets for all ICs.
- Complete components set, including all ICs - all manufactured by selected world-leading suppliers.
- New rugged keyboard, touch-sensitive, wipe-clean.
- Ready-moulded case.
- Leads and plugs for connection to domestic TV and cassette recorder. (Programs can be **SAVED** and **LOADED** on to a portable cassette recorder.)
- Mains adaptor of 600 mA at 9VDC nominal unregulated.
- FREE course in BASIC programming and user manual.

JOIN THE REVOLUTION - DON'T GET LEFT BEHIND - ORDER YOUR MICRO ACE NOW!!

Send Check, Money Order or quote your Credit Card No. to:
MicroAce 1348 East Edinger, Santa Ana, California, Zip Code 92705.
 or phone (714) 547 2526 quoting your Credit Card Number.

Quantity	Description	Unit Price	TOTAL
	MicroAce Kit 1K	\$149.00	
	MicroAce Kit 2K	\$169.00	
	Manual	\$10.00	
	1K Upgrade Kit	\$29.00	
Shipments inside California add 6% TAX			TOTAL

- Amex.
- Diners
- Check
- Money Order
- Master Charge
- Visa

Card No. _____

Exp. Date _____

Name _____

Address _____

City _____ State _____ Zip _____

Challenger Writes on Comprint

Edward H Carlson, 3872 Raleigh Dr, Okemos MI 48864

I use an Ohio Scientific C2-4P for word processing and text editing. I selected the Comprint 912 as a printer because of its legibility (9 by 12 dot matrix), speed (3 lines per second), quietness (electrostatic printing, not impact), and low cost. The choice of the parallel-interface model reduced costs further. I want to show you a 6502 assembly-language program that interfaces a 6522 VIA (versatile interface adapter) parallel port to the Comprint 912.

The Model 500 main processor board of an OSI Challenger II has a provision for a 6820, a 6520, or a 6521 PIA (peripheral interface adapter) containing two 8-bit parallel ports. The 6522 VIA enhances the PIA functions with extra handshake options and two timers. I had already added a 6522 to my processor board in the space for the PIA. A little extra work was required because six pins have different functions on the 6522. I made the modification by changing only four lines on the Model 500 processor board. The price was a nonstandard naming of the address lines to the sixteen registers of the 6522.

The address conversions needed are noted at the bottom of listing 1. The 6522 resides at hexadecimal location F7xx in memory.

The Comprint has several parallel I/O (input/output) options. I've used the *wide strobe/acknowledge* mode, enabled by pulling a jumper pin from the Comprint circuit board. Besides the seven lines of ASCII (American Standard Code for Information Interchange) data, there are three control lines. DAV is the strobe signal sent by the computer telling the printer that valid data is on the data lines. NDAC is the acknowledge signal sent by the printer telling the computer that the data has been accepted. NRFD is the busy line that the printer sets high when its data buffer is full and unable to accept further data.

At the 6522 end, the lines are assigned as follows: DAV is CB2, put high and strobed low when the 6502 processor writes data to port B of the 6522 VIA. It must be set high again before the next ASCII character is sent. NDAC is CB1, configured to detect the trailing edge, low-to-high transition, of the acknowledge signal sent from the printer. NRFD is pin PB7 of the eight-line parallel data. One wants to detect the high or low state of this line, not an edge as it makes a transition.

Listing 1: After installing the 6522 VIA in the Model 500 processor board of the OSI Challenger II, this 6502 assembly-language program interfaces the 6522 parallel port to the Comprint 912.

```

10 C000                                * = $C000
20 C000                                ;
30 C000 48                            ; OUTCHR PHA                                PARALLEL PORT TO COMPRINT 912
40 C001 A902                          LDA #$02                                A CONTAINS CHARACTER
50 C003 8D0EF7                         STA $F70E                             ENABLE B PORT OF 6522
60 C006 A97F                            LDA #$7F                                DATA DIRECTION
70 C008 8D08F7                         STA $F708
80 C00B 8D07F7                         STA $F707                                CLEAR INTERRUPT FLAGS
90 C00E A990                            LDA #$90                                READY STROBE, PERIPHERAL CONTROL
100 C010 8D03F7                        STA $F703                                CB1 TO GO LOW ON WRITE, DAV
110 C013 AD00F7                        BUSY LDA $F700                                READ B PORT INPUT
120 C016 2980                          AND #%10000000                         BIT 7 IS NRFD OF COMPRINT
130 C018 30F9                          BMI BUSY                                BUSY IF BIT 7 IS HIGH
140 C01A 68                             PLA
150 C01B 49FF                          EOR #$FF                                INVERT, DATA ACTIVE LOW
160 C01D 8D00F7                        STA $F700                                OUTPUT TO PRINTER
170 C020 AD07F7                        ACK LDA $F707                                LOOK FOR NDAC ON CB2
180 C023 2910                          AND #$10                                NDAC IS ACKNOWLEDGE FROM
190 C025 C910                          CMP #$10                                COMPRINT
200 C027 D0F7                          BNE ACK                                IF NOT FOUND, LOOK AGAIN
210 C029 A9F0                          LDA #$F0                                RESTORE CB1 TO HIGH, END DAV
220 C02B 8D03F7                        STA $F703
230 C02E 60                             RTS
235 C02F                                ;
240 C02F                                ; B Port I/O Register                Standard    Mine
250 C02F                                ; Auxiliary Control Register        00          00
260 C02F                                ; Peripheral Control Register       0B          0E
270 C02F                                ; Interrupt Flag Register           0C          03

```

Volume II

Ciarcia's

Circuit Cellar

Steve Ciarcia, described as a "technological treasure," is BYTE's most popular writer. His innovative circuit designs are ingenious, timely, practical, easy-to-build, and—they work.

Ciarcia's Circuit Cellar, Volume II is more than a series of hardware designs: it is a ready reference and workbook of related projects, now available as a single source.

Volume II features 19 articles, including 14 that were voted by BYTE's readers as the best articles of the month, such as: **Build a Computer-Controlled Security System**, **Communicate On a Light Beam** (laser communications), **Anyone Know the Real Time?** (real-time clocks), **The Intel 8086, Add Non-volatile Memory to Your Computer**, **Computerize a Home** (AC remote control from your computer), **A Computer-Controlled Wood Stove**, **Ease Into 16-Bit Computing** (The Intel 8088), and **I/O Expansion for the Radio Shack TRS-80: Parallel and Serial Ports**.

Special offer: Buy both Volume I and Volume II now and get Volume I for one-half price. Offer valid through April 15th. All orders must be postmarked by that date.

Volume I contains a collection of more than a year's worth of the popular series Steve writes for BYTE magazine. Included are six winners of BYTE's On-going Monitor Box (BOMB) award voted by the readers as the best articles of the month: **Control the World** (a four-channel digital-to-analog converter for controlling appliances and other devices); **Memory Mapped I/O**; **Program Your Next EROM in BASIC**; **Tune In and Turn On** (a computerized wireless AC control system); **Talk To Me** (add a voice to your computer); and **Let Your Fingers Do the Talking** (a touch panel for your video display).

Buy these books at your favorite computer bookstore or direct from BYTE.

Use our toll-free number (1-800-258-5420) and order your copies today.



B4

- Please send _____ copies of **Ciarcia's Circuit Cellar, Volume I**, \$8.00
 Please send _____ copies of **Ciarcia's Circuit Cellar, Volume II**, \$12.95
 Please send _____ special offer—the complete set of **Ciarcia's Circuit Cellar, Volumes I & II**, \$16.95
 (Hurry-offer expires April 15, 1981)

Name _____ Title _____ Company _____

Street _____ City _____ State/Province _____ Zipcode _____

- Check enclosed in the amount of \$ _____
 Bill Visa Bill Master Charge
 Card No. _____ Exp. Date _____
 Add 75¢ per book to cover postage and handling.



70 Main Street
 Peterborough, New Hampshire 03458

Technical Forum

The subroutine to write one character to the printer is given in the listing 1. When called, accumulator A contains the character to be sent. The Comprint expects inverted data (ie: 1 to be low and 0 to be high). A hardware modification can be made to the Comprint 912 to accept noninverted data, but I elected to do the inversion in software with an exclusive-OR (XOR) instruction.

First, port B is enabled. Then data lines PB0 thru PB6 are assigned to output the ASCII character, and data line PB7 is assigned to input the busy signal. The interrupt-flag register is cleared (by writing 1s to it) so that it can detect transitions in CB1.

Next, a mask is written to the peripheral control register, which does two things:

1. requests an interrupt flag to be set for low-to-high transitions of the acknowledge line CB1;
2. requests CB2 to go low when the processor writes to

the 6522, to make the beginning of the strobe signal DAV.

Port B is now ready to see if PB7 is high, denoting a busy signal. If not, the data is sent and the interrupt-flag register is repeatedly read to await the acknowledge signal before continuing. (Bit 4 is set by an active transition of CB1, not bit 3 as given in the old edition of the Osborne and Associates book *An Introduction to Microcomputers*.) This flag is reset by the next write to Port B.

Finally, the DAV line is set high again, to end the wide strobe pulse, and the subroutine is exited.

Some options that could be tried are: use of the narrow-strobe/acknowledge mode of the Comprint 912, use of port A of the 6522, or use of a PIA instead of the VIA. In each case, the program would need modifications. ■

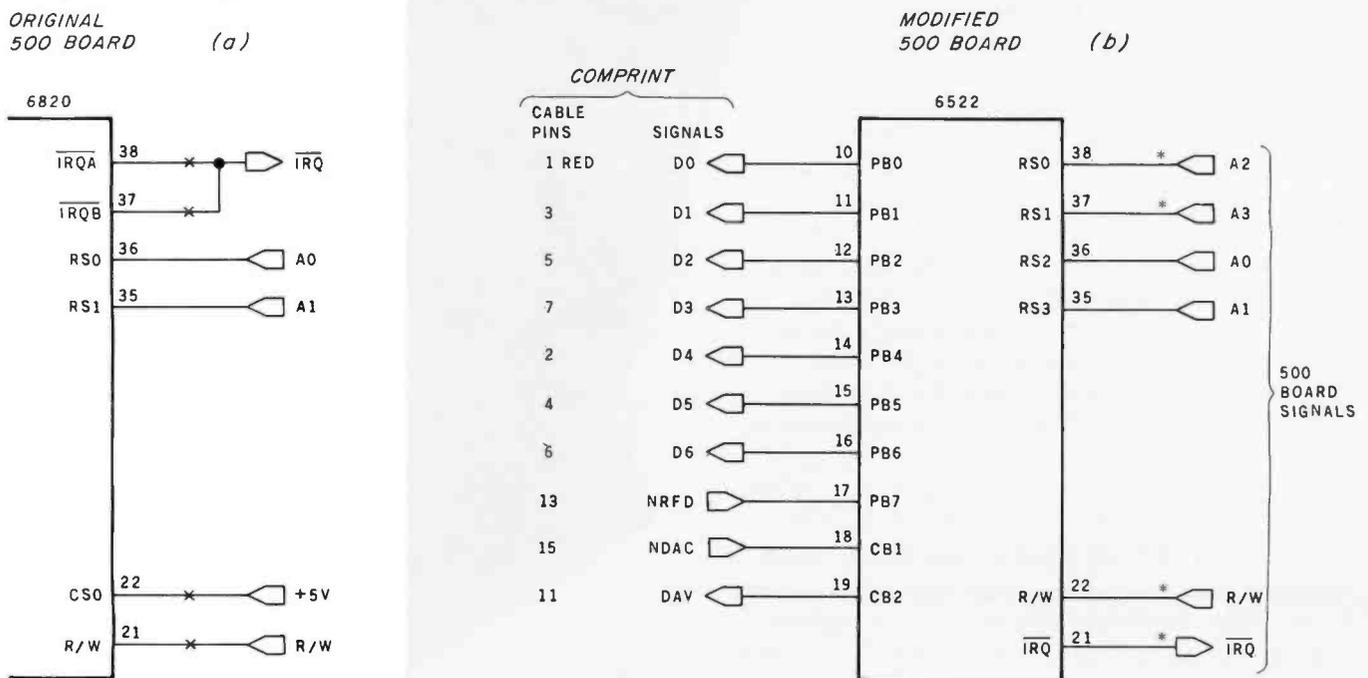


Figure 1: The hardware modification that enables the Comprint 912 printer to work with the OSI Challenger II. When the 6820 position on the Model 500 processor board is modified to take the 6522 VIA, the four marked lines must be cut (the lines to pins 21, 22, 37, and 38, see figure 1a). New lines must be attached to these pins (denoted by asterisks in figure 1b). Note the nonstandard address-line assignments after the rewiring is completed.



ADVANCED MICRO SYSTEMS • 26188 ADAMOR ROAD • CALABASAS, CA. 91302
OPEN MON.-FRI. 10-8 SAT. 10-6 Tel.: (213) 880-4670

COMPLETE QUALITY SYSTEMS AT LOW, LOW PRICES!

ALL SYSTEMS ALLOW UPWARD EXPANDABILITY AND INCLUDE:

1. TELEVIDEO 912C

2. ANADEX DP-9500 SERIES GRAPHIX PLUS PRINTER

3. 64K DYNAMIC RAM

5. PLUS ONE OF THE FOLLOWING DISK DRIVE SETS :

a. 2x5 1/4" FLOPPY
(400K BYTES)
FOR

b. 2x8" FLOPPY
(1M BYTES)
FOR

c. 2x8" FLOPPY
(2M BYTES)
FOR

d. 8" FLOPPY
5 1/4" WINCHESTER
(6MB) FOR

e. 8" FLOPPY
8" HARD DISK
(11 MB)FOR

f. 8" FLOPPY
14" HARD DISK
(27 MB)FOR

\$5350.

\$5650.

\$6150.

\$7750.

\$7960.

\$8995.

SYSTEMS ARE DELIVERED AS AVAILABLE. PRICES, TERMS, SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE. ALLOW 30-60 DAYS

FOR DELIVERY. PRICE FOB CALABASAS, CA 91302. DECISION I - TRADEMARK OF MORROW DESIGN. PRICES ARE FOR PREPAID (DEPOSIT) ORDERS.



Great software doesn't have to be hard to find. Just look for the Hayden name.

PERFORMANCE! SOFTWARE

NEW! HISTO-GRAPH (Boyd) A calendar-based histogram or bar-graph production system. Allows the user to enter numeric data that relates to a date, and reproduces that data as a high-resolution histogram. 09009. Apple II Disk. \$29.95

NEW! DATA-GRAPH (Boyd) Aids in the preparation of graphs and charts. Numeric data can be entered into Data-Graph and used to create colorful one-, two-, or four-quadrant graphs. 09109. Apple II Disk. \$49.95

NEW! DOUBLE PRECISION FLOATING POINT FOR APPLESOFT™ (S-C Software) Extends the accuracy of the arithmetic available on the Apple from nine digits to a full 21-digit precision on all functions in Applesoft compatible format. 09409. Apple II Disk. \$49.95

ORDER NOW!

Hayden Book Company, Inc.
50 Essex Street, Rochelle Park, NJ 07662

Send me the software checked below. A check or money order is enclosed. I understand that Hayden pays shipping and handling costs and that I can return any disk or tape within 10 days if it is defective or I am dissatisfied with it for any reason. Residents of NJ and CA must add sales tax. Offer good in US only. Name of individual ordering must be filled in. B 4/81

- | | | |
|--------------------------------|--------------------------------|--------------------------------|
| <input type="checkbox"/> 03403 | <input type="checkbox"/> 03604 | <input type="checkbox"/> 07004 |
| <input type="checkbox"/> 03404 | <input type="checkbox"/> 03804 | <input type="checkbox"/> 07009 |
| <input type="checkbox"/> 03408 | <input type="checkbox"/> 03904 | <input type="checkbox"/> 07101 |
| <input type="checkbox"/> 03409 | <input type="checkbox"/> 04804 | <input type="checkbox"/> 07103 |
| <input type="checkbox"/> 03410 | <input type="checkbox"/> 04909 | <input type="checkbox"/> 07301 |
| <input type="checkbox"/> 03414 | <input type="checkbox"/> 05103 | <input type="checkbox"/> 08609 |
| <input type="checkbox"/> 03440 | <input type="checkbox"/> 05108 | <input type="checkbox"/> 09009 |
| <input type="checkbox"/> 03444 | <input type="checkbox"/> 05303 | <input type="checkbox"/> 09109 |
| <input type="checkbox"/> 03484 | <input type="checkbox"/> 05308 | <input type="checkbox"/> 09409 |
| <input type="checkbox"/> 03504 | <input type="checkbox"/> 05903 | <input type="checkbox"/> 09704 |

Name _____

Address _____

City/State/Zip _____

81 009

NEW! OP-AMP DESIGN (Gabielsou) Provides the necessary values for your design and will suggest appropriate op-amp types. Includes a choice of six op-amps, and the program will then determine if your selection of an op-amp will be acceptable within your chosen parameters. Can be updated to accommodate future op-amps. 09704. Apple II tape. \$16.95

LINE & VARIABLE CROSS REFERENCE GENERATOR (Johnson) Provides a cross-reference of line numbers and variable names. 07301. PET tape. \$16.95

APPLESOFT UTILITY PROGRAMS (Gilder) Increase your BASIC programming speed and flexibility. Contains 9 useful subroutines: 1. REM Writer 2. PRINT Writer 3. POKE Writer 4. Hexadecimal/Decimal Converter 5. Line Counter 6. Renummer 7. Append 8. Byte Counter 9. Slow List/Stop List 03504. Apple II tape. \$29.95

RENUMBER & APPEND: Utility Programs for the Apple (Gilder) Renummer your Applesoft program and append a second program to the one in memory. 03804. Apple II tape. \$14.95

REVIVE (Gilder) When a program is accidentally erased. REVIVE searches through memory and finds the information that enables it to restore the pointers that have been changed. 03604. Apple II tape. \$19.95

SLOW LIST/STOP LIST: Utility Programs for the Apple (Gilder) Start, stop, and control the speed of your program with Apple II's game paddles. 03904. Apple II tape. \$10.95

PSEUDODISK (Neuschatz) This money-saving program simulates a disk memory system for Integer BASIC programs. It allows multiple programs in memory at the same time which can be run from a catalog. 04804. APPLE II tape. \$24.95

6502 DISASSEMBLER (Stamm) Produce assembly language source files with labeled subroutines and references from programs already in memory. It is compatible with Hayden's ASSEMBLY LANGUAGE DEVELOPMENT SYSTEM. 08609. APPLE II Disk. \$39.95

DATA MANAGER: A Data Base Management System and Mailing List (Lutus) Store information on a floppy disk, and retrieve it quickly and easily by specific names, or by category. 04909. Apple II Disk Version. \$49.95.

Apple is a trademark of Apple Computer Company, Inc., and is not affiliated with Hayden Book Company, Inc.

FINPLAN: A Financial Planning Program for Small Businesses (Montgomery) Allows you to enter data from a balance sheet into the program, to make assumptions about the future growth of business, and to have the computer project results for up to a five year period based on those assumptions. And if you change any data, the program revises all resulting data automatically. The disk version can be used only with TRSDOS Version 2.3. 05103. TRS-80 Level II tape, \$69.95; 05108. TRS-80 Level II Disk Version. \$74.95

SARGON II (Spracklen) The Champ of champs. "...an excellent program which will provide a true challenge for many players... Save your money and buy SARGON II..." '80 Software Critique. 03403. TRS-80 Level II; 03404. Apple II; 03410. OSI C1P; 03440. OSI C4P; each tape \$29.95. 03408. TRS-80 Level II Disk; 03409. Apple II Disk; 03414. OSI C1P Disk; 03444. OSI C4P Disk; 03484. C8P Disk; each \$34.95

BLACKJACK MASTER: A Simulator/Tutor/Game (Wazaney) A serious game that performs complex simulations and evaluations of playing and betting strategies. 05303. TRS-80 Level II tape. \$24.95; 05308. TRS-80 Disk Version. \$29.95

REVERSAL (Spracklen) Winner of the software division of the First International Man-Machine OTHELLO™ Tournament, this version of the 200-year old game Reversi, features 27 levels of play and high-resolution color graphics. 07004. APPLE II tape. \$29.95; 07009. APPLE II Disk. \$34.95

ROYAL FLUSH: Competitive Poker Solitaire (Wazaney) A game you can play alone or with any number of players. High score wins in this poker-based, fun-filled card game. Choose from possible game variations. 07101. PET; 07103. TRS-80 Level II, each tape. \$14.95

STARCLASH (Walton) An exciting game of galactic strategy for one or two players. 05903. TRS-80 Level II tape. \$16.95

Available at your local computer store!

Call Toll Free

24 hours a day,
(1-800-821-3777, ext. 302)* TO CHARGE
YOUR ORDER TO Master Card or Visa.
Minimum order is \$10.00; customer pays
postage and handling.
From Missouri call (1-800-892-7655, ext 302)

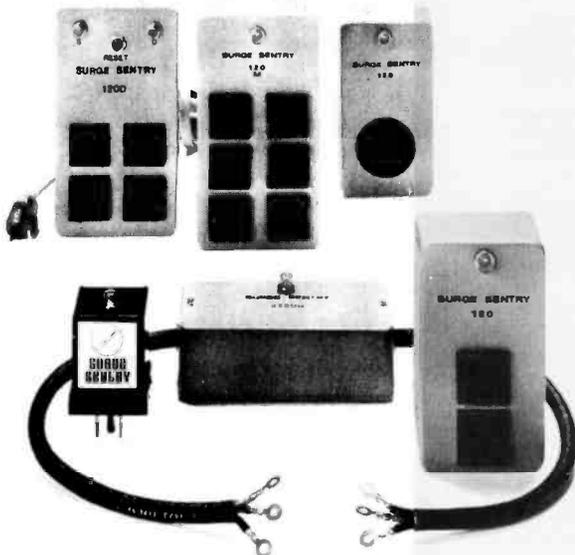
Hayden
Book Company, Inc.
50 Essex Street, Rochelle Park, NJ 07662

KILL SURGES LIKE LIGHTNING!

AC power line surges are destructive, can cost you money, and can't be prevented. But you can stop them from reaching your sensitive electronic equipment with a Surge Sentry.

Surge Sentry acts in picoseconds to dissipate up to a 1,000,000 W, 100 μ second surge. Triggers at 10% above nominal peak voltage. Works in parallel with the power line. Is easy to install for immediate protection. No complicated wiring or special tools required.

Several different models to choose from, including an OEM version. Call or write today for a free brochure.



RKS
ENTERPRISES, INC.

643 South 6th Street, San Jose, CA 95112
(408) 288-5565

DEALER INQUIRIES INVITED

Technical Forum

On the Use of Fourier Transforms to Explore Biological Rhythms

A J Owens, Bartol Research Foundation, University of Delaware, Newark DE 19711

In his editorial "Is Pseudoscience Done by Computer Pseudo-Computer-Science?" (November 1979 BYTE, page 6), Carl Helmers encouraged the analysis of numerical data to test the validity of the biorhythm hypothesis: that our lives are dominated by a few quasi-sinusoidal cycles. He suggested taking data on our personal lives, perhaps rating each day on a scale of 1 to 10, and then analyzing the time series using the fast Fourier transform (FFT).

Coincidentally, motivated by some biorhythm proponents in an introductory astronomy class that I was teaching, I have been carrying out exactly that program since January 1977. Through November 1979, my data set consisted of 1024 consecutive daily ratings of my personal well-being, recorded by me each evening on a scale of 1 to 10.

While reading Mr Helmers' editorial, I decided to program my AIM-65 microcomputer to analyze the data. (I had previously analyzed 256- and 512-day subsets of the data as they became available, using a FORTRAN program run on a minicomputer.)

With only 4 K bytes of user memory, my AIM-65 could barely run the program to analyze 256 data points

About the Author

A J Owens is a research physicist and professor at the Bartol Research Foundation of the Franklin Institute, which is located at the University of Delaware. He received his postgraduate degrees from the California Institute of Technology in the field of theoretical physics. Although he uses mainframe computers for his astrophysical research, he claims to be a novice in dealing with microcomputers, having graduated downward from time-sharing systems and minicomputers. He currently uses a Rockwell AIM-65 linked to a BETA-1 digital cassette system.

Technical Forum is a feature intended as an interactive dialog on the technology of personal computing. The subject matter is open-ended, and the intent is to foster discussion and communication among readers of BYTE. We ask that all correspondents supply their full names and addresses to be printed with their commentaries. We also ask that correspondents supply their telephone numbers, which will not be printed.

TWICE THE BYTE!



8" DISK CONTROLLER NOW—DOUBLE SIDED OPTION!

- DOUBLES APPLE II STORAGE
- APPLE DOS COMPATIBLE
- SHUGART 800 OR 850 COMPATIBLE
- IBM 3740 DATA ENTRY CAPABILITY
- CP/M, UCSD PASCAL CAPABILITY

Available at your local APPLE Dealer: \$400.



SORRENTO VALLEY ASSOCIATES
11722 SORRENTO VALLEY RD.
SAN DIEGO, CA 92121

**computer
case
company**

COMP CASE



CASES NOW AVAILABLE

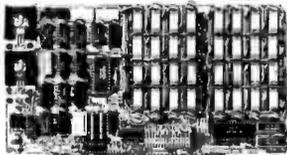
- AP101 Apple and Single Disk Drive \$109
- AP102 Apple and Double Disk Drive 119
- AP103 Apple, 9 inch Monitor and Double Drive 129
- RS201 TRS-80, Expansion Unit and Double Drive 109
- RS202 TRS-80 Monitor and Accessories 84
- P401 Paper Tiger Printer 99
- P402 Line Printer II-Centronics 730 89
- CC90 Matching Attache Case 75

CASES SOON AVAILABLE

- RS204 Model III Radio Shack
- RS205 Radio Shack Color Computer
- AP104 Apple /// with Disk Drives and Silentype
- AP105 12 inch Monitor and Accessories

computer case company

5650 INDIAN MOUND CT. COLUMBUS, OHIO 43213 (614) 868-9464

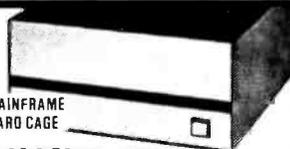


64K BYTE EXPANDABLE RAM

DYNAMIC RAM WITH ON BOARD TRANSPARENT REFRESH GUARANTEED TO OPERATE IN NORTHSTAR, CROMEMCO, VECTOR GRAPHICS, SOL AND OTHER 8080 OR Z-80 BASED S100 SYSTEMS * 4MHZ Z-80 WITH NO WAIT STATES.

- SELECTABLE AND DESELECTABLE IN 4K INCREMENTS ON 4K ADDRESS BOUNDARIES.
- LOW POWER—8 WATTS MAXIMUM.
- 200NSEC 4116 RAMS.
- FULL DOCUMENTATION.
- ASSEMBLED AND TESTED BOARDS ARE GUARANTEED FOR ONE YEAR AND PURCHASE PRICE IS FULLY REFUNDABLE IF BOARD IS RETURNED UNDAMAGED WITHIN 14 DAYS.

	ASSEMBLED / TESTED
64K RAM	\$395.00
48K RAM	\$529.00
32K RAM	\$459.00
16K RAM	\$389.00



5100 MAINFRAME AND CARD CAGE

- ★ W/ SOLID FRONT PANEL ... \$239.00
- ★ W/ CUTOUPS FOR 2 MINI-FLOPPIES ... \$239.00
- ★ 30 AMP POWER SUPPLY \$119.00
- ★ 8 SLOT MOTHERBOARD \$149.00
- ★ 19 SLOT MOTHERBOARD \$199.00

16K MEMORY EXPANSION KIT ONLY \$58

FOR APPLE, TRS-80 KEYBOARD, EXIDY, AND ALL OTHER 16K DYNAMIC SYSTEMS USING MK4116-3 OR EQUIVALENT DEVICES.

- ★ 200 NSEC ACCESS, 375 NSEC CYCLE
- ★ BURNED-IN AND FULLY TESTED
- ★ 1 YR. PARTS REPLACEMENT GUARANTEE
- ★ QTY. DISCOUNTS AVAILABLE



VISTA V-200 MINI-FLOPPY SYSTEM

- ★ S100 DOUBLE DENSITY CONTROLLER
 - ★ 204 KBYTE CAPACITY FLOPPY DISK DRIVE WITH CASE & POWER SUPPLY
 - ★ MODIFIED CPM OPERATING SYSTEM WITH EXTENDED BASIC
- \$695.00**

BETA
COMPUTER DEVICES

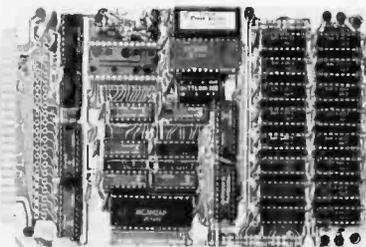
1230 W. COLLINS AVE.
ORANGE, CA 92668
(714) 633-7280

Call, residents please add 6% sales tax. MasterCard & Visa accepted. Please allow 14 days for checks to clear bank. Phone orders welcome. Shipping charges will be added to all shipments.

32K BYTE MEMORY RELIABLE/COST EFFECTIVE EXPANDABLE RAM FOR 6502 AND 6800 SYSTEM—AIM 65-KIM-SYM-PET-S44-BUS

- ★ PLUG COMPATIBLE WITH THE AIM-65/SYM EXPANSION CONNECTOR BY USING A RIGHT ANGLE CONNECTOR (SUPPLIED) MOUNTED ON THE BACK OF THE MEMORY BOARD.
- ★ MEMORY BOARD EDGE CONNECTOR PLUGS INTO THE 6800 S 44 BUS.
- ★ CONNECTS TO PET OR KIM USING AN ADAPTOR CABLE.
- ★ RELIABLE—DYNAMIC RAM WITH ON BOARD INVISIBLE REFRESH—LOOKS LIKE STATIC MEMORY BUT AT LOWER COST AND A FRACTION OF THE POWER REQUIRED FOR STATIC BOARDS.
- ★ USES +5V ONLY, SUPPLIED FROM HOST COMPUTER.
- ★ FULL DOCUMENTATION, ASSEMBLED AND TESTED BOARDS ARE GUARANTEED FOR ONE YEAR AND PURCHASE PRICE IS FULLY REFUNDABLE IF BOARD IS RETURNED UNDAMAGED WITHIN 14 DAYS.

ASSEMBLED WITH 32K RAM	\$395.00
& WITH 16K RAM	\$339.00
TESTED WITHOUT RAM CHIPS	\$279.00
HARD TO GET PARTS (NO RAM CHIPS)	
WITH BOARD AND MANUAL	\$109.00
BARE BOARD & MANUAL	\$49.00



PET INTERFACE KIT—CONNECTS THE 32K RAM BOARD TO A 4K OR 8K PET. CONTAINS: INTERFACE CABLE, BOARD STANDOFFS, POWER SUPPLY MODIFICATION KIT AND COMPLETE INSTRUCTIONS. \$49.00

U.S. PRICES ONLY

GET THE SOFTWARE THAT'S GOING PLACES. THE UCSD p-SYSTEM.™

You want a copy of the exciting software system that's going places. Professionals everywhere are using the UCSD p-System. Now, you can have it. The UCSD p-System offers: a complete software development system, your choice of languages, and a portable system that runs on your microcomputer today and tomorrow. Send in the coupon below and join the pros today. Phone orders accepted with Visa or Master Card.

Yes, I want the software system that's going places—the UCSD p-System. Here's my order:

UCSD p-System* (Version IV.0) including documentation:

- with UCSD Pascal™ Compiler \$500.00
- with FORTRAN-77 Compiler \$500.00
- with UCSD Pascal and FORTRAN-77. \$750.00
- BASIC Compiler Add-On \$150.00
- Assemblers Package (cross-assemblers) for Z-80, 6502, 6800, 6809, 8080, 9900, Z8, PDP-11™/LSI-11™ \$ 250.00
- Complete UCSD p-System with UCSD Pascal Documentation Set \$50.00
- Send me more information (general)
- Send distributor information
- Send information on the availability of systems for the 6800, 6809, and/or 9900 processors

My system has: (check only one)

- CP/M™ Version I.4
- CP/M Version II.0 with 128-byte sectors
- 8080 or Z80 processor without CP/M (requiring some assembly language programming)
- 6502 processor (requiring some assembly language programming)
- PDP-11 with RX01 RX02 (check one)
- LSI-11 with RX01 RX02 (check one)

NOTE: (pertaining to two items above) For availability of RK05 and RL01 disk drivers, contact SofTech Microsystems.

*System requires 48K contiguous RAM. Software is shipped on 8-inch floppy disks, and can be transferred to other formats.

- Check or money order enclosed Ship C.O.D. (U.S. orders only)

Calif. and Mass. residents must add applicable sales tax. For foreign shipping charges, contact SofTech Microsystems.

Ship to: _____

Address: _____

City: _____ State: _____

Zip: _____ Phone: _____

Allow six weeks for delivery.



SofTech Microsystems, Inc.
9494 Black Mountain Road
San Diego, CA 92126
Ph: 714/578-6105
TWX: 910-335-1594

(UCSD p-System and UCSD Pascal are trademarks of the Regents of the University of California. CP/M is a registered trademark of Digital Research Corporation. LSI-11 and PDP-11 are trademarks of Digital Equipment Corporation.)

Technical Forum

—in fact, the comments had to be deleted to fit the program into the memory. The FFT algorithm used here was originally written for a Digital Equipment Corporation time-sharing computer, and the only modifications are the small input routine and the calculation of the power spectrum at the end. The fast Fourier transform routine for 256 data points takes about 3 minutes to run.

It is of crucial importance in any time-series analysis to understand (and report) details concerning the statistical uncertainty in the results that are obtained. Otherwise, the importance of an insignificant wiggle in the Fourier transform at the "right" place can be blown far out of proportion. Fortunately, information scientists have studied the problem of extraction of signals from noise, and the basic concepts are not too difficult to grasp. For a complete (and technical) account, I suggest reading *Random Data: Analysis and Measurement Procedures*, by J S Bendat and A G Piersol (Wiley-Interscience, New York, 1971).

Suppose that you begin with N data points, each a sample from some process that is random or noisy. Obviously, no matter how you "massage" the data, you have only N independent samples. In the fast Fourier transform, the N data points sampled at intervals of time separated by Δt are transformed into N Fourier coefficients in the frequency domain, one each for the sine and the cosine terms corresponding to frequencies $1/N\Delta t$, $2/N\Delta t$, . . . , $(N/2-1)/N\Delta t$, $1/2\Delta t$. For random data, the Fourier coefficients have random phases, so one usually reports the *power spectrum*, which is the sum of the squares of the sine and the cosine terms (altered by a multiplication constant used to normalize the result). The original N data points give $N/2$ power spectral estimates in frequency space, each with two degrees of freedom—one each from the sine and cosine terms.

Inasmuch as each raw-power spectral-density estimate has only two degrees of freedom, it is rather poorly determined. In only two-thirds of the cases can one expect the "true" power spectral level to be in the interval between zero and two times the measured power spectrum.

To improve the accuracy of the estimates, one *averages* the power spectrum. One method of doing this, the one that I applied, is to divide the total data set into smaller groups of points, calculate the power spectrum for each subset, and then average the power spectra from each group. For example, my set of 1024 days was divided into four groups of 256 points each. Power spectra for each of the four groups were calculated, and the resulting four spectra were averaged at each of the 128 power spectral points in frequency space.

A second approach is to calculate the power spectrum of the entire record (eg: 1024 days). One then averages the several adjacent frequency bins (eg: four) to get a smaller number of more accurately known power spectral estimates.

In either case, averaging four spectra (or frequency bins), each with two degrees of freedom, gives power spectral estimates with eight degrees of freedom. As a result, we expect that, in two-thirds of the cases, the "true" power spectrum at a given frequency will then lie between 0.5 and 1.5 times the measured value. In general, the fractional uncertainty in each estimate is $\pm\sqrt{(2/D)}$,

Desk Main/Frame Desk Main/Frame

LOW COST & ATTRACTIVE STYLING

- MAIN/FRAME INTEGRATED INTO FURNITURE QUALITY DESK
- ELECTRONICS PACKAGE SLIDE MOUNTED FOR EASY ACCESS
- SUPPORTS TWO 8" FLOPPY DRIVES FROM SEVERAL MANUFACTURERS (DRIVES NOT INCLUDED)
- 10 SLOT MOTHERBOARD INCLUDES CONNECTORS
- POWER SUPPLY FOR DRIVES AND CARDS
- DESK AND MAIN/FRAME AVAILABLE SEPARATELY
- MATCHING PRINTER DESK AVAILABLE



WRITE OR CALL FOR OUR BROCHURE WHICH INCLUDES OUR APPLICATION NOTE: 'BUILDING CHEAP COMPUTERS'

INTEGRAND

8474 Ave. 296 • Visalia, CA 93277 • (209) 733-9288
We accept BankAmericard/Visa and MasterCharge



*April Shower
of Savings*



	LIST	SALE
48 K Apple Plus	\$1530 ⁰⁰	\$1195 ⁰⁰
Disk II w/Int. & Dos 3.3	\$645 ⁰⁰	\$585 ⁰⁰
IDS-460-G w/graphics	\$1395 ⁰⁰	\$1245 ⁰⁰

Apple III Available Now

Prices subject to change



**FARNSWORTH
COMPUTER CENTER**

1891 N. Farnsworth Ave.
(Immediately S. of E-W Tollway)
Aurora, IL. 60505
(312) 851-3888
Weekdays 10-8; Sat. 10-5

3 NEW MODEMS!



1. A Smart One
with auto everything
built in!

- Auto Dial
- Auto Answer
- Auto Mode (originate/answer)
- "Direct Connect" for any computer with an RS232 Interface.

\$299.00

2. A "Direct Connect" for the Apple.*

- Does not need an interface card!
- Auto Dial
- Auto Answer
- 25 Keyboard commands.
- Will also operate interactively with your programs!

\$289.00

3. An Acoustical Modem for the Apple.*

- Does not need an interface card!
- Costs less to get on line than any similar modem.
- 25 Keyboard commands.
- Will also operate interactively with your programs!

\$179.00

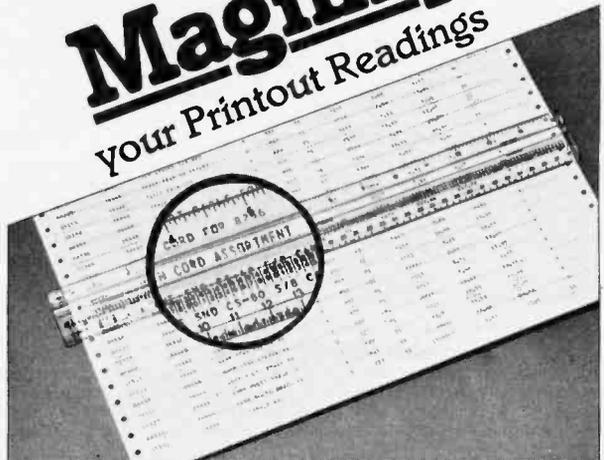
**MICROMATE
ELECTRONICS, INC.**

East Coast: 2094 Front Street
East Meadow, New York 11554
(516) 794-1072

West Coast:
1116A 8th Street Suite 110
Manhattan Beach, California 90266

All "Direct Connect" modems are FCC certified.
*Registered trademark of Apple Computer, Inc.

Magnify
Your Printout Readings



only **\$2.95** plus postage
with the **NEW PRINTVIEWER**
from LEE PRODUCTS

Ensure more accurate, efficient readings, fewer errors with the new fifteen-inch transparent Printviewer. Yellow-tinted magnifier gives easy readability.

In addition you have the special added feature of built-in inches and centimeter rule that goes along with the 1/10" scale for print position and analysis.

To order, send \$2.95 plus 60¢ postage and handling. Write for information on quantity orders.

LEE PRODUCTS COMPANY

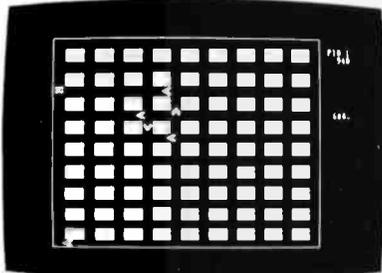
Dept. B4,800 East 80th Street • Minneapolis, MN 55420
Makers of SORTKWIK the original fingertip moistener

SORCERER SOFTWARE

from QUALITY SOFTWARE

All Programs Are On Cassette

**ARROWS
AND
ALLEYS™**
arcade-like
action at
its best!



The latest of Quality Software's great arcade games for the Sorcerer is ARROWS AND ALLEYS, by Vic Tolomei. You drive your car in a maze of alleys. Your task is to eliminate a gang of arrows that constantly pursues you. You have a gun and the arrows don't, but the arrows are smart and they try to stay out of your sights and will often attack from the side or from behind. Eliminate the arrows and another, faster gang comes after you. Four levels of play. Requires 16K or more of RAM. \$17.95

BEDIT by Ernest Bergmann. A BASIC editor. This short and easy to use program is a machine language routine that loads in low memory and allows you to edit your BASIC programs by modifying text on the video screen. No more retyping a long line just to change one character. A few cursor movements make the necessary modifications. Even renumbering lines is easy to do. This program is a real timesaver. Runs on any size Sorcerer. \$11.95

FORTH for the Sorcerer. Now Sorcerer owners can enjoy the convenience and speed of the fascinating FORTH programming language. Based on fig-FORTH and adapted for the Sorcerer by James Albanese, this version uses simulated disk memory in RAM and does not require a disk drive. Added to standard fig-FORTH are an on-screen editor, a serial RS-232 driver, and a tape save and load capability. Numerous examples are included in the 130 pages of documentation. Requires 32K or more of RAM.

price before June 1, 1981: \$49.95
price after June 1: \$59.95

GRAPHICS ANIMATION by Lee Anders. This package provides the BASIC programmer with a powerful set of commands for graphics and animation. The program is written in machine language but is loaded together with your BASIC program and graphics definitions with a CLOAD command. Any image from a character to a large graphic shape may be plotted, moved, or erased with simple BASIC commands. Encounters of plotted character sets with background characters are detected and background images are preserved. Contains a medium resolution plotting routine. A keyboard routine detects key presses without carriage returns. Includes a separate program for constructing images. Runs on any size Sorcerer. \$29.95

QS SMART TERMINAL by Bob Pierce. Convert your Sorcerer to a smart terminal. Used with a modem, this program provides the capability for you to communicate efficiently and save connect time with larger computers and other microcomputers. The program formats incoming data from time-sharing systems such as The Source for the Sorcerer video. Incoming data can be stored (downloaded) into a file in RAM. Files, including programs, may be saved to or loaded from cassette, listed on the video, transmitted out through your modem, or edited with an on-board text editor. Interfaces with BASIC and the Word Processor Pac. \$49.95

USE YOUR SORCERER FOR BUSINESS?

Quality Software is currently preparing release of two cassette based business programs — a word processor at only \$59.95 and a general business systems package at \$99.95 that can be used for mailing lists, payroll, inventory, or accounts receivable. Both are written in machine language. Call us for details.

We have more than 20 programs for the Sorcerer
PLEASE WRITE FOR OUR CATALOG

QS QUALITY SOFTWARE
6660 Reseda Blvd., Suite 105, Reseda, CA 91335
Telephone 24 hours, seven days a week: (213) 344-6599

HOW TO ORDER: If there is no SORCERER dealer near you, you may order directly from us. MasterCard and Visa cardholders may place orders by telephone. Or mail your order to the address above. California residents add 6% sales tax. *Shipping Charges:* Within North America orders must include \$1.50 for first class shipping and handling. Outside North America the charge for airmail shipping and handling is \$5.00 — payable in U.S. currency.

*The name "SORCERER" has been trademarked by Exidy, Inc.

Technical Forum

where D is the number of degrees of freedom.

The BASIC computer program shown in listing 1 is quite simple. The routine in lines 100 thru 180 allows the data to be entered. Because the input data are real (ie: they have no imaginary component), they are stored in the one-dimensional array X , and the one-dimensional

Listing 1: Power spectrum calculation program. This program was used to calculate the data points plotted in figures 1 and 2.

```

1 REM          PROGRAM FFTPOW
2 REM          POWER SPECTRUM USING FFT
3 REM          A. J. OWENS 16-NOV-79
4 REM          REAL PART OF FUNCTION IN X, IHAG IN Y
6 DIM X(256),Y(256)
10 REM
20 REM
25 REM          INPUT ROUTINE GIVES DATA X AND Y AND NUMBER
27 REM          OF DATA POINTS, N, A POWER OF 2.
29 REM          INPUT ROUTINE IS IN LINES 100-199.
30 REM          FFT CALCULATION ROUTINE IS IN LINES
32 REM          200-590. PRINTOUT OF THE POWER SPECTRUM
34 REM          IS IN LINES 591-800.
100 REM        INPUT ROUTINE
150 N=256
160 FOR I=1 TO N
170 INPUT X(I)
175 Y(I)=0
180 NEXT I
200 REM BEGIN FFT CALCULATION
202 G=INT(LOG(N)/LOG(2))+1.00000E-06)
203 P=2*3.14159/N
204 FOR L=0 TO G-1
206 G1=2^(G-L-1)
208 H=0
210 FOR I=1 TO 2^L
220 K1=INT(H/G1)
230 GOSUB 530
240 Y1=COS(P*K1)
250 Y2=-SIN(P*K1)
260 FOR J=1 TO G1
270 Y3=X(H+G1+1)*Y1-Y(H+G1+1)*Y2
280 Y4=X(H+G1+1)*Y2+Y(H+G1+1)*Y1
290 X(H+G1+1)=X(H+1)-Y3
300 Y(H+G1+1)=Y(H+1)+Y4
310 X(H+1)=X(H+1)+Y3
320 Y(H+1)=Y(H+1)+Y4
330 H=H+1
340 NEXT J
350 H=H+G1
360 NEXT I
370 NEXT L
380 FOR I=0 TO N-1
390 K1=I
400 GOSUB 530
410 IF K2>=I THEN 480
420 K3=X(I+1)
430 X(I+1)=X(K2+1)
440 X(K2+1)=K3
450 K3=Y(I+1)
460 Y(I+1)=Y(K2+1)
470 Y(K2+1)=K3
480 NEXT I
499 GO TO 591
500 REM STATEMENTS 500 TO 510 PRINT OUT RESULTS
501 REM OF THE FFT ITSELF; SKIPPED HERE
502 FOR I=0 TO N-1
504 PRINT I;X(I+1);'+I'+Y(I+1)
506 NEXT I
520 GO TO 591
530 K2=0
540 FOR K=1 TO G
550 K3=INT(K1/2)
560 K2=2*(K2-K3)+K1
570 K1=K3
580 NEXT K
590 RETURN
591 REM PRINT OUT POWER SPECTRUM
593 PRINT 'STEP BETWEEN DATA POINTS';
595 INPUT T
599 PRINT 'NUMBER OF POINTS AVERAGED';
600 INPUT M
605 PRINT
610 PRINT ' FREQUENCY      POWER'
620 Q=2*T/(M*N)
630 FOR J=0 TO N/2 STEP M
640 S=0
650 FOR I=1 TO M
660 S=S+Q*(X(J+I+1)*X(J+I+1)+Y(J+I+1)*Y(J+I+1))
670 NEXT I
680 F=(2*M+M)/(2*N*T)
690 PRINT F;S
700 NEXT J
800 GO TO 599
999 END

```

800-323-1780* NCE's HOTLINE FOR SAVINGS

- **Ribbons for:** Diablo, Qume, IBM, Wang, NEC, All Data Printers and Typewriters.
- **Printwheels, Elements and Thimbles.**
- **Magnetic Media:** Floppy disks, mini-floppy, Tape, Packs and Cassettes.
- **Disc storage systems,** Quietizers, Anti-static mats, Ink rolls and much more.
- **Terminals and accessories.**

• TO ORDER •

Phone orders invited, using credit cards. Or send check, cashiers check or money order that draws on a U.S. bank. Please add 3% (\$5.00 Minimum) for handling, shipping and insurance. Illinois residents add 5% sales tax. **Mail order pricing only. Catalog mailed upon request.**

DISKETTES

- 100% Certified
- 2 Year Warranty
- 10 Million Passes
- Human Engineered
- EZ View Box
- The Best Disk Available Today.

	Box of 10
5 1/4" (Soft Sector)	29.95
5 1/4" (10 Sector)	29.95
5 1/4" (16 Sector)	29.95
8" Single Side-Single Density	32.50
8" Single Side Reversible	52.50
8" Single Side Double Density	50.00
8" Double Sided Double Density	52.50



"Run With the Thoroughbreds"
Satisfaction Guaranteed

NCE Supply Corp.
915 W. Liberty Drive
Wheaton, IL 60187
Phone: 800-323-1780 Toll Free
*312-682-0001 Within Illinois
TELEX 724389ATT NCE
• Distribution Worldwide •



THE FORTH SOURCE

Specializing in printed material for the FORTH language. Send for listing of current material.

Installation Manual	\$10.00
8080 Listing	10.00
6502 Listing	10.00
6800 Listing	10.00
6809 Listing	10.00
PDP-11 Listing	10.00
PACE Listing	10.00
Alpha Micro Listing	10.00
<i>more coming</i>	
Using FORTH, manual	\$25.00
fig-FORTH Cross Compiler	30.00
PDP-11 User's Guide	20.00
Tiny Pascal in fig-FORTH	10.00
<i>more coming</i>	

Foreign orders add 30% for Airmail.
Dealer inquiries invited.

Write for complete listing of FORTH material.

MOUNTAIN VIEW PRESS
PO Box 4656
Mt. View, CA 94040

A REFURBISHED "SELECTRIC" ASCII TERMINAL
FOR THE SMALL BUSINESSMAN OR SERIOUS HOBBYIST.

The AJ 841 I/O terminal. Now available from dealers nationwide.

Demand for our AJ 841 I/O computer terminal has been great. And now it's getting even greater. So call your local computer shop dealer right away. Supply is limited! You may never have another opportunity like this one to buy your own professional terminal.



The AJ 841 features:

- Choice of serial RS 232 or parallel interface
- ASCII code
- 14.9 cps printout
- High quality Selectric printing
- Heavy-duty Selectric mechanism
- Off-line use as typewriter
- Documentation included
- 30-day warranty on parts and labor (details available on request)

Call toll-free now

For location of your nearest AJ dealer, call toll-free:

800/538-9721

California residents call collect 408/263-8520, Extension 263.

Available only in the continental United States



See us at the NCC
booth 1608

LISP

for TRS-80 Models I & III

SuperSoft LISP allows the TRS-80 to become a complete Artificial Intelligence laboratory! It is the tool that takes you to the frontier of Computer Science.

The SuperSoft LISP is a *complete and full* implementation. (It is NOT a subset!) It contains an efficient garbage collector which optimizes the usage of user RAM, and supports the TRS-80 graphics. Below are some features:

- Runs in 16k level II (with only 6K overhead)
- Fully implements atom property list structure.
- PROG is supported.
- FUNARG device is implemented.
- Efficient garbage collection.
- Complete with LISP editor and trace.
- Allows complete range of single precision numeric data.
- Works with old as well as new ROMs.
- Contains 97 functions.
- Sample Programs.

The LISP package is supplied on tape or discette and with a complete user manual.

cassette version: \$75.00
(requires 16K level II)

Disk version: \$100.00
(requires 16K disk)

(manual only: \$15.00)

All Orders and General Information:
SUPERSOFT ASSOCIATES
P.O. BOX 1628
CHAMPAIGN, IL 61820
(217) 359-2112
Technical Hot Line: (217) 359-2691
(answered only when technician is available)



SuperSoft
First in Software Technology

TRS-80 TRADEMARK TANDY CORP

Technical Forum

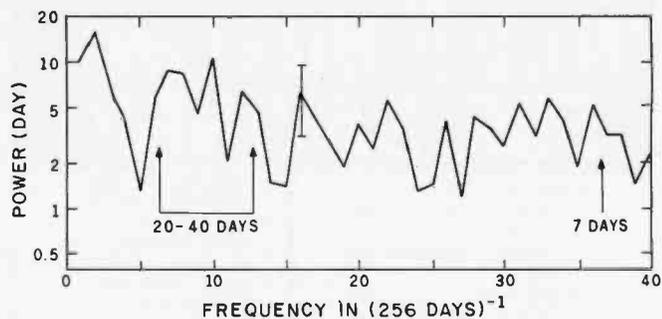


Figure 1: A power spectrum chart averaging four periods of 256 days each. This figure of the low end of the full-power spectrum graph shows the relative intensities of sine waves of various frequencies. The range of values bracketed by the arrows labeled "20-40 days" represents the power of sine waves with periods between 20 and 40 days. If biorhythms were present in this power spectrum, they would have appeared as significant peaks at certain points within this range. The vertical line at frequency=15 shows the possible variation of the point on the graph and is a measure of the possible error in measurement at that point.

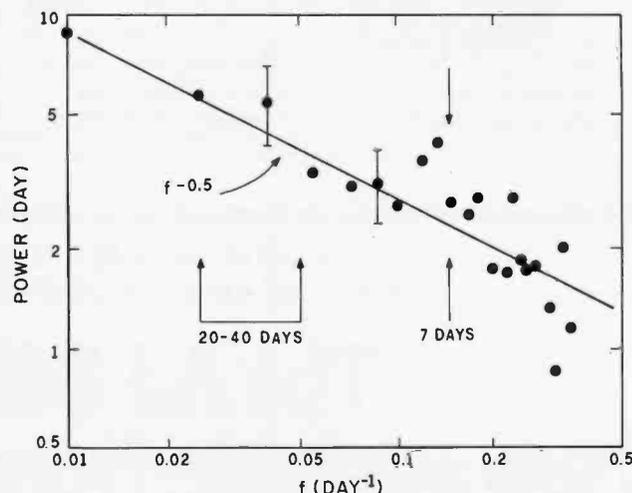


Figure 2: A modified power spectrum chart. The data of figure 1 was averaged over four frequency bins, giving a more accurate set of data points, and plotted using logarithmic scales for both the frequency and power axes. The notation used is described in the caption for figure 1.

array Y is set to zeros. Lines 200 thru 590 perform an N-point fast Fourier transform:

$$F_n = \sum_{k=0}^{k=N-1} Z_k \exp(-2\pi i k n / N)$$

where $Z_k = X_k + iY_k$ is the (complex) input vector and F_n is the complex Fourier transform ($i = \sqrt{-1}$ and is the unit measure along the imaginary axis when dealing with complex numbers). The real (cosine) part of F is placed in X and the imaginary (sine) part in Y by the routine. The n th frequency, corresponding to the Fourier coefficient F_n , is $f_n = n / (N\Delta t)$. The power spectrum is calculated in

OHIO DATA

Modem Kit

300 Baud Acoustic Coupler

\$69.00

- Includes:
- Power Supply
 - Speakers
 - Printed Circuit Board
 - All Integrated Circuits, Resistors & Capacitors
 - Instruction and Trouble Shooting Book

Order Direct or Call for the Location of the Closest Dealer

Add \$4.00 for Shipping Charge.
Ohio Residents add 6.5% for Sales Tax



VISA

MASTERCARD

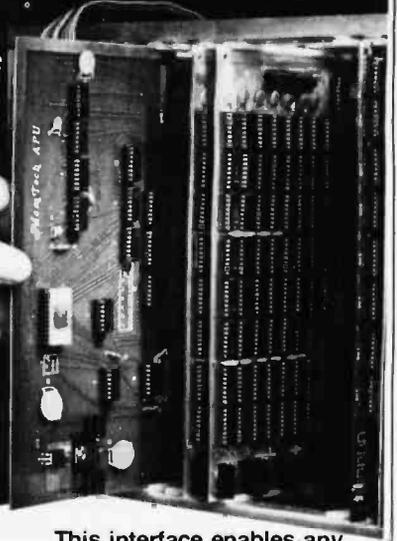
OHIO DATA PRODUCTS CORPORATION

14600 Detroit Avenue • Cleveland, Ohio 44107 • (216) 221-9000
Allow 6 weeks for Delivery

SPEED UP YOUR SYSTEM!

Fortran or
Compiled Basic
3 times faster
using the

Memtech
Arithmetic
Processing
Unit Interface.



This interface enables any S-100 buss microcomputer to communicate with the AMD 9511 APU. It can perform a *Floating Point Multiply in 56 μS* vs. 3000 μS in software. Trigonometric and exponential functions are also performed (41 in all).

Assembled with 3MHz 9511 \$460 (with 2MHz \$390)
Library for Microsoft Fortran \$100, Basic \$100

California residents add 6% sales tax. Price includes shipping to any point in U.S. and sockets for all IC's.

Memtech Co.
665 Shelter Creek, Suite 237, San Bruno, CA 94066

THE FIRST TRS-80[®] COMPATIBLE COMPUTER WITH HIGH DENSITY COLOR GRAPHICS!



LNW 80

PC BOARD **\$89.95**

Ask about our : Keyboard cabinet
Leadex
VIDEO 100-80

LNW RESEARCH

LNW RESEARCH 14881 - C MYFORD RD TUSTIN CA 92660 (714)552-8946

LNW RESEARCH introduces the LNW80, a high performance color computer, compatible with the TRS-80[™] Model I. The fully integrated LNW80 is a sophisticated and versatile microcomputer with the following powerful features.

COMPATIBILITY

Hardware and software compatible to the Radio Shack TRS-80[™] Model I computer, provides the widest software base of any microcomputer. cassette interface; expansion bus

DISPLAY

Quality upper and lower case display.

Two modes of color graphics. high resolution graphics, 384 x 192 in eight colors - higher density than the Apple II*. Low density color graphics of 128 x 192 are also available in eight colors.

high resolution - black and white graphics - of 384 x 192 mixed with text and TRS-80[™] standard graphics.

Reverse video. composite video RF output.

PERFORMANCE

The LNW80 utilizes the fast Z-80A microprocessor which executes at a speed of 4 MHz - over twice the speed of the TRS-80[™] Model I.

NEW

EXTERNAL DATA SEPARATOR
ASSEMBLED AND FULLY TESTED
\$14.95

SYSTEM EXPANSION

AT **\$69.95** [PC BOARD & USER MANUAL]

- SERIAL RS232C/20 mA I/O
- FLOPPY CONTROLLER
- 32K BYTES MEMORY
- PARALLEL PRINTER PORT
- DUAL CASSETTE PORT
- REAL-TIME CLOCK
- SCREEN PRINTER BUS
- ONBOARD POWER SUPPLY
- SOFTWARE COMPATIBLE
- SOLDER MASK, SILK SCREEN

ORDERING INFORMATION

Add \$3 for postage and handling.
CA residents add 6% sales tax



6809 SOFTWARE POWER TOOLS BY MICROWARE®

OS-9™ MULTIPROGRAMMING OPERATING SYSTEM

A true multitasking, real time operating system for timesharing, software development, database, process control, and other general applications. This versatile OS runs on almost any 6809-based computer.

■ UNIX™-like file system with hierarchical directories, byte-addressable random-access files, and full file security. Versatile, easy-to-use input/output system is hardware independent and expandable.

■ Powerful "shell" command interpreter features: I/O redirection, multiple job stream processing, and more. Includes a complete set of utility commands.

■ OS-9 Level Two uses hardware memory management and can address over one megabyte of memory. Also includes pipes and filters for inter-process data transfers.

■ OS-9 Level One runs on systems without memory management hardware having up to 56K memory.

OS-9 Level Two \$495* Level One \$195

BASIC09™ PROGRAMMING LANGUAGE SYSTEM

Extended BASIC language compiler/interpreter with integrated text editor and debug package. Runs standard BASIC programs or minimally-modified PASCAL programs.

■ Permits multiple named program modules having local variables and identifiers. Modules are reentrant, position independent and ROMable.

■ Additional control statements for structured programming: IF ... THEN ... ELSE, FOR ... NEXT, REPEAT ... UNTIL, WHILE ... DO, LOOP ... ENDLOOP, EXITIF ... ENEXIT.

■ Allows user-defined data types and complex data structures. Five built-in data types: byte, integer, 9 digit floating-point, string and boolean.

■ Runs under OS-9™ Level One or Level Two. \$195*

OTHER OS-9™ FAMILY SOFTWARE

- Stylograph™ Screen-Oriented Word Processor
- Interactive Assembler ■ Macro Text Editor
- Interactive Debugger

BASIC09 and OS-9 are trademarks of Microware® and Motorola. UNIX is a trademark of Bell Laboratories.* Most software is available on ROM or diskette in versions for many popular 6809 computers. Contact Microware® for specific availability.



MICROWARE®

Microware Systems Corp., Dept. B2
5835 Grand Avenue, Des Moines, Iowa 50304
(515) 279-8844 • TWX 910-520-2535

Technical Forum

Frequency in (256 days) ⁻¹	log ₁₀ (Power)
1	1.00
2	1.20
3	0.83
4	0.59
5	0.10
6	0.76
7	0.94
8	0.91
9	0.61
10	1.00
11	0.29
12	0.79
13	0.65
14	0.16
15	0.13
16	0.79
17	0.62
18	0.44
19	0.26
20	0.56
21	0.39
22	0.73
23	0.52
24	0.12
25	0.17
26	0.58
27	0.08
28	0.62
29	0.53
30	0.42
31	0.72
32	0.47
33	0.74
34	0.57
35	0.27
36	0.70
37	0.48
38	0.49
39	0.12
40	0.49

Table 1: Table of values for the power spectrum chart of figure 1. The second column of numbers is the base-10 logarithm of the value of the power. For example, for point 20, 10^{0.56} equals 3.63, which is the value plotted in figure 1 at the point frequency=20. The marks for 7, 20, and 40 days in figure 1 correspond to frequency values (with units of (256 days)⁻¹) of 36.6, 12.8, and 6.4, respectively. The logarithm of the variation of the error mark at frequency=16 is +0.18 and -0.30 from the recorded value of 0.79.

lines 591 thru 800, using the relation:

$$P_n = (2\Delta t/N) |F_n|^2$$

The program allows averaging of the power over any specified number of frequency bins. If M frequency estimates are averaged, the number of degrees of freedom in the single power spectrum is $D=2M$ and the fractional statistical uncertainty is $\pm\sqrt{(2/2M)} = \pm\sqrt{(1/M)}$.

As mentioned above, I scored 1024 consecutive days on a scale of 1 to 10 and analyzed the data in 256-day groups. The average scores for the four groups were 5.1, 4.6, 4.5, and 4.6, indicating a mean near 5 with a hint of a long-term decline. The day-to-day variation (standard deviation) was close to 1 for each of the four periods.

Averaging the power spectra for the four periods, I ob-



NEW!

CHECKBOOK - CHECKWRITER PROGRAM FOR:
 TRS 80CC™ TRS 80 LEVEL II™
 ATARI 800™ APPLE II™
 HEATH H-89™
 CASSETTE TAPE \$9.95
 or LISTING \$5.95

NOW... Continuous Checks
*That Can be Used With or Without Your Computer!!
 The Best in A Home Checking System*

That's right Continuous Checks fan-folded in a 3-to-a-page desk set design. And they can be computer printed, handwritten or typewritten - whichever suits the quantity or situation.

SPECIAL DESIGN

Our checks are not a high-volume business form adaptation. They're specially designed Computer/Manual Checks for the home or low volume user. And Programming is Easy. All stub and check information is on the same line. No need to change tractor width when loading either. Our checks are the same 9 1/2" width as standard tractor feed printer paper. Tear-down size is the same as the classic personal sized check issued by all banks.

COMPLETE HOME SYSTEM

With this system you can print the bulk of your monthly checks on your computer. Your checks and stubs can then be stored in our attractive Data Ring Binder Checkbook. Later, if you have a few checks to write, there's no need to load them into a printer - just write a check at your desk as shown above.

And you can mail your checks in our dual windowed envelopes to eliminate addressing chores.

UNIQUE
 You won't find checks like these anywhere. And, our special small quantity printing process will give you excellent quality and appearance. Standard color-coordinated imprinting and encoding is as shown above (logo can be omitted) on blue, grey, tan, or green checks.

PRICED RIGHT

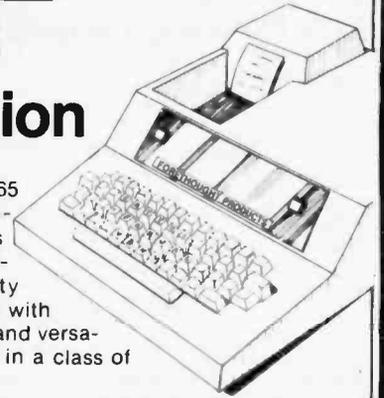
Two Hundred checks are just \$29.95 (envelopes \$13.95). Five Hundred checks are \$49.95 (envelopes \$27.95). Data Ring Checkbooks are only \$6.95.

Special "ORDER NOW" Offer

If you order directly from this ad, we'll send you a monthly Checkbook-Checkwriting program FREE on cassette tape for any one of the computers listed above. You'll save \$9.95. Just enclose a voided check (for encoding information) with your payment. (VISA - MasterCard orders must show signature, expiration date, and account number). Or, send today for samples. *Sorry, we can't make this Free Offer unless you order directly from our ad.* (MAIL ADDRESS: SOURCE TCM#11) (PHONE: 213 702 2341)

SYNERGETIC SOLUTIONS 4715 SHEPHERD RD. MULBERRY, FL 33860
 PHONE: (813) 646-6557

Complete AIM 65 Expansion



For complete AIM 65 expansion, Forethought Products brings you the AIM-Mate Series, quality expansion products with price, performance and versatility that puts them in a class of their own.

AIM-Mate Series expansion, including RAM (to 48K), PROM, I/O, video and floppy disk interface, STD BUS interface, parity protection and more, lets you configure the kind of system you need.

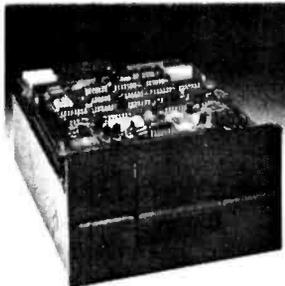
The compact AIM-Mate case puts it all together in a sturdy, portable, desk top unit.

Write today for complete details on the AIM-Mate System- AIM 65 expansion products for the professional.



87070 Dukhobar Road, Eugene, Oregon 97402 (503) 485-8575

The DataTrak™ 5 Floppy Disk Drive The DataTrak™ 8 Floppy Disk Drive
 from **Qume®** Distributed by **asap**



The DataTrak™ 5 double-sided double-density drive uses state-of-the-art technology to give you superior data integrity through improved disk life, data reliability, and drive serviceability using 5 1/4" media.

Qume's independent head load yields wear characteristics far superior to competitive drives. This superior wear performance produces savings on both diskette usage and drive maintenance.

Improved data reliability, resulting from superior amplitude and bit shift characteristics, optimizes operator efficiency and reduces processing time for end-users.

And DataTrak's unique modular design means simplified field servicing for you and your customers.

Design Features

Expanded storage capacity
 • Two-sided, double density

Proven head carriage assembly

- Ceramic head with tunnel erase
- Dual-head flex mounting arrangement
- Superior head load dynamics

Precise lead screw actuator

- Fast access time - 20 ms track-to-track
- Low friction and minimum wear
- Low power dissipation

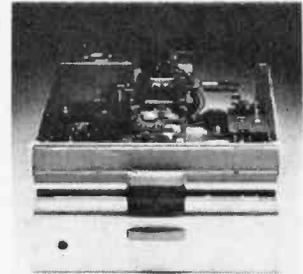
Additional features

- Industry standard 5 1/4" media format
- ISO standard write protect
- Door lock out for media protection
- Requires DC voltage only
- Daisy Chain up to 4 drives
- Heads load on command independent of loading media

Product Specifications

Performance Specifications

- Capacity
- Unformatted: 437.5K or 500K bytes
- Qume Formatted: 286.7K or 327.7K bytes
- Recording Density: 545b BPI
- Track Density: 48 TPI
- Cylinders: 35 or 40
- Tracks: 70 or 80
- Recording Method: FM or MFM
- Rotational Speed: 300 RPM
- Transfer Rate: 250K bits/second
- Latency (avg.): 100 ms
- Access Time: Track-to-track 20 ms
- Settling 15 ms
- Head Load Time: 50 ms



The DataTrak™ 8 double-sided, double-density drive uses state-of-the-art technology to give you superior data integrity through improved disk life, data reliability, and drive serviceability.

Qume's innovative approach to controlling head load dynamics yields wear characteristics far superior to competitive drives. In independent evaluation, DataTrak 8 is setting industry standards for tap test performance. This superior wear performance produces savings on both diskette usage and drive maintenance.

Improved data reliability, resulting from superior amplitude and bit shift characteristics, optimizes operator efficiency and reduces processing time for end-users.

And DataTrak's unique modular design means simplified field servicing for you and your customers.

Design Features

Expanded storage capacity
 • Two-sided, double density

Fully IBM compatible

- IBM 3740 and System 32 drives
- IBM 3600 and 4964 drives
- IBM System 34 drives

Proven head carriage assembly

- Ceramic head with tunnel erase
- Dual-head flex mounting arrangement
- Superior head load dynamics

Fast, precise steel belt drive

- Fast access time - 3 ms track-to-track

- Low friction and minimum wear
- Low power dissipation

Additional features

- ISO standard write protect
- Programmable door lock
- Negative DC voltage not required
- Daisy Chain up to 4 drives
- Side-by-side mounting in standard 19" RETMA rack

Product Specifications

- Performance Specifications**
- Capacity: Unformatted 1.6 Mbytes/disk
- IBM format 1.2 Mbytes/disk
- Recording Density: 6816 BPI
- Track Density: 48 TPI
- Cylinders: 77; Tracks: 154
- Recording Method: MFM
- Rotational Speed: 360 RPM
- Transfer Rate: 500K bits/second
- Latency (avg.): 83 ms
- Access Time: Track-to-track 3 ms
- Settling 15 ms
- Average 91 ms
- Head Load Time: 35 ms
- Disk: Diskette 2D or equivalent

asap computer products, inc.

1198 E. Willow
 Signal Hill, CA 90806

AUTHORIZED DISTRIBUTOR FOR QUME
 CALL FOR PRICE AND DELIVERY
 (800) 421-7701 or (213) 595-6431 (In California)

HELPING THE SMALL COMPUTER ENTREPRENEUR

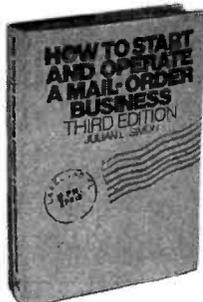
How To books and seminars from
Essex Publishing Company



#10. HOW TO START YOUR OWN SYSTEMS HOUSE. *Leslie Nelson.* Practical step-by-step guide for the EDP professional or small businessman. Covers all aspects of starting and operating a small systems business. **\$36.00**



#35. SOFTWARE WRITER'S MARKET. *Bernard Korites.* 1800 places to sell your software. If you are in the software business this directory is your key to profits. **\$45.00**



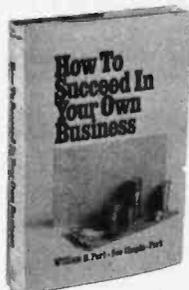
#130. HOW TO START & OPERATE A MAIL-ORDER BUSINESS. *Julian Simon.* Indispensable for those selling software, equipment or supplies by mail. 3rd revised edition, 544 pages. **\$24.95**



#290. HOW TO FINANCE YOUR SMALL BUSINESS WITH GOVERNMENT MONEY. *R.S. Hayes and J.C. Howell.* Amazingly, one of the best sources of start-up and expansion capital is Uncle Sam. This book shows you in detail how to go about it. **\$14.95**



#211. HOW TO START AND PROMOTE YOUR OWN NEWSLETTER. *Howard L. Shenson.* Newslettering is a high profit business. This detailed, step-by-step seminar shows you how you can do it. Includes cassettes, written materials and binder. **\$59.00**



#291. HOW TO SUCCEED IN YOUR OWN BUSINESS. *W.R. Park and S.C. Park.* Gives the first-time, untested entrepreneur a look at what to expect. Brings a wealth of specific operating data for over 80 kinds of businesses. **\$19.95**

ESSEX PUBLISHING CO.
285 Bloomfield Avenue • Caldwell, N.J. 07006



Order Books by number:

Send check, money order (US \$), VISA or Master Charge #. Publisher pays 4th class shipping. For UPS shipping (U.S.A. only) add \$1.00 per book. For Air Mail shipping add \$2.50 per book in the U.S.A., \$6.00 in Mexico and Central America, \$12.00 per book elsewhere. N.J. residents add 5% sales tax.

Check enclosed Credit Card 4th Class UPS Air

Name

Address

City State Zip

Card # Exp. Date

For faster shipment on credit card orders call (201) 783-6940 between 9 and 5 Eastern time.

Technical Forum

Point Number	$\log_{10}(f)$	$\log_{10}(\text{Power})$
1	-2.01	0.96
2	-1.60	0.78
3	-1.39	0.75
4	-1.25	0.53
5	-1.14	0.49
6	-1.06	0.50
7	-0.99	0.43
8	-0.92	0.55
9	-0.87	0.61
10	-0.82	0.42
11	-0.78	0.39
12	-0.74	0.45
13	-0.70	0.24
14	-0.67	0.22
15	-0.64	0.45
16	-0.61	0.26
17	-0.59	0.24
18	-0.56	0.24
19	-0.54	0.11
20	-0.51	-0.07
21	-0.49	0.30
22	-0.47	0.06

Table 2: Table of values for modified power spectrum of figure 2. Here, both columns of numbers are the base-10 logarithms of their respective values as plotted in figure 2. For example, for point 2, $10^{-1.60}$ and $10^{0.78}$ give values of 0.025 and 6.026, which can be read off the horizontal and vertical axes of figure 2. The marks for 7, 20, and 40 days in figure 2 correspond to frequency values (with units of (days)⁻¹) of 0.141, 0.050, and 0.025, respectively. The logarithm of the variation of the error mark as shown in figure 2 is +0.10 and -0.12.

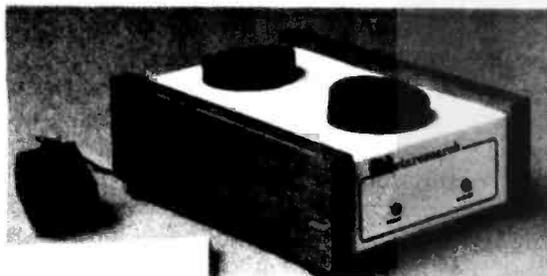
tained the power spectrum, the low-frequency part of which is shown in figure 1. Note that the power spectrum's vertical axis is logarithmic; this makes the size of the statistical uncertainty in each point the same. A typical error flag at frequency = 15 is shown. A few relevant cyclic periods are shown, including the week (seven days) and the canonical biorhythm periods (twenty to forty days).

The safest thing to say is that there is no evidence whatsoever for enhancements above the background noise level in the biorhythm range. Even if all the variation in the six power spectral points in the twenty- to forty-day range is attributed to biorhythms, the contribution is only about fifteen percent of my total variance from day to day. But there is no evidence for any periodicities in this region, and the noise in the biorhythm range looks similar to that at both lower and higher frequencies.

The perceptive reader may notice that the power spectrum shown in figure 1 is not flat, as would be the case for perfectly "white" or uncorrelated noise. This implies that there is some temporal structure in my day-to-day feeling of well-being. To investigate this more closely, I averaged the data in figure 1 over four adjacent frequency bins, to give power spectra with thirty-two degrees of freedom. The results are shown in figure 2, given as a log-log plot. The solid line shows that the power spectrum is well fit by a power law spectrum, $P(f) \propto f^{-0.5}$. This is an unusual power spectrum. White noise has a flat spectrum, and random-walk noise has a f^{-2} spectrum. Electrical "flicker

New Low-cost Modem

MA-50



- Answer/Originate
 - 300 Baud
 - Bell 103 and 113 Compatible
 - RS232C Interface
 - Half/Full Duplex
 - Full One Year Warranty
- Complete with manual and AC safety transformer.

\$11900

Detaresearch, Inc.
1100 SE Woodward
Portland, Oregon 97202
(503) 232-1712

Add \$2.00 shipping
VISA M.C. accepted

4.25
BISSING
SDIC/SSIA
Software for your Microcomputer
8080 Z80 8086 Z8000

IBM 2770
IBM 2780
IBM 3270
IBM 3741
IBM 3780
IBM 3776

WINTERHALTER & ASSOCIATES, INC.
SPECIALISTS IN DATA COMMUNICATIONS
3825 ZEEB ROAD
DEXTER, MICHIGAN 48130
313-426-3029 or
313-665-5582

JDR MICRODEVICES, INC.

1101 South Winchester Blvd.
San Jose, California 95128
800-538-5000
408-247-4852

NEED YOUR ORDER SHIPPED TODAY?

THEN CALL TOLL FREE

800-538-5000

TERMS

Include \$2.00 for shipping. \$10.00 minimum order. send SASE for complete catalog.
Bay Area Residents add 6 1/2% sales tax.
Calif. Residents add 6% sales tax.

Your

BANKAMERICARD
Welcome Here

WE WILL BEAT ANY COMPETITORS PRICES. GIVE US A CALL AND WE'LL PROVE IT!!!

LS SERIES LOOK AT THIS LS PRICING!

74LS00	.32	74LS38	.39	74LS122	.55	74LS170	1.89	74LS266	.68
74LS01	.28	74LS40	.25	74LS123	.99	74LS173	.82	74LS273	1.69
74LS02	.38	74LS42	.79	74LS125	.99	74LS174	1.19	74LS275	3.39
74LS03	.32	74LS47	.78	74LS126	.88	74LS175	1.09	74LS279	.59
74LS04	.35	74LS48	.78	74LS132	.69	74LS181	2.19	74LS283	1.03
74LS05	.28	74LS51	.35	74LS136	.58	74LS190	1.15	74LS293	1.25
74LS08	.38	74LS54	.35	74LS138	.79	74LS191	1.31	74LS293	1.89
74LS09	.38	74LS55	.32	74LS139	.79	74LS192	.88	74LS295	1.09
74LS10	.32	74LS73	.44	74LS145	1.19	74LS193	.98	74LS298	1.24
74LS11	.29	74LS74	.48	74LS148	1.39	74LS194	1.80	74LS352	1.59
74LS12	.29	74LS75	.58	74LS151	.79	74LS195	1.39	74LS353	1.59
74LS13	.38	74LS76	.50	74LS153	.79	74LS196	.82	74LS363	1.39
74LS14	.99	74LS78	.59	74LS154	2.39	74LS197	.82	74LS365	.99
74LS15	.35	74LS83	.90	74LS155	1.19	74LS221	1.28	74LS368	.99
74LS20	.26	74LS85	1.23	74LS156	.95	74LS240	1.89	74LS367	.99
74LS21	.30	74LS86	.45	74LS157	.79	74LS241	1.89	74LS368	.99
74LS22	.34	74LS90	.70	74LS158	.82	74LS242	1.89	74LS373	1.85
74LS26	.40	74LS92	.82	74LS160	.94	74LS243	1.89	74LS374	1.81
74LS27	.35	74LS93	.71	74LS161	.99	74LS244	1.79	74LS377	1.48
74LS28	.39	74LS95	1.11	74LS162	.99	74LS245	2.89	74LS385	1.90
74LS30	.35	74LS96	.86	74LS163	.99	74LS251	1.32	74LS386	.65
74LS32	.39	74LS107	.43	74LS164	.99	74LS253	.89	74LS390	1.90
74LS33	.54	74LS109	.49	74LS165	.99	74LS257	.89	74LS393	1.90
74LS37	.78	74LS112	.48	74LS166	2.40	74LS258	.89	74LS395	1.69
		74LS113	.48	74LS168	1.79	74LS259	2.89	74LS670	2.20
		74LS114	.55	74LS169	1.79	74LS260	.68		

MEMORY SALE

4116—300NS	8/19.95	100/2.25ea
4116—200NS	8/23.95	100/2.75ea
2114L—300NS	8/29.95	100/3.00ea
2708—450NS	4.95ea	8/4.80ea
2716—5V 450NS	7.95ea	8/6.95ea
2732—INTEL	29.95ea	CALL
2532—TI PIN OUT	21.95ea	CALL

THESE PRICES GOOD FOR BYTE READERS ONLY—TO GET THESE UNHEARD OF PRICES YOU MUST STATE WHEN ORDERING: APRIL BYTE MEMORY SALE—SALE ENDS APRIL 30, 1981

3242
REFRESH
CHIP FOR
16K RAM
\$9.95ea

8080A		Z80			
8085A	12.95	8238	5.50	Z80-CPU	8.45
8080A	3.95	8251	6.95	Z80A-CPU	9.45
8212	2.75	8253	12.95	Z80-DMA	18.00
8214	5.25	8255	6.50	Z80-SIO/2	27.50
8216	2.75	8257	16.95	Z80-SIO/9	20.50
8224	2.95	8259	14.95	Z80-CTC	7.85
8226	3.49	8275	49.95	Z80-PIO	7.60
8228	4.95	8279	15.95		

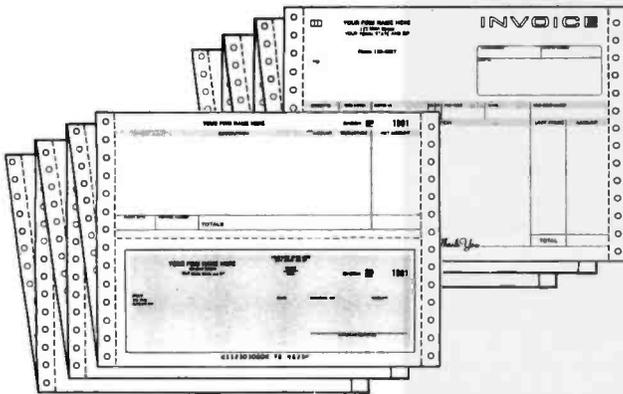
ALL MERCHANDISE 100% GUARANTEED! CALL US FOR VOLUME QUOTES

FREE COMPUTER FORMS KIT

with continuous business forms
for small computer systems

Each kit contains samples, programming guides, flyers, prices and order forms for checks, invoices, statements, envelopes, stock paper and labels to fit almost every computer system.

- Available in quantities of 500, 1,000, 2,000, 4,000, 6,000
- Low Prices (500 checks only \$32.50)



- **FAST SERVICE** — It is our policy to ship within 6 working days following our receipt of your order.
- **MONEY BACK GUARANTEE** — If for any reason you are not completely satisfied, your money will be promptly refunded.

Fast Service by mail or . . . **PHONE TOLL FREE**
1 + 800-225-9550

Mass. residents 1 + 800-922-8560
8:30 a.m. to 5:00 p.m. Eastern Time Monday — Friday

Please Ship FREE Kit To: _____ CODE 460

Name _____

Company _____

Street _____

City, State and Zip _____

Phone _____

Computer make & model _____



**Neb
Computer Forms**

78 Hollis Street, Groton, Mass. 01450
A Division of New England Business Service, Inc.

Technical Forum

noise" has an f^{-1} spectrum. My biorhythms, instead of producing quasi-periodic "music of the spheres," seem to be more in the nature of a slightly colored and unique random hiss! ■

Biorhythms and Fourier Transforms

Proponents assert that the relative strength and weakness of mankind in areas roughly described as "physical," "emotional," and "intellectual" vary in cycles of twenty-three, twenty-eight, and thirty-three days, respectively, with each of the curves approximating sine waves of equal amplitude. Of course, the effects of each influence are added together, so that an overall index of a particular day's merit (as the author recorded by assigning each day a number between 1 and 10) would not readily show the presence (or absence) of these sinusoidal waves.

This is where Fourier transforms (either fast or discrete) come in. In theory, any complex periodic waveform can be shown to be the sum of a number of sine waves of differing frequencies and amplitudes. The Fourier method transforms an amplitude-versus-time waveform into its equivalent amplitude-versus-frequency waveform—ie: the transformed waveform tells the relative strengths of the different frequency sine waves that, when added together, will give the original amplitude-versus-time waveform.

Once this is understood, it becomes apparent that, if a specified waveform contains definite twenty-three-, twenty-eight-, and thirty-three-day cycles, these cycles should cause visible peaks in the appropriate places on the frequency (horizontal) axis of the transformed waveform. The lack of such peaks would indicate that these frequencies contribute no more to the overall waveform than other frequencies do. A transformed wave that is roughly a flat horizontal line indicates that sine waves of all frequencies contribute equally to the original waveform. Such a waveform has no dominant frequencies. A signal consisting of random components with no discernible dominant frequencies is known as white noise.

Another verification of the transformed wave is concerned with the amplitude of existing peaks. In this situation, those peaks that correspond to the biorhythm cycles should be of equal amplitude, because the three biorhythm cycles are defined as being of equal amplitude.

Response by Carl Helmers

This article suggests an approach to verification of any biological cycles hypothesis. It is not a controlled scientific experiment, and any conclusions are thus applicable only to this particular individual's characteristics.

By applying techniques of signal analysis to a broader population of individuals, it might be possible to design a scientifically valid experiment.

References

- Bendat, J S, and A G Piersol, *Random Data: Analysis and Measurement Procedures*, Wiley-Interscience, New York NY, 1971.
- Stanley, W D, and S J Peterson, "Fast Fourier Transforms on Your Home Computer," December 1978 BYTE, pages 14 thru 25.

ksam90™

The Key Sequential Access Method (ISAM) for the professional. In many successful applications since 1977. Used by equipment manufacturers like Cromemco & Philips. Runs on floppy or hard disk systems under CP/M,* CDOS, IMDOS, with a special version for UCSD Pascal. Easy interfaces to CBASIC 2, Microsoft Basic, Fortran, Pascal, and assembly language.

Features:

- ⊙ Any number of keys
- ⊙ Fixed, variable, and data sensitive records
- ⊙ B-tree file structure with no overflow areas insures fast access
- ⊙ Access by full or partial keys, sequential movement in both directions, and access by record number
- ⊙ Automatic disk space reclamation
- ⊙ Self-reorganizing files
- ⊙ Files may span up to 4 disks
- ⊙ Powerful utility package included
- ⊙ Written in machine language for speed & efficiency
- ⊙ Requires only 5k of memory



Single site object licence \$ 395
 Demo package on 8" SSSD CP/M format \$ 50
 California residents add 6% sales tax
 OEM & Dealer inquiries invited

EMS Efficient Management Systems, Inc.
computer applications

3645 Grand Ave., Ste 304 - Oakland, CA 94610

CP/M is a registered trademark of Digital Research

TERMINALS FROM TRANSNET

PURCHASE PLAN • 12-24 MONTH FULL OWNERSHIP PLAN • 36 MONTH LEASE PLAN

	DESCRIPTION	PURCHASE PRICE	PER MONTH		
			12 MOS.	24 MOS.	36 MOS.
DEC	LA36 DECwriter II	\$1,095	\$105	\$ 58	\$ 40
	LA34 DECwriter IV	995	95	53	36
	LA34 DECwriter IV Forms Ctrl.	1,095	105	58	40
	LA120 DECwriter III KSR	2,295	220	122	83
	LA120 DECwriter III RO	2,095	200	112	75
	VT100 CRT DECscope	1,595	153	85	58
TEXAS INSTRUMENTS	TI745 Portable Terminal	1,995	199	106	72
	TI765 Bubble Memory Terminal	2,595	249	138	93
	TI783 Portable KSR, 120 CPS	1,745	167	93	63
	TI785 Portable KSR, 120 CPS	2,395	230	128	86
	TI787 Portable KSR, 120 CPS	2,845	273	152	102
	TI810 RO Printer	1,895	182	102	69
CENTRONICS	TI820 KSR Printer	2,195	211	117	80
	730 Desk Top Printer	715	69	39	26
	737 W/P Desk Top Printer	895	86	48	32
	704 RS232-C Printer	1,795	172	96	65
DATAMEDIA	6081 High Speed Band Printer	5,495	527	293	198
	DT80/1 CRT Terminal	1,695	162	90	61
	DT80/1L 15" Screen CRT	2,295	220	122	83
LEAR SIEGLER	DT80/5 APL CRT	2,095	200	112	75
	ADM3A CRT Terminal	875	84	47	32
	ADM5 CRT Terminal	975	93	52	35
	ADM31CRT Terminal	1,450	139	78	53
HAZELTINE	ADM42 CRT Terminal	2,195	211	117	79
	1420 CRT Terminal	945	91	51	34
	1500 CRT Terminal	1,095	105	58	40
QUUME	1552 CRT Terminal	1,295	125	70	48
	Letter Quality KSR, 55 CPS	3,395	326	181	123
HEWLETT PACKARD	Letter Quality RO, 55 CPS	2,895	278	154	104
	2621A CRT Terminal	1,495	144	80	54
	2621P CRT Terminal	2,650	255	142	96

FULL OWNERSHIP AFTER 12 OR 24 MONTHS • 10% PURCHASE OPTION AFTER 36 MONTHS

ACCESSORIES AND PERIPHERAL EQUIPMENT

ACOUSTIC COUPLERS • MODEMS • THERMAL PAPER • RIBBONS • INTERFACE MODULES • FLOPPY DISK UNITS

OTHER POPULAR TERMINALS, COMPUTER PERIPHERALS AND COMPUTERS AVAILABLE.



TRANSNET CORPORATION

1945 ROUTE 22 • UNION, N.J. 07083 • (201) 688-7800
 TWX 710-985-5485

\$125⁰⁰ each
complete software systems packages!

ACCOUNTS PAYABLE
ACCOUNTS RECEIVABLE
GENERAL LEDGER with CASH JOURNAL

CALL IN YOUR ORDER NOW!
(617) 373-1599

Circle 234 on inquiry card.

ZENITH • ALTOS • TRS 80

"We're doing to SOFTWARE what 'MICRO' did for the computer."

S&M SYSTEMS, INC

SPECIALISTS IN FULL SERVICE SYSTEMS

P.O. Box 1225, 2 Washington Street, Haverhill, Ma. 01830

Ask BYTE

Conducted by Steve Ciarcia

4116 Pointers

Dear Steve,

Being an ardent do-it-yourselfer, I'm currently in the process of designing a homebrew computer system. Since the 16 K-bit type-4116 dynamic memories are cheap, compact, and use little power, I have decided to use them as my main memory components. Designing the interface is no problem, but I'm all too aware of the 4116's cantankerous nature with respect to circuit-board layout, power-supply fluctuations, and so forth. What should I know about these devices?

Ken McDonald
Yellowknife, NWT, Canada

The most important thing to remember when designing any computer that uses 4116s is that the power-supply volt-

ages have to be turned on and off in sequence. To keep from blowing the 4116 on power-up, the -5 V supply must be turned on before the +5 V and +12 V supplies. On power-down, the -5 V has to remain on while the +5 and +12 are removed.

In lower-current power supplies (such as you will probably use), the sequencing can be accomplished through the time constants of the power supply itself; this technique is used in the TRS-80. By giving the -5 V section a very fast time constant compared to the other two supplies, it appears to come on first. On power-down, the sequence is reversed. Because the -5 V has such a low-current draw on it, it will stay up long after the other voltages have dropped.

Other than that, use prime components and stay away from surplus devices. For more information on refresh timing signals of dynamic memories, refer to my article in the March 1981 BYTE "Build the Disk-80: Memory Expansion and Floppy-Disk Control," on page 36...Steve

Any Port In a Storm

Dear Steve,

I'm not sure if I understood the little that I read of your article "I/O Expansion for the TRS-80, Part 2: Serial Ports." (See the June 1980 BYTE, page 42.) Can I use the modem on my Radio Shack RS-232C port and my serial (Diablo) printer on your RS-232C port or vice versa? If so, are there any tricks to it?

Stan
via The Source

You say that you already have an RS-232C interface, so I'll presume it is Radio Shack's TRS232, which is installed inside the TRS-80 Expansion Interface. Normally, only one interface can be accommodated, and it is hard-wire-addressed as port hexadecimal E8. Because the COMM-80 has selectable addressing, it can be added to your system and set for one of fifteen other addresses. With a software driver that directs any output to this second serial port, you can plug your Diablo into it and use both ports without conflict.

What you really need is a CHATTERBOX, which is a COMM-80 with an acoustic modem installed in the same enclosure. It is designed so that, when the modem is in use, the characters being transmitted and received are

Anti-Static Dust Covers

Protect your computer and accessories.

- Anti-static vinyl helps prevent static from damaging sensitive components and causing faulty operation.
- Double-fold stitching will not rip out and is unmatched for strength and long life.
- Heavy gauge textured vinyl blends with any decor and folds easily for convenient storage.
- Over 1000 custom designs guaranteed to fit precisely.
- 100% satisfaction guarantee means we stand behind our product.

Yes, there are differences in Dust Covers. Differences which can be vitally important to the proper functioning of your system.

At Cover Craft we've manufactured the highest quality Dust Covers for the electronics industry for more than six years. We've been selected by major equipment manufacturers to make covers for their products. Our covers are in use in every state and in more than 50 countries. We know what it takes!



THE BEST
DUST COVERS
AT ANY PRICE

MOST PRICED
\$7.95 to \$11.95
PLUS POSTAGE AND
HANDLING
VISA-MasterCharge

So visit your dealer or contact Cover Craft for our latest catalog and list of over 200 dealers.

COVER CRAFT
P.O. BOX 555 • AMHERST, NH 03031 • (603) 889-6811

sent out through the RS-232C connector. You can plug your Diablo directly into the CHATTERBOX and have a modem with a printer output. Absolutely no changes in any software are needed.
...Steve

TRS-80 Tape Formats

Dear Steve,

The TRS-80 has more software created for it than any other system. This software is usually transferred on a cassette that is readable only on

Table 1

Tape Formats

BASIC Tape Format	
Leader	256 zeros followed by an A5 sync byte
D3 D3 D3	BASIC header
XX	Single-character file name
LOB (low-order byte)	Next line's address
HOB (high-order byte)	Pointer
LOB	Line number
HOB	
XX ... XX	Line contents
00	End-of-line marker
.	
00 00	End-of-file markers

System Tape Format	
Leader	256 zeros followed by an A5 sync byte
55	System-format header byte
XX XX XX XX XX XX	6-character file name
3C	Data header
XX	Data length, 00 = 256 bytes
LOB	Loading
HOB	Address
XX ... XX	Actual line contents
XX	Checksum of line bytes and load address
.	
78	End-of-file marker
LOB	Entry
HOB	Address

Editor/Assembler Source Tape Format	
Leader	256 zeros followed by an A5 sync byte
D3	Source header
XX XX XX XX XX XX	File name
d1 d2 d3 d4 d5	5-digit line number in ASCII (bit 7 is set)
20	Data header
XX ... XX	Line (128 bytes maximum)
0D	End-of-line marker
.	
1A	End-of-file marker

BASIC Statement Storage Format in Memory	
LOB	Address of next line
HOB	Line number in binary form
LOB	Line contents
HOB	End-of-line marker
XX ... XX	
00	
.	
00 00	End-of-file marker



E.R. Hardin's

MILITARY MADNESS

for Apple, Atari and TRS-80

TOMCAT vs. MIG

Blue skies and 40,000 feet over the Rhine Valley, when a MIG-25 suddenly blips onto your radar screen.

Your F-14 Tomcat has a brace of rockets and avionics to help survive the antics of Ivan.

Are you brave enough to climb into the cockpit and take your chances against a Russian pilot?

cassette \$19.95

GUNSHIP

Dateline; Vietnam. Tet offensive of 1968. Battle ground troops with mini-guns and rockets. Crash and burn if you're clumsy.

cassette \$19.95

GREEN BERET

Run a mission behind the lines, in North Vietnam. Blow up bridges, kidnap politicians, raid prison camps. You are the team commander.

cassette \$19.95

511 Iowa Ave.
Iowa City, IA 52240

Call 1-800-227-1617, operator 364
(in California 800-772-3545, operator 364)

VISA

MASTERCARD

a TRS-80. For people with other computers, this vast amount of software is unusable. Please tell me the data-storage format used by Tandy for its TRS-80.

Paul Shields
Victor Harbor, S A, Australia

Table 1 on page 329 shows the various TRS-80 Model I cassette-recording formats....Steve

Problem With Light Controls

Dear Steve,

It seems that a lot of BYTE readers are interested in home control via the BSR System X-10. I've fooled around with computerized home-control devices for some time, and I think BYTE readers should be aware of one rather distressing trait of the light-control modules.

When an incandescent bulb burns out, the filament in the bulb falls across its supports creating a momentary

short circuit across the A C line. I have had three BSR units damaged when a bulb has gone out. Once it involved a single table lamp with a 70-watt bulb. Another time the failure occurred in a wall-switch module controlling my outdoor-perimeter circuit of 400 watts.

This seemingly practical and low-cost method of home control becomes something of a folly when you find that you must replace a \$16 control module because a \$0.69 bulb has burnt out. I have not been able to return modules for replacements, because the salespeople accuse me of overloading the module.

In the future, I hope that the design of these modules will include protection against the surge that occurs when a light bulb fails. Until then, I don't think they are all that practical and probably should not be committed to serious uses (for which they are advertised), such as a

burglar deterrent.
Chris Gundlach
Huntington WV

I, too, have noticed that situation, and I've mentioned it to BSR. They are aware of the problem, but there isn't much that can be done to totally eliminate "zapping" the module except installing a 50 A triac (the cost would be prohibitive). There aren't too many ways to achieve fold-back current-limiting in a triac.

Don't feel too bad. I've lost seven modules and a controller because of various problems, such as transients and blown bulbs. While the BSR unit is still cost-effective in consumer applications, I would be wary of it in critical control situations.

A few companies have asked me about using the BSR for industrial remote-control and solar-heating systems, and I told them essentially what you have said to me. The application, of

course, determines the ultimate interface selection. When the alternative is a thousand-dollar computer front end, the BSR may still be the best choice—even if a receiver has to be replaced once in a while....Steve

The following is a letter sent to me concerning Mr Gundlach's problem, from BSR....Steve

BSR Responds to Criticism

Dear Mr Gundlach,

You are correct in your identification of the problem. All commercially available dimmers that contain triacs, as our lamp- and wall-switch modules do, are subject to zapping if a blown light-bulb filament falls in a "short circuit" position instead of open circuit.

Since the introduction of the System X-10 in the fall of 1978, all products have been updated and improved as necessary. We now use triacs

 **Apparat, Inc.**
INTRODUCES HOT NEW PRODUCTS
FOR YOUR APPLE

THE EXTENDER by S. Knaster
Provides Applesoft with extended features that make programming easier:

- PRINT USING - All the features of this useful format statement
- AUTO - Computer generated line numbers
- DEC/HEX - Conversion between hex and decimal - can be used in PEEK, POKE and CALL
- EDIT - Simplifies editing of Applesoft program lines.

And much more \$49.00

APPARAT 40X2 DISK DRIVE
Delivers more than twice the storage capacity (205K) of a standard Apple add-on disk drive.

- Plugs into the standard Apple disk controller
- Any diskette written on the Apple drive can be read by the Apparat 40X2
- Attractive metal case with integrated power supply
- Special firmware included to access all tracks under DOS 3.3 (firmware for DOS 3.2 and Pascal optional)

Prices start at \$499.00

PASCAL LEDGER \$149.95

NEW DOS 80

Versions of NEWDOS/80 2.0 now available for TRS-80[™] Models I and III, both with double density support.

- MANY NEW FEATURES IN BOTH VERSIONS**
- Disassembler with symbolic source text output to printer or disk
 - Pre-allocate (create) files
 - Single character R command to repeat previous DOS command
 - Auto repeat of all keys
 - Copy by file for system diskettes
 - Single drive copy by file
- Model I or Model III \$149.00

For more on all our HOT new products for the Apple and TRS-80[™] see our catalog in this month's 80 MICROCOMPUTING or send \$1.00 for a copy of our catalog (refundable on your first order)
Dealer inquiries welcomed. See us at the West Coast Computer Fair.
Apple and Applesoft are trademarks of Apple Computer
TRS-80 trademark of Tandy Corporation

 **Apparat, Inc.**
4401 South Tamarac Parkway
Denver, Colorado 80237
Order Desk 1-(800)-525-7674 (except CO., HI., AK)
Technical/Service 1-(303)-741-1778

that we feel are most resistant to zapping. Our overall return rate is quite low, and has steadily decreased with respect to blown triacs. This is substantiated in part by the fact that the major retail chains continue to buy our products in large quantities and would not do so if there were persistent problems.

We are shipping you replacements for your failed units at no charge. I would greatly appreciate any feedback on performance that you care to give...good or bad!

Sorry you had some difficulties.

Peter A Lesser
Vice President
General Manager
X-10 Division
BSR Inc

The Two Can't Connect

Dear Steve,

I have an early (second year of production) Radio

Shack TRS-80 Model I 16 K-byte Level II computer that I'm having trouble adding peripherals to. I have a Quick Printer II, an Exatron Stringy Floppy, and a typewriter interface, each of which can be plugged into the expansion connector of the TRS-80 keyboard unit.

I also have a 1-into-2 cable that should allow me to use two peripherals at once. However, if more than one peripheral is plugged into the cable, the computer randomly executes the initial power-up routine—destroying whatever I was working on.

It doesn't seem to matter which peripherals I try to combine, nor does it matter if one is off. I don't think the problem is in the cable, because it works well with each of the peripherals singly and in either connection.

What could this be? I'd like to use the system for text processing, but that's impossible right now.

Ron Tye
Long Beach CA

The TRS-80 Model I sometimes does strange things when cables are connected to the keyboard. The longer the cables, the more likely the problem you described. With one peripheral installed, it may work properly, but when the load of another is added, the bus signals become sensitive to noise. Keeping the cables as short as possible helps.

The solution is to either add a circuit that buffers all

the signals from the keyboard or, at the very least, actively terminate the extension cable.

If you do not mind a little soldering, you can try terminating your present cable. At the end of the cable, from each signal, attach a 1 k-ohm resistor to +5 V and a 470-ohm resistor to ground. You'll have to add a separate 5 V supply, since +5 V is not available on the keyboard connector....Steve■

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

If you are a subscriber to The Source, send your questions by electronic mail or chat with Steve (TCE317) directly. Due to the high volume of inquiries, personal replies cannot be given. Be sure to include "Ask BYTE" in the address.

SONG OF ROLAND

SOFTWARE

for TRS-80, APPLE and ATARI

BEOWULF

Clash swords with the monster Grendel. If you win the battle, smack your lips and feast in the great hall. **\$19.95**

THE HIGH PRIEST

Learn secrets known only to the gods. Foretell good fortune, beware of bad. But don't ask the questions, if you don't want to know the answers. **\$19.95**

HUMBABA WILL GET YOU

Outside, in the dark of the night, he lurks, waiting to rip your arm out of its socket. Your only defense is your wits and reaction time. Beware. **\$19.95**

511 IOWA AVE.
IOWA CITY, IA. 52240

MASTERCARD

VISA

1-800-227-1617 operator 364
(in California) 800-772-3545 operator 364

Event Queue

April 1981

April-June

Microprocessor Software, Hardware, and Interfacing, various cities throughout the United States. This hands-on course provides a foundation in the skills required for the design, programming, and real-world interfacing of microprocessor applications. For further details and a schedule of meeting places and times, contact Integrated Computer Systems Inc, 3304 Pico Blvd, POB 5339, Santa Monica CA 90405, (213) 450-2060.

April-October

Computer Sales-Marketing Workshops, various cities throughout the United States. These workshops are designed for retail salespeople and computer-marketing managers and their staffs. For a schedule of times and loca-

tions, contact Datasearch Inc, 4954 William Arnold Rd, Department C, Memphis TN 38117, (901) 761-9090.

April 1-2

Communications in the Twenty-First Century, Philip Morris Operations Center, Richmond VA. This conference will focus on technological advances and their economic, political, social, and psychological implications. Elie Abel, Professor of Communications at Stanford University, and Lord Briggs, provost of Worcester College, Oxford, England, are the keynote speakers. For information, contact the manager of Media Relations, Philip Morris Inc, 100 Park Ave, New York NY 10017.

April 1-3

Assuring Quality in Electronic Data-Processing Applications, McCormick Inn Hotel, Chicago IL. The objec-

tive of this conference is to explain the methods, tools, and techniques that are valuable in improving the quality of computerized applications. Tutorials cover the areas of quality assurance; managing structured design; and designing, implementing, and enforcing application standards. Contact DPMA Quality Assurance Conference, 12611 Davan Dr, Silver Spring MD 20904, (301) 622-0066.

April 3-5

The Sixth West Coast Computer Faire, Civic Auditorium, San Francisco CA. The Faire, a major personal-computing event, has continually attracted larger and larger numbers of exhibitors and attendees. A full program of talks plus a large display of hardware and software are featured. For more information, contact Computer Faire, 333 Swett Rd, Woodside CA 94062, (415) 851-7075.

April 4

The Third Annual RAMS Spring Computer Show, Perinton Square Mall, Fairport NY. This event is sponsored by the Rochester Area Microcomputer Society. For more information, contact RAMS, POB D, Rochester NY 14609.

April 7-8

Top Secrets '81, Pointe Resort, Phoenix AZ. Honeywell's annual computer security and privacy conference. Many data-security authorities will discuss the business and legal impact of the latest incidents in computer crime and abuse. The conference fee is \$500. Contact the Security Symposium Registrar, Honeywell Information Systems, M/S T-99-4, POB 6000, Phoenix AZ 85005, (800) 528-5343; in Arizona (602) 249-7954.

April 7-9

Computerized Office Equipment Expo—Midwest '81, O'Hare Exposition Center, Rosemont IL. This exposition

has exhibits and seminars on the use of computers and related equipment in business environments. For details, contact Industrial & Scientific Conference Management Inc, 222 W Adams St, Chicago IL 60606, (312) 263-4866.

April 7-9

Electro/81, New York Coliseum and Sheraton Centre Hotel, New York NY. Electro/81 will feature computers and computer-related equipment, plus seminars on components, devices, and materials; computer communications; memories; office automation; speech; and more. Contact Electronic Conventions Inc, 999 N Sepulveda Blvd, Suite 410, El Segundo CA 90245, (800) 421-6816; in California (213) 772-2965.

April 9-12

Southwest Computer Show and Office Equipment Exposition, Market Hall, Dallas Market Center, Dallas TX. Hardware and software for business, education, government, home and personal use will be featured. Mini- and microcomputers, office machines, supplies and services, graphics equipment, and word processing will also be exhibited. Contact National Computer Shows, 824 Boylston St, Chestnut Hill MA 02167, (617) 739-2000.

April 10-11

The Eleventh Annual VCUC Conference, Sheraton Red Lion Inn, Blacksburg VA. The VCUC (Virginia Computer Users Conference), a division of the ACM (Association for Computing Machinery), and the Computer Science Department of the Virginia Polytechnic Institute and State University are holding this conference. The themes are "Personal Computing" and "System Performance." Write to J Rosow or S Haldeman, VCUC 11, 562 McBryde Hall, VPI and SU, Blacksburg VA 24061.

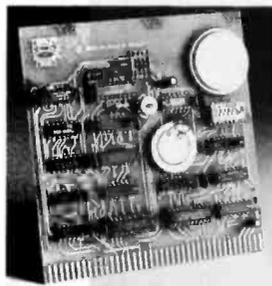
What is a

CLOCALPEEP?

Another name for the CCB-II, which is:

- a clock
hour, minute, second
- a calendar
day, day of week,
month, year
- an audio alarm

All on one board for your



TRS-80 Model II

It includes a pacemaker battery which will give over 8 years of continuous timekeeping.

From the folks who brought you the best CP/M® for the Model II.

\$175 plus shipping

Prepaid, COD, Mastercharge or Visa orders accepted. California residents add 6% sales tax.

TRS-80 is a trademark of Tandy Corp.

CP/M is a registered trademark of Digital Research Inc.



PICKLES & TROUT
P.O. BOX 1206, GOLETA, CA 93116. (805) 967-9563

Warning: Installation requires opening the Model II, which may void its warranty. We suggest that you wait until the warranty period has expired before installing the CCB-II.

DIGITAL DATA RECORDER MODEL CC-9B

For five years now, the CC series recorders have been the industry NRZ Asynchronous recorder standard. Now the D series sets a new standard in stability and reliability with its tachometer feedback LC stabilized motor circuit.



DC1 Model
Price \$275.00
DC2 Model
Price \$285.00

- 4800 or 9600 Baud (3" or 6" per second)
- 10⁻⁸ Error Rate RS232 or TTL In and Out
- RTS motor start
- CTS Data start
- DB 25 or special connector optional
- 110/220 - 50/60 Hz
- Wow & Flutter ± .3%
- Speed Stability (long term) ± .1%

NATIONAL MULTIPLEX CORPORATION

260 Lackland Drive East
Middlesex, New Jersey 08846
Tel. (201) 356-9200 TWX 710-997-9530

NEVADA COBOL

For CP/M
Powerful subset of ANSI-74
Why wait?
All the elegant simplicity
of COBOL is now affordable!

\$99⁹⁵
DISKETTE & MANUAL

REQUIRES only 16K RAM.
Available on 8" CP/M standard single density or 5 1/4" diskettes for North Star, TRS-80 Mod I and Superbrain. Other formats too! Manual alone \$24.95.

These powerful, easy to use
COBOL APPLICATION PACKAGES
are also available:

1. **BUDGET PLAN REPORT GENERATOR**
Fantastic time saver and planning aid for beginning or established businesses.
2. **PERSONAL FINANCIAL REPORTING**
Eye-opening insights of personal spending.
3. **LABELS** for mailing lists.
4. **PRECOBOL** (a preprocessor).

ALL 4 in one BOOK!
73 pages with complete COBOL source code listings and super documentation.

\$24⁹⁵

WE WELCOME C.O.D.'s

 **Ellis Computing**
600-41st Avenue
San Francisco, CA 94121
U.S.A.



(415) 751-1522

In CA add sales tax. CP/M trade mark of Digital Research. TRS-80 trade mark of Tandy Corp.

UP & RUNNING

REFURBISHED TERMINAL SALE!

A limited offer from Data Access Systems, Inc.,
in addition to their full line of new products.

MFR/MODEL	SALE PRICE	DESCRIPTION
Lear Siegler ADM-3	\$525	Video terminal.
Texas Instruments 725	\$300	Portable thermal printer with built-in coupler.
735	\$650	Portable thermal printer with built-in coupler.
745 (limited ASCII keyboard)	\$1175	Portable thermal printer with built in coupler.
745 (full ASCII keyboard)	\$1225	Portable thermal printer with built-in coupler.
735 KSR	\$600	Desktop thermal printer.
Digital Equipment LS-120	\$1450	132 column 180 CPS printer.
LA-36	\$750	132 column 30 CPS printer with E.I.A.
ADDS Regent 20 (new)	\$595	Video terminal.
Regent 25 (new)	\$775	Video terminal.

All units are DASI factory refurbished and in good working condition. Includes 30-day parts and labor warranty, on site. Call your local DASI office, or toll free: (800) 257-7748. In N.J. (800) 232-6510.

Corporate Offices: Cole Rd. & Camden Ave., P.O. Box 1230, Blackwood, NJ 08012. (609) 228-0700. Toll Free (800) 257-7748. In New Jersey, (800) 232-6510.

District Offices: Atlanta-(404) 449-5435. Austin-(512) 474-9643. Boston-(617) 769-6420. Chicago-(312) 967-0440. Cincinnati-(513) 793-9714. Cleveland-(216) 473-2131. Dallas-(214) 256-5536. Denver-(303) 741-2922. Detroit-(313) 589-1409. Hartford-(203) 674-1697. Houston-(713) 682-5965. Los Angeles-(213) 618-0400. Milwaukee-(414) 963-9008. Minneapolis-(612) 854-4466. New Jersey-(201) 227-8880. New York City-(212) 564-9301. Orange County-(714) 979-2157. Philadelphia-(215) 667-8315. Phoenix-(602) 263-5034. Portland-(503) 644-8600. Rochester-(716) 377-2080. St. Louis-(314) 576-2804. San Antonio-(512) 655-3274. San Francisco-(415) 872-1811. San Jose-(408) 244-3772. Seattle-(206) 251-5070. Washington, DC-(301) 459-3377.



DATA ACCESS SYSTEMS, INC.

Also available:

Digital Computer Logic and Electronics

This course is designed as an introduction to digital electronics and is written at a pace that suits the raw beginner. No mathematical knowledge is assumed other than the use of simple arithmetic and decimals, and no electronic knowledge is expected at all. The course moves painstakingly through all the basic concepts of digital electronics in a simple and concise fashion: questions and answers on every page make sure that all the points are understood. **Price: \$14.95**

Design of Digital Systems

Written in a similar question and answer style to Digital Computer Logic and Electronics, this course moves at a much faster pace and goes into the subject in greater depth. Ideally suited for scientists or engineers wanting to know more about digital electronics, its six A size volumes lead step by step through number systems and Boolean algebra to memories, counters and arithmetic circuits and finally to an understanding of calculator and computer design. **Price: \$19.95**



Microcomputers are coming — ride the wave! Learn to program with a new course written for the beginner. Learn BASIC the language of the small computer and the most easy-to-learn computer language in widespread use. A self-instruction course that takes you from complete ignorance to real proficiency with a unique style of graded hints. 60 illustrated lessons teach the five essentials of good programming: problem definition; flowcharting; coding the program; debugging; clear documentation. And you don't even need a computer! **Price: \$22.95**

Send check with order to:
Cambridge Learning Inc.,
1 Judith Drive
North Reading, MA 01864
or call (617) 664-3657 with
Mastercard or VISA
Mass. residents add 5% Sales Tax

\$5.00 discount for orders over \$30.00.
All prices include surface shipping
For Airmail add \$10.00

CAMBRIDGE LEARNING INC.

Event Queue

April 13-16

The Executive Computer Conference, Washington DC. The theme of this 2-day meeting is "Improving Organizational Productivity through Systems Technology." Special emphasis will be placed on management's perspective of the contributions the computer has made to organizational productivity. For information, contact Kendall E Burroughs, The Executive Computer Conference, 1730 N Lynn St, Suite 400, Arlington VA 22209, (703) 521-6209.

April 13-16

The Fifteenth International Symposium on Minicomputers and Microcomputers, MIMI '81, Sheraton Hotel, Mexico City, Mexico. The scope of this symposium covers hardware, software, distributed processor architecture, computer networks, telecommunications, real-time applications, education, and more. Contact Ing. Jorge Gil, Academic Secre-

tary, MIMI Symposium, IIMAS-UNAM, Apartado Postal 20-726, Mexico 20 D F, Mexico.

April 14-16

The Seventh Annual Federal DP Expo, Sheraton Washington Hotel, Washington DC. This conference and exposition is for computer-system users in the US government. More than 150 exhibitors and over 100 speakers will highlight the event. Contact The Interface Group, 160 Speen St, Framingham MA 01701, (800) 225-4620; in Massachusetts, call (617) 879-4502.

April 25-26

Trenton Computer Festival, Trenton State College, Trenton NJ. This annual flea market and swap meet of personal-computer equipment also features speakers, user-group meetings, and an exhibit of commercial products. It is sponsored by the Amateur Computer Group of New Jersey, the Philadelphia Area Computer Society, and

the Trenton State Computer Society. Contact TCF-81, Trenton State College, Trenton NJ 08625, (609) 771-2487.

April 26-30

Saudibusiness '81, Riyadh, Saudi Arabia. This show has been designed for the fast-growing Saudi Arabian business community. Pavilions by the United States, the United Kingdom, West Germany, France, Italy, and approximately fifteen other countries will be featured. For more information, contact Donald Ryan, Project Manager, Rm 3200, US Department of Commerce, Washington DC 20230, (202) 377-4652.

April 27-30

National Design Engineering Show and Conference, McCormick Place, Chicago IL. The theme of this show is "Computers Throughout the Design Function." Additionally, the principal areas of consideration are design management, computer-aided design, materials, mechanical components and systems, and electronics. Contact Clapp & Poliak Inc, 245 Park Ave, New York NY 10167, (212) 661-8410.

April 30-May 1

An Assessment and Forecast of Computer Graphics, Saddle Brook Marriott, Saddle Brook NJ. This annual conference will assess the present state of computer graphics and will evaluate hardware, software, systems services, and applications. The impact of new technologies on computer graphics and the role of graphics in business will be discussed. Contact Bob Sanzo, Frost & Sullivan Inc, 106 Fulton St, New York NY 10038, (212) 233-1080.

May 1981

May 2

National Computer Problem-Solving Contest for Junior and Senior High School Students, throughout the US. Small teams of junior and senior high school students

will compete for two hours on computer systems to solve five programming problems. Winners will be judged on whether their programs run properly using the test data supplied in the problem, are easy to read, and are logical, imaginative, and creative.

To receive a copy of the 1981 contest problems, local school directors should contact the University of Wisconsin—Parkside by April 4. Directors must agree to keep the problems confidential until the day of the contest. After that, any organization can use the problems to conduct its own contest. Local contest winners can enter the national and international contest. A national and worldwide ranking will be determined by a team of judges from the University of Wisconsin—Parkside. All interested schools or organizations can share the 1981 contest problems.

For additional information, write Dr Donald T Piele, Associate Professor of Mathematics, University of Wisconsin—Parkside, Kenosha WI 53141.

May 4-7

National Computer Conference, McCormick Pl, Chicago IL. Approximately 90,000 people are expected to attend this year's National Computer Conference (NCC). The use of robots and artificial intelligence will be among the program sessions at the Personal Computing Festival during the NCC. This will be the first time that personal-computing exhibits have joined the rest of the conference in the main exhibit area. Over thirty technical sessions will be held. All major companies will be represented. Contact the American Federation of Information Processing Societies Inc, POB 9658, 1815 N Lynn St, Arlington VA 22209, (703) 558-3617.

May 5-8

INTELCOM 81/Paris, Paris, France. INTELCOM (International Telecommunications and Computer Conference and Exhibition) 81/Paris is

Selectric® Interface System

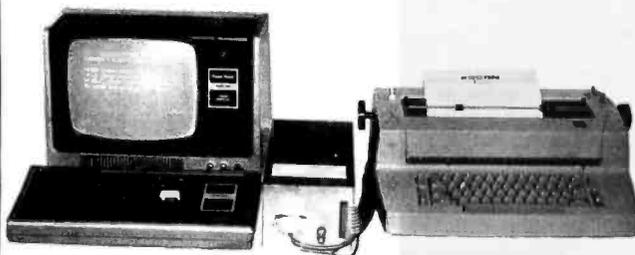
EASILY interfaced to any IBM Selectric I, II, or III.

STOP spinning your wheels. Letter quality at an affordable price.

CONNECTS via Parallel or RS-232, accommodates varied handshaking.

ONLY \$575 to \$599. Dealer inquiries invited.

NEW design provides added features.



ESCON Products, Inc.
12919 Alcosta Blvd.
San Ramon, Ca., 94583
(415) 820-1256

part of a program to promote an international dialogue on vital subjects in the telecommunications field. This conference attempts to guide the evolution of the computer and its technology by combining the efforts of private companies, government, and equipment users. For information about attending, presenting a paper, or exhibiting at INTELCOM 81/Paris, contact the Conference Affairs Group, Horizon House, 610 Washington St, Dedham MA 02026, (800) 225-9977; in Massachusetts (617) 326-8220.

May 11-13
Fourth Annual Rosen Research Personal-Computer Forum, Playboy Resort, Lake Geneva WI. This forum features guest speakers from all the major personal-computer hardware and software companies. The Rosen Forum is one of the most prestigious and important seminars in the industry. For further details on this 3-day session, contact Rosen Research Inc, 200 Park Ave, New York NY 10166, (212) 586-3530.

May 11-13
Custom Integrated Circuits Conference, CICC'81, Americana Hotel, Rochester NY. The CICC aims to bring together designers, producers, and users of custom integrated circuits to discuss recent developments and future directions in the field. Papers will be read on applications, algorithm-implementing integrated circuits, fabrication techniques, interfaces and interconnects, computer-aided design, and testing and qualification. Contact Dr Rajinder Khosla, General Chairman, Research Laboratories, B-81, Eastman Kodak Company, Rochester NY 14650, (716) 722-2525.

May 11-13
The Thirty-First Electronic Components Conference, Colony Square Hotel, Atlanta GA. Papers will be read on semiconductor-processing technology, optoelectronic devices, manufacturing technology, materials, hybrid

microcircuits, discrete components, interconnections, reliability, and connectors. Contact T G Grau, Bell Laboratories, Whippany Rd, Rm 3B-312, Whippany NJ 07981; or Electronics Industries Association, 2001 Eye St NW, Washington DC 20006.

May 14-16
The Tenth ASIS Mid-Year Meeting, Fort Lewis College, Durango CO. The American Society for Information Science's (ASIS's) theme for this year's meeting is "Using Information." Among the topics to be addressed are user studies, decision making, organizational change, government, education, management, access to information, and designing information systems for use. For information, contact ASIS, 1010 16th St NW, Washington DC 20036, (202) 659-3644.

May 17-20
Expo '81, Loew's Anatole Hotel, Dallas TX. Expo '81 is a combination of exhibits and technical sessions. The exhibits cover everything from graphics systems to industrial computer-control systems. The technical sessions range from tool design, design engineering, and robotics to numerical control. For more information, contact Numerical Control Society, 519 Zenith Dr, Glenview IL 60025, (312) 297-5010.

May 20-22
Joint Conference on Easier and More Productive Use of Computing Systems, University of Michigan, Ann Arbor MI. This conference intends to combine the insights of the social sciences, humanities, computer science, and human-factors engineering. Contact Gregory A Marks, 4258 Institute for Social Research, University of Michigan, Ann Arbor MI 48106, (313) 763-3482.

May 20-22
Videotex '81, Royal York Hotel, Toronto, Ontario, Canada. Videotext information systems allow users to call up information, make

VERSION 3.0

It keeps getting better and better!

Starting over a year ago with the original set of programs from Osborne & Associates, we have gradually developed a self-installing, reliable business package. A partial list of our enhancements:

No-Hassle Installation.

You simply select your desired configuration from a series of menus and go. There is no recompiling necessary, except for some state payroll tax routines.

CRT Independence.

We support 16 terminal types directly, and provide a method for specifying more. We can make it run with your CRT - or your money back.

File Access.

Our GL account file lookups are much faster than the original. And now - with version 3.0 - we have doubled the number of accounts, customers, and vendors that can reside on a disk.

There are many other improvements - send for details.

We believe our product to be the best Osborne-based business package available for CP/M-based microcomputers. We are committed to the ongoing support of our users, through both a tech-support phone line and a generous upgrade policy.

Vandata has been supplying applications software for over eight years. Quality and support are our way of doing business.

Our 30-day money-back guarantee speaks for itself.

General Ledger with Cash Journal	\$295
Accounts Receivable	\$295
Accounts Payable	\$295
Payroll with Cost Accounting	\$295
All Four Packages (GL, AR, AP, PR)	\$995
Magic Wand (Super Word Processor!!)	\$345
Pearl Level III (best prog. tool available)	\$645
CBASIC-2	\$110
TRS-80 [®] MOD II CP/M [®] 2.2 (P & T)	\$185
H89/Z89 CP/M [®] 2.2 (Magnolia)	\$199

Formats: Std. 8", 5" NorthStar DD, TRS-80 MOD II[®], H89/Z89. Manuals for GL, AR/AP, and PR are not included in price - add \$20 per manual desired (AR/AP are in one manual). CP/M[®] and CBASIC-2 required to run accounting software. Users must sign licensing agreement. Dealer inquiries invited.

To order call: **(206)542-8370**

or write: **VANDATA**
 17541 Stone Ave. N.
 Seattle, WA 98133

CP/M[®] is a registered trademark of Digital Research
 TRS-80[®] is a registered trademark of Radio Shack, Inc.

VANDATA BUSINESS SOFTWARE

Event Queue

reservations, pay bills, exchange electronic mail, read an electronic newspaper, shop, and play video games. This conference will review videotext developments in Europe, Japan, and North and South America. Demonstrations of videotext systems will be given. Seminars on standards, legal aspects, and economic issues will be featured. Contact Videotex '81, 316 Lonsdale Rd, Suite 3, Toronto, Ontario, M4V 1X4, Canada, (416) 598-1981.

May 21-23

Annual Conference of the Educational Computing Organization of Ontario, Sheraton Centre and the Ontario Institute for Studies in Education, Toronto, Ontario, Canada. Exhibitions on the use of computers in schools and discussions on how to locate suitable educational materials will be featured. Contact the Conference Office, OISE, 252 Bloor St W, Toronto, Ontario, M5S 1V6, Canada.

June 1981

June 6-9

Atlanta Small Computer Show, Atlanta Hilton, Atlanta GA. Producers of small computers, peripherals, sup-

plies, and services will be exhibiting at this show. Business owners, corporate and government executives, data-processing managers, doctors, lawyers, and other professionals are expected to attend. Obtain additional information from The Atlanta Small Computer Show, 4060 Janice Dr, Suite C-1, East Point GA 30344, (404) 767-9798.

June 9-11

Understanding and Using Computer Graphics, Chicago IL. This seminar covers the latest in graphic-system technology, including hardware, software, and applications. Contact Bob Sanzo, Frost & Sullivan Inc, 106 Fulton St, New York NY 10038, (212) 233-1080.

June 14-18

The Second National Conference of the National Computer Graphics Association, Baltimore Convention Center, Baltimore MD. Computer-graphics demonstrations, exhibits, and workshops will be held. Contact the National Computer Graphics Association Inc, 2033 M Street NW, Suite 330, Washington DC 20036, (202) 466-5895.

June 16-18

NEPCON East '81, New York Coliseum, New York NY.

This exposition is aimed at engineers, prototype developers, production specialists and testing personnel. Technical programs will be presented. Contact Industrial & Scientific Conference Management Inc, 222 W Adams St, Chicago IL 60606, (312) 263-4866.

June 17-19

National Educational Computing Conference, North Texas State University, Denton TX. This conference will provide a forum for individuals and institutions interested in educational computing. Computer literacy, computer education for teachers, and computers in education are some of the topics to be covered. Contact Dr Jim Poirot, NECC-81 General Chairman, Computer Sciences Department, North Texas State University, Denton TX 76203.

June 20-22

The Fifth Annual Computerfest, Franklin University, Columbus OH. Talks on robots and calculators will be featured. Microcomputers and small-business systems will be presented. This show is being sponsored by the Midwest Affiliation of Computer Clubs and Franklin University. Contact Computerfest '81, Paul Pittenger, 215

Delhi Ave, Apt J, Columbus OH 43202, (614) 224-6237.

June 29-July 1

The Nineteenth Annual Meeting of the Association for Computational Linguistics, Stanford University, Stanford CA. Syntax, parsing, and sentence generation, computational semantics, discourse analysis and speech acts, speech analysis and synthesis, machine and machine-aided translation, and mathematical foundations of computational linguistics are some of the topics to be discussed. Contact Don Walker, Artificial Intelligence Center, SRI International, Menlo Park CA 94025, (415) 326-6200, ext 3071. ■

BYTE's Bits

Atari Slashes Prices

Atari Inc has reduced the price of the Atari 400 computer with 8 K bytes of memory to \$530. The 16 K expanded version of the 400 is now selling for \$630. Atari also reduced the Model 810 5¼-inch floppy-disk drive to \$599.95.

On another front, Atari plans to begin selling a \$150 word-processing program later this year. ■

SciTronics

introduces . . .

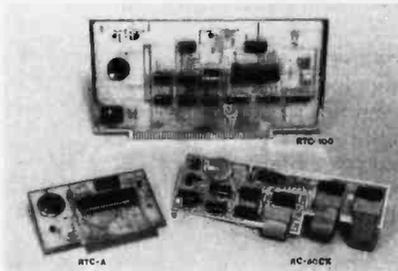
REAL TIME CLOCKS

with full Clock/Calendar Functions

The Worry-free Clocks for People Who Don't Have Time to Worry!!

What makes them worry-free?

- Crystal controlled for high (.002%) accuracy
- Lithium battery backup for continuous clock operation (6000 hrs!!!)
- Complete software in BASIC-including programs to Set and Read clock
- Clock generates interrupts (seconds, minutes, hour) for foreground/background operation



Versions available for:

- S-100 bus computers **RTC-100 \$159**
- Apple II computer **RTC-A \$129**
- SciTronics RC-80 owners **RC-80CK \$109**

Applications:

- Logging Computer on time
- Timing of events
- Use it with the SciTronics Remote Controller for Real Time control of A.C. operated lights and appliances

Send
Check or
money
order to:
SciTronics Inc.
523 S. Clewett St., P.O. Box 5344
Bethlehem, PA 18015
(215) 868-7220

Please list system with which you plan to use controller • Master Charge and Visa accepted. COD's accepted. PA residence add sales tax.



**Boards for S-100 BUS
from S.C. Digital**
"CPU-Z80"

Advanced Z80A based CPU board
S219 Assembled and Tested
S149 Kit *(less Interrupt)

Features: Model CPU-Z80

- 2/4 Mhz SW selectable.
- Built in 8 Prioritized Vectored Interrupts with 8 possible levels of Nested Interrupts using powerful Mode 2 of Z80, all done in Hardware, expandable with external ckt.
- Vector Jump on RESET, in 4K increments.
- Supports 2K of EPROM (not supplied), DMA, dynamic RAM refresh . . . many more.

*Kit comes with all parts except chips connected to Interrupts.



"INTERFACE: 1"
I/O, Memory
Interface Board

S229 Assembled and Tested
S169 Kit

Features: Model 3SPC

- 3 Serial w/ RS232C or 20ma Current Loop, 1 Parallel.
- 4K of EPROM/ROM and 4K of RAM (ROM/RAM not supplied).
- Built in Kansas City Standard Cassette interface usable to 1200 Baud.
- Generates all popular baud rates up to 19.2K baud, including 110 & 134.5.
- SW settable Address, Baud Rates, Ports.

"UNISELECT" 16K Static RAM with universal Bank Select
Model 16KUS \$235 A & T, with 200 nsec memory chips.

All boards meet IEEE-S100 standards. Fully socketed, solder masks, gold contacts, and guaranteed for one full year. Kit guaranteed parts, only.

Delivery: from stock to 72 hours. Ordering: You may call for M.C., Visa or C.O.D. orders. (Add \$4.00 for C.O.D.) Personal checks o.k., but M.O. speeds shipment. Takes 7 to 15 days to clear personal checks before shipping.

Undamaged boards can be returned within 10 days for full refunds. Illinois residents add 5% sales tax.

O.E.M. PRICING AVAILABLE, DEALER INQUIRY INVITED

S.C. Digital

P.O. Box 906 Phone:
Aurora, IL 60507 (312) 897-7749

MAIL ORDER DISCOUNTS



APPLE II PLUS 48K

\$1,175



APPLE III CALL FOR PRICES

ACCESSORIES

DISK II DRIVE & CONTROLLER (DOS 3.3)	525	MICROSOFT Z-80 SOFTCARD SYSTEM	290
DISK II DRIVE ONLY	455	MICROSOFT 16K RAM CARD	169
INTEGER BASIC FIRMWARE CARD	149	VIDEO 80 COLUMN BOARD & SWITCH	330
APPLESOFT II FIRMWARE CARD	149	HAYES MICROMODEM II	315
M&R SUP-R-MOD RF MODULATOR	30	LEDEX 12" B&W MONITOR	149
CENTRONICS PRINTER INTERFACE CARD	179	SANYO 12" GREEN MONITOR	265
HIGH-SPEED SERIAL INTERFACE CARD	145	SILENTYPE PRINTER W/INT. CARD	535
SSM AIO SERIAL/PARALLEL I/O CARD	185	EPSON MX-80 PRINTER	620
LANGUAGE SYSTEM W/PASCAL	420	MPI 88G PRINTER	695
DAN PAYMAR LOWER CASE ADAPTER	45	QUME SPRINT 5/45 PRINTER	2,550

SOFTWARE

APPLE DOS TOOLKIT	65	APPLE FORTRAN	159
APPLE PLOT	60	APPLEWRITER	65
TAX PLANNER	99	DOW JONES PORTFOLIO EVALUATOR	45
APPLE PILOT	125	DOW JONES NEWS & QUOTES REPORTER	85
VISICALC	119	THE CONTROLLER BUSINESS SYSTEM	515
DESKTOP PLAN	79	SUPER INVADER (DISK)	30
CCA DATA MANAGEMENT	85	BASF 5 1/4" DISKETTE (10)	30

TO ORDER: Please send cashier's check, money order or personal check (allow 10 business days to clear). VISA and Master Card credit card service add 2%. American Express credit card service add 5%. Shipping, handling and insurance in U.S. add 3% (minimum \$3). California residents add 6% sales tax. Foreign orders add 10% for shipping. Equipment is subject to price change and availability. All equipment carries factory warranty. TELEX: 697120 DATAMAX-SDG

computer age, inc.

Authorized Apple Dealer & Service Center
4688 CONVOY ST., SUITE 105, SAN DIEGO, CA 92111 (714) 565-4062



Clock/Calendar

ComputerWatch

Now available on Three Buses

Features

- 12/24 Hr. Format
- Month-Day-Year
- Day of Week
- Leap Year Bit
- 4 Interrupts
- +/- 30 Sec. Adjust
- Battery Backup
- Simple to Program

*APPLE II



*TRS-80



\$100



**\$150 FOB
CompuTime**

* Apple is a Trademark of Apple Computer Co.
* TRS80 is a Trademark of Tandy Corp.

Dealer Inquire (714) 536-5000
P.O. Box 5343 Huntington Beach, CA 92646

**Model EP-2A-87
EPROM Programmer
NEW - CRT ENTRY MODE**



The Model EP-2A-87 EPROM Programmer has an RS-232 compatible interface and includes a 2K or 4K buffer. During the ON-LINE mode, another computer can down-load to the buffer. Only two easy-to-implement commands are available to an external computer. (Load

buffer and read buffer.)

In the OFF-LINE mode, the EP-2A-87 will program, verify, test buffer, and load the buffer from the EPROM socket. During the programming cycle, the EPROM is checked before programming to insure that it is erased and after programming it automatically verifies that programming is correct. Power requirements are 115 VAC 50/60 Hertz at 15 watts.

Part No.	Description	Price
EP-2A-87-1	Programmer with 2K buffer	\$575.00
EP-2A-87-2	Programmer with 4K buffer	650.00
	Non standard voltage option (220 v, 240 v, 100 v)	15.00
PM-0	Personality Module, programs TMS 2708	18.00
PM-1	Personality module, programs 2708	18.00
PM-2	Personality module, programs 2732	34.00
PM-3	Personality module, programs TMS 2716	26.00
PM-4	Personality module, programs TMS 2532	34.00
PM-5	Personality module, programs 2716, TMS 2516	18.00
PM-6	Personality module, programs 2704	18.00
PM-7	Personality module, programs 2758, TMS 2508	18.00
PM-8	Personality module, programs Motorola MCM68764	36.00

Optimal Technology, Inc.
Blue Wood 127
Earlysville, Virginia 22936
Phone (804) 973-5482

Introducing

THE BENCHMARKTM WORD PROCESSING SYSTEM

THE BENCHMARK software system sets new standards in word processing. First, it can be delivered to run on the CP/M[®] or the North Star DOS, so there may be no need to buy a special operating system. Second, it has all the features of systems costing thousands of dollars more. Third, the price is as low as, or lower than, most word processing systems.

Anyone can learn to run and use THE BENCHMARK in one day of self training. Completely self-prompting in English, THE BENCHMARK is a full capability word processor, has been thoroughly tested in an office environment and proved to meet the needs of the most sophisticated user.

- Multi-operating system
- Changes terminal drivers
- Customized to utilize all the features of terminal & printer
- Overtyping - erases, corrects
- Variable, electronic decimal tab
- Screen menus simplify operation
- Block move and get

ONLY \$499 plus tax where applicable

THE BENCHMARK is distributed by R&B Computer Systems. Dealer inquiries are invited.

R&B Computer SystemsTM

1954 E. University
1-800-528-7385

Tempe, Arizona 85281
AZ-602-968-7101

THE BENCHMARK is a trademark of Metasoft Corporation
CP/M is a registered trademark of Digital Research

Books Received

Advanced Micro Devices Condensed Catalog. Sunnyvale CA: Advanced Micro Devices Inc, 1981; 18 by 24.5 cm, 147 pages, softcover, no ISBN, free of charge.

COBOL, A Vehicle for Information Systems, Robert T Grauer. Englewood Cliffs NJ: Prentice-Hall Inc, 1981; 19 by 24.5 cm, 432 pages, hardcover, ISBN 0-13-139709-5, \$18.95.

The Creative Kid's Guide to Home Computers, Fred D'Ignazio. Garden City NY: Doubleday & Company Inc, 1981; 16 by 24 cm, 130 pages, hardcover, ISBN 0-385-15313-9, \$9.95.

Digital Electronics Troubleshooting, Joseph J Carr. Blue Ridge Summit PA: Tab Books Inc, 1981; 13 by 21 cm, 350 pages, softcover, ISBN 0-8306-1250-5, \$9.95; hardcover, ISBN 0-8306-9677-6, \$16.95.

The Effective EDP Manager, Michael R Frank. New York: AMACOM, 1980; 16 by 23.5 cm, 197 pages, hardcover, ISBN 0-8144-5635-9, \$17.95.

Experiments in Amplifiers, Filters, Oscillators, and Generators, Morris Tischler. New York: McGraw-Hill Book Company, Gregg Division, 1981; 22 by 28 cm, 170 pages, softcover, ISBN 0-07-064780-1, \$6.95.

Experiments in General and Biomedical Instrumentation, Morris Tischler. New York: McGraw-Hill Book Company, Gregg Division, 1981; 22 by 28 cm, 201 pages, softcover, ISBN 0-07-064781-X, \$8.95.

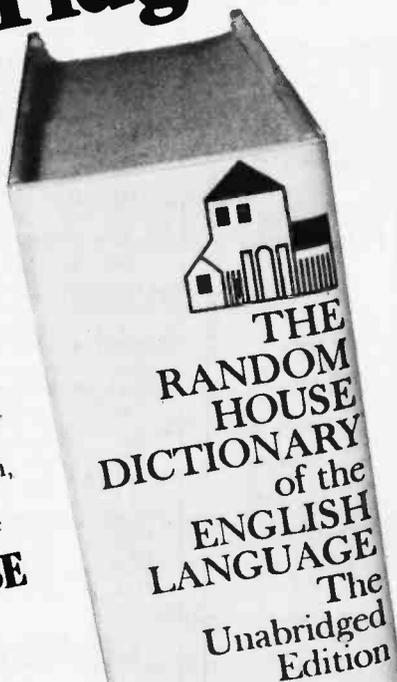
Experiments in Telecommunications, Morris Tischler. New York: McGraw-Hill Book Company, Gregg Division, 1981; 22 by 28 cm, 186 pages, softcover, ISBN 0-07-064782-8, \$7.95.

The FORTRAN Cookbook, Thomas P Dence. Blue Ridge Summit PA: Tab Books Inc, 1980; 13 by 21 cm, 334 pages, softcover, ISBN

THE ANSWER BOOK The Unabridged!

- THE MOST AUTHORITATIVE DICTIONARY OF ITS KIND
- Comprehensive—more than 260,000 entries; 2,091 pages; large format 9"x12" page size; 9 lbs 14 oz.
- Up-to-Date—with new words and terms
- Easy to Use—more than 50,000 example phrases and sentences; 2,000 illustrations; 10,000 synonym lists and studies; thumb-indexed
- Full-color ATLAS; much, much more

\$49.95, now at your bookstore
RANDOM HOUSE



MICROSTAT NOW AVAILABLE FOR CBASIC2*

MICROSTAT is the statistics package for microcomputers, and is proving itself to users around the world, including:

Stanford, Harvard, Johnson & Johnson, Duke, University of Washington, UCLA, Lockheed, University of Pennsylvania, Oklahoma State, U.S. Geological Survey, Monsanto, University of Toronto, Sweden's National Central Bureau of Statistics, Utah State, Butler University, SUNY, Van Camps, Texas A&M, University of Wisconsin

and a growing list of other organizations. MICROSTAT's Data Management Subsystem (DMS) makes creating your own data files easy and includes numerous editing and transformation capabilities. Files produced by DMS can then be used to generate statistics in all common statistical areas (e.g., descriptive statistics, ANOVA, correlation, multiple regression, probability and hypothesis tests, nonparametrics and others) plus some not so common ones. Whether pure research or industrial quality control, MICROSTAT is the statistics package for you.

MICROSTAT sells for \$250.00 and is supplied on 8" SD or 5 1/4" (North Star) disks. The user's manual sells for \$18.00 and includes sample data and printouts. Please specify version when ordering. Foreign inquiries, please write directly to us.



ECOSOFT

P.O. Box 68602
Indianapolis, IN 46268
(317) 283-8883

* CBASIC2 is a registered trade mark of Software Systems

TEXAS COMPUTER SYSTEMS Radio Shack

Authorized Sales Center

All Radio Shack merchandise available at a discount. Ask for our price list.

We offer the lowest prices on

TRS-80 COMPUTERS

MODEL II 64K \$3349 (Plus shipping)

All accessories for Model II available -- disk expansions, printers and software

EPSON MX-80 \$CALL Letter quality matrix similar to the Line Printer IV and the Centronics printer but has full software control of 40, 80, 96, or 132 columns. List \$645

80 cps bidirectional printing, tractor feed, disposable printhead, \$300 less than the nearest competitor printer, it's the best buy in a letter quality multi-strike printer. Our price is too low to advertise.

★ Anadex 9500/9501 ★ Line Printer V ★ The New Daisy Wheel II

- ★ Payment: Money Order, Cashier's Check, Certified Check, Personal
- ★ Checks require 3 weeks to clear
- ★ VISA MASTERCHARGE -- Add 3%
- ★ Prices subject to change at any time
- ★ No tax out-of-state TX add 5%
- ★ All items new, guaranteed by manufacturer
- ★ Delivery subject to availability

TEXAS COMPUTER SYSTEMS

An Authorized RADIO SHACK® Sales Center F701

Box 1174, Brady, Texas 76825

TOLL FREE Number 800-351-1473

Texas Residents 915-597-0673

REFORMATTER™

opens
new files!



© MicroTech Exports 1980

With **REFORMATTER** disk utilities you can read and write IBM 3740 and DEC RT-11 single density formatted diskettes on your CP/M® system.

REFORMATTER enables you to access large system databases, improve data exchange with other organizations, increase program development capabilities, and use your micro in distributed processing.

REFORMATTER programs feature bi-directional data transfer and full directory manipulation. ASCII/EBCDIC conversion provided with CP/M ↔ IBM. *MP/M is now fully supported.*

Program Data Sheets, Application Guides, and Machine Compatibility Guides available.

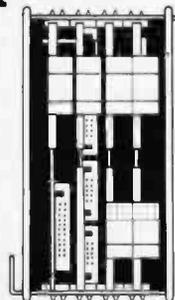
Each program \$195.00 from stock. Specify CP/M ↔ IBM or CP/M ↔ DEC. Order from MicroTech Exports, Inc., 467 Hamilton Ave., Suite 2, Palo Alto, CA 94301 ☐ Tel: 415/324-9114 ☐ TWX: 910-370-7457 MUH-ALTOS ☐ Dealer and OEM discounts available.

CP/M® is a registered trademark of Digital Research.

DEC LSI-11 Components

Dependable service
at discount prices

Domestic
and Export



Mini
Computer Suppliers, Inc.

25 Chatham Rd., Summit, N.J. 07901

Since 1973

(201) 277-6150 Telex 13-6476

©Mini Computer Suppliers, Inc.
1979

**If you're looking for
the best prices
in the U.S.A. on**



TRS-80[®] MICROCOMPUTERS

We have consistently offered the TRS-80 line at savings up to 20%, which means you can save \$150 to \$1500 by buying directly from Computer Discount of America.

TRS-80 Model II, 64K System, with disc drive only \$3385.00

Other TRS-80 Model II, or Model III computers and systems, Color Computers, and Pocket Computers are in stock at similar savings.

Our savings are as big on expansion interfaces, printers, diskettes — everything for your TRS-80 System.

ATARI[®] MICROCOMPUTERS



We have the full line of ATARI personal computers and systems, including Models 400 and 800. The computers, accessories, and hardware are brand new, in factory sealed cartons, and carry a full factory warranty. Most models are in stock for immediate delivery (usually within 7-10 days), and a price quote is as near as your phone. So if you're looking for the **best prices in the U.S.A.**, for microcomputers and accessories, call Computer Discount of America, Inc., West Milford, New Jersey 07480. 201-728-8080. **NO TAX ON OUT-OF-STATE SHIPMENTS.**

TOLL FREE 800-526-5313

**Computer
Discount
of America**

Authorized TRS-80 dealer, store B-282.

Books Received

0-8306-1187-8, \$8.95; hardcover, ISBN 0-8306-9914-7, \$14.95.

Guide to Microcomputers, Franz J Fredericks. Washington DC: Association for Educational Communications and Technology, 1980; 15.5 by 23 cm, 152 pages, softcover, ISBN 0-89240-038-2, \$11.50.

How to Build Your Own Working Microcomputer, Charles K Adams. Blue Ridge Summit PA: Tab Books Inc, 1980; 13 by 21 cm, 308 pages, softcover, ISBN 0-8306-1200-9, \$9.95; hardcover, ISBN 0-8306-9684-9, \$16.95.

Introduction to Computer Design and Implementation, S Imtiaz and Kwok T Fung. Rockville MD: Computer Science Press Inc, 1981; 16 by 23.5 cm, 271 pages, hardcover, ISBN 0-914894-11-0, \$19.95.

Introduction to Computers and Data Processing, Gary B Shelly and Thomas J Cashman. Fullerton CA: Anaheim Publishing, 1980; 21 by 27 cm, 498 pages, softcover, ISBN 0-88236-115-3, \$15.95. Accompanying the textbook are a *Teacher's Guide and Answer Manual, Test Bank*, and transparency masters. *Student Workbook and Study Guide* for above, 21 by 27 cm, 247 pages, softcover, ISBN 0-88236-116-3, \$5.95.

Introductory Structured COBOL Programming, Gary S Popkin. New York: Van Nostrand Reinhold Company, 1981; 19.5 by 24 cm, 471 pages, harcover, ISBN 0-442-26771-1, \$18.95.

The MC6809 Cookbook, Carl D Warren. Blue Ridge Summit PA: Tab Books Inc, 1981; 13 by 21 cm, 176 pages, softcover, ISBN 0-8306-1209-2, \$6.95; hardcover, ISBN 0-8306-9683-0, \$11.95.

Microprocessor Background for Management Personnel, James Arlin Cooper. Englewood Cliffs NJ: Prentice-Hall Inc, 1981; 16 by 23.5 cm, 163 pages, hardcover, ISBN 0-13-580829-4, \$14.95.

Microcomputer Interfacing Handbook: A/D & D/A, Joseph J Carr. Blue Ridge Summit PA: Tab Books Inc,



APPLE II PLUS: YOU SAVE
16K \$1049 22%
48K \$1099 29%
64K \$1269 27%
Apple III Call

All are 1981 model with Apple RAM. 64K unit is 48K unit with Microsoft 16K RAM board.

IMPORTANT NOTE: We will repair all Apple equipment regardless of where you purchased it.

Disk II & Controller 3.3 \$ 499 23%
Disk II \$ 439 16%
Monitors, Sanyo 9" B&W \$ 169 30%
 12" B&W \$ 249 21%
 12" Grn. \$ 299 21%
 13" Col. \$ 449 20%

RF Modulator, M&R \$ 25 38%
Silentype printer \$ 499 22%
Qume Sprint 5 45RO \$2499 20%
Serial Interface Card \$ 129 35%
Apple Writer program \$ 59 21%
Visicalc \$ 119 21%

80 Column Video:
 Apple Smarterm \$ 299 17%
 M&R, Superterm \$ 319 14%
 Videx, \$ 249 18%
Language/Pascal Sys. \$ 379 24%
Apple Plot \$ 55 21%
Apple Pilot \$ 119 21%

Microsoft:
Z80 Softcard \$ 250 28%
16K RAM Card \$ 169 16%
Paper Tiger printer Call Call
Tiger to Apple cable \$ 19 46%
Epson MX 80 W/Interface Call Call
DC Hayes Micromodem \$ 299 23%
16K Expansion RAM Kit \$ 39 74%
10 Memorex 5" disks \$ 25 45%
10 3M Scotch 5" disks \$ 35 33%
10 Maxell 5" disks \$ 39 33%

Accounting Software,
"Insoft Accountant" \$ 365 66%
 (a full professional quality integrated GL,A/R,A/P, Payroll package with hotline support). Send for free sample printouts.

Above prices for mail orders only. Mail Order Dept. located in Jacksonville, OR. Our store show room is at 126 NE F St., Grants Pass, OR. Store prices include service and will differ. No mail order sales at store. CALL ORDER DESK:

(800) 547-1289

TECHNICAL & OREGON:

(503) 899-7297

ORDERING INFORMATION: Minimum order \$100. Money Orders, Cashier Checks or Bank Wire Welcomed. Visa and MC orders add 3%. Personal checks accepted (allow up to 20 days to clear). All orders add 3% for shipping, handling and insurance. Include your telephone number. No COD's. Prices subject to change without notice. Order desk hours are 9 to 6 PST, 10 to 3 Saturdays.

COMPUTER EXCHANGE

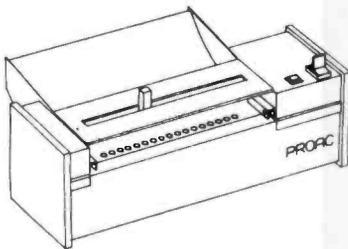
MAIL ORDER DEPARTMENT OF
 THE MICRO **COMPUTER STORE**

P O BOX 1380

Jacksonville, OR 97530

Circle 257 on Inquiry card.

LEAPAC SERVICES



L2D PLOT PACKAGE	\$160.00
L2D & L3P PACKAGES	\$160.00
MAURO PROAC MP 750 PLOTTER	\$695.00
with L2D package	\$795.00
with L2D & L3P packages	\$950.00

MAURO PLOTTER Uses 11" wide paper of any length such as 8" bind or 17" graph paper. Plotting resolution is 700 steps per inch with .005 tracking error at plotting speeds of up to 2" per second. Uses standard fiber tip pens that can be obtained at any Stationery Store. Requires only 5 pins of a parallel output port. Vector driver software in source is supplied with the plotter for 8080, Z80, 6502 & 6800 micro processors. APPLE TRS 80 and RS 232 interface cards are available as options.

LEAPAC SOFTWARE Complete two dimensional and perspective plotting software packages are available including ASCII character annotation and curve plotting. This software is hardware independent and will not become obsolete as you upgrade your plotting equipment. The software is supplied as 8080, Z80 relative timing formats for MICROSOFT compatible products: FORTRAN 80, COBOL 80, COMPILE BASIC and MACRO 80 on 8" CP, M, or 5.1" NORTHSTAR TRS 80 or HEALTH 88 compatible diskettes.

L2D PACKAGE Two dimensional plot package that contains over 25 entries that allow you to clip or window your drawings, annotate your drawings, and draw irregular curves. Contains CalComp Compatible calls such as PLOTS, PLOT WHERE, FACTOR, etc.

L3P PACKAGE Perspective or three dimensional plot package that contains over 70 entries that allow you to plot perspective figures such as the split piston above. Routines for STEREO GENERATION, ZOOMING, FLY BY'S, and ANIMATION are built into the package for minimal programming effort.

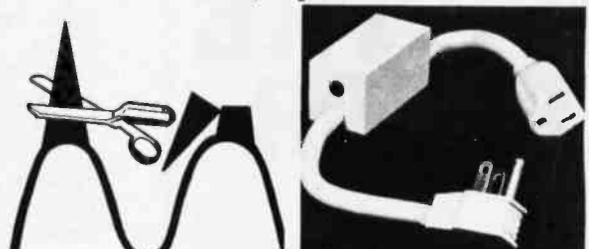
Write for more detailed information. A package of 6 users guides is available for \$30.00 containing over 180 pages describing the use of the above packages. Credit back on purchase of packages.

Besides the Mauro Plotter interface, optional drivers are available for CalComp and Houston Instrument Drum plotters, Houston Instrument HI PLOT DMP 34.6 & 87 plotters, and daisy wheel or spindle printers such as DIABLO 1620 & 1640, QUME SPRINT 5 and NEC 5510 & 5520.

LEAPAC SERVICES (916) 381-1717
8245 MEDITERRANEAN WAY SACRAMENTO, CALIFORNIA 95826

CP, M is a registered trade mark of Digital Research, Inc.
HI PLOT & OMP are trade marks of Houston Instruments.
TRS 80 is a trade mark of Tandy Corporation.
Z80 is a trade mark of Zilog, Inc.

ClipperTM



LINE VOLTAGE TRANSIENT CLIPPING

Features Parallel Operation 5000 Hits/Second

PROTECTS:

- Computers
- Micro-Computer Systems
- Word Processors
- Cash Registers
- Power Supplies

PROTECTS AGAINST:

- High Energy Voltage Transients
- On-Off Switching
- Lightning Induced Transients
- Inrush of On/Off Power

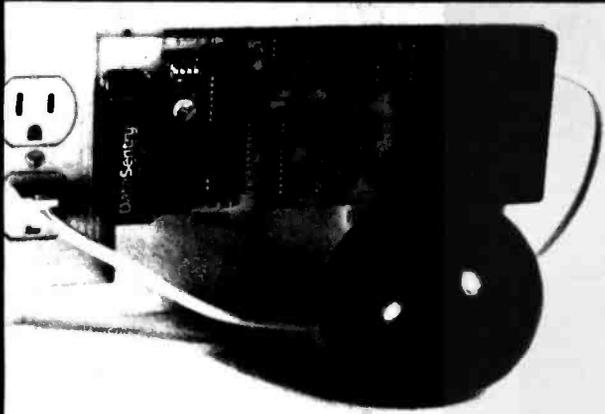
DYMARC

INDUSTRIES, INC.



787F
TRANSIENT VOLTAGE
SURGE SUPPRESSOR LISTED

7133 Rutherford Rd. Baltimore, Md. 21207
(301) 298-3130 800-638-9098



REMOTE MONITORING AND CONTROL FOR THE APPLE II COMPUTER

Real time clock/calendar included

Connects directly to and communicates thru the AC power line. **OUTPUT** Operates up to 256 BSR System X-10 remote control modules. Also operates intelligent control modules and alarm and voice output modules, soon to be available from ICS. **INPUT** Use the BSR Command Console to send commands to your computer. Monitor the status of security and temperature remote input modules, and the status of ICS output modules. **CLOCK** The clock provides sec, min, hour, date, day of week, mo, year, plus 4 selectable interrupt rates for background operation of control programs. On board battery backup. **SOFTWARE** On board software is provided to handle the remote I/O, set and read clock, run background control schedules, and simulate the BSR Command Console. Easy access from BASIC.

TRADEMARKS-APPLE II: Apple Computer, Inc., System X-10: BSR Ltd.
SEE YOUR DEALER OR ORDER FROM ICS FOR \$185 (+\$5 ship./hand.)

INTELLIGENT CONTROL SYSTEMS, INC.
PO BOX 14571 MINNEAPOLIS, MN 55414 (612) 699-4342

CATCH THE S-100 INC. BUS!



	LIST PRICE	OUR SPECIAL CASH PRICE
Morrow Designs "Thinker Toys" Switchboard I/O A&T	259.00	207.00
Central Data 16K Dynamic RAM expandable to 64K A&T	259.00	220.00
Mullen TB-4 Extender Card w/Probe Kit	59.00	50.00
Ithaca Intersystems MPU-80 Series II A&T	395.00	316.00
SSM IO/4 with 2P&2S Kit	210.00	178.00
North Star Floating Point Board A&T	399.00	339.00

Subject to Available Quantities • Prices Quoted Include Cash Discounts. Shipping & Insurance Extra.

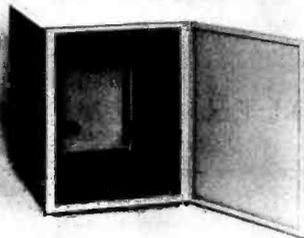
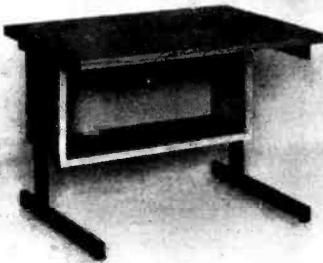
We carry all major lines such as
S.D. Systems, Cromemco, Ithaca Intersystems, North Star,
Sanyo, ECT, TEI, Godbout, Thinker Toys, SSM.
For a special cash price, telephone us.

S-100, inc.

7 White Place, Clark, N.J. 07066
201-382-1318

Hours: Mon. - Fri. — 10 a.m. to 6 p.m.

GET IT OFF THE FLOOR



Now that you have a shiny new computer terminal, what are you going to put it on? Computer Furniture and Accessories makes a variety of furniture for a wide range of computer applications. In combinations of six widths, three depths, and three heights. With "L" shaped returns, Micro shelves, data shelves, RETMA mounting, and printer stands. With optional drawers, doors, CRT turntables, and casters. Sizes, shapes and colors designed to fit your office or computer room environment. Reasonably priced and shipped from stock.

Call CF&A. We'll get your system up where you can really put it to use.

CF&A

Computer Furniture and Accessories, Inc.
 1441 West 132nd Street
 Gardena, CA 90249
 (213) 327-7710

Books Received

1980; 13 by 21 cm, 350 pages, softcover, ISBN 0-8306-1271-8, \$8.95; hardcover, ISBN 0-8306-9704-7, \$14.95.

Motorola Optoelectronic Device Data, Motorola Technical Information Center. Phoenix AZ: Motorola Inc, 1980; 17.5 by 23.5 cm, 302 pages, softcover, no ISBN, \$3.25.

Operating Systems, Harold Lorin and Harvey M Deitel. Reading MA: Addison-Wesley Publishing, 1981; 17 by 24 cm, 378 pages, hardcover, ISBN 0-201-14464-6, \$19.95.

People and Project Management, Rob Thomsett. New York: Yourdon Press, 1980; 15 by 23 cm, 106 pages, softcover, ISBN 0-917072-21-9, \$10.50.

PET/CBM Personal Computer Guide, Second Edition, A Osborne and Carrol S Donahue. Berkeley CA: Osborne/McGraw-Hill, 1980; 16.5 by 23.5 cm, 501 pages, softcover, ISBN 0-931988-55-1, \$15.

The PLL Synthesizer Cookbook, Harold Kinley. Blue Ridge Summit PA: Tab Books Inc, 1980; 13 by 21 cm, 279 pages, softcover, ISBN 0-8306-1243-2, \$7.95; hardcover, ISBN 0-8306-9707-1, \$13.95. ■

This is a list of books received at BYTE Publications during this past month. Although 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.

WANTED:

APPLE, PET, TRS-80, CP/M SOFTWARE

Westico is a publisher and distributor of professional software for microcomputers. If you have a new program ready for distribution or want your existing programs to reach a larger market, contact:

Phillip Woellhof, V.P. Mktg.
 Westico, Inc.
 25 Van Zant Street
 Norwalk, CT 06855
 (203) 853-6880

To increase your profits, take advantage of Westico's worldwide promotion and distribution.

WESTICO

The Software Express Service

LETTER QUALITY

ASCII
 KSR
 TERMINALS



\$1600

PERKIN-ELMER CAROUSELS: 132 column commercial quality word processing terminals complete with keyboard. Microprocessor controlled, internal buffer, full ASCII, RS-232 and 30 ma. narrow-width minitape. Fully described in 6 pages of specs. Call or write for copy. From \$1600 FOB.

4027, 2104, 4096 75c

INTERSIL 4Kx1 DYNAMIC RAM: 300ns, ceramic, low power. P/N 7005-12, equiv to 4027, 2104, 4096. Priced at 1/3 the usual hobby price. Large OEM inventories, results in giveaway price. New chips, satisfaction guaranteed. Sold only in original sleeves of 24, \$18 per sleeve, incl. UPS. Full specs with order or on request.

6 OUTPUT POWER SUPPLY FLOPPY, EPROM, CPU ETC. \$35

BRAND NEW NDRTH #3878: sealed box-in. Chip used in MCP constant terminals 5V/3A, 24V/1.2A, 16V/2.6A (all adjustable w/OV prot. & cur limiting), 12V/0.1A, 24V/0.3A (both w/OV prot.), 12V/0.1A (adj). Fully regulated, conservative linear design, partially encl. w/CHTS, assay daps & theory/service docs. 3.5 x 5.5 x 1.1" 115V/2C. Burns an 8" floppy or drop the 8V to 12V and run 2-3 miniloppets. Guaranteed \$35 ea. + 12 lbs. UPS.

Write/call for info on other surplus bargains. Terminals, printers, power supplies, memory chips, core boards, etc.

TERMS: UPS COD, Visa, Master Charge on approval. COD + \$2. Cuds + 4%. NJ and sales tax. Everything guaranteed working to specs. Immediate shipment or immediate refund.

ELECTRAVALUE INDUSTRIAL
 P.O. BOX 157-B
 MORRIS PLAINS, NJ 07950

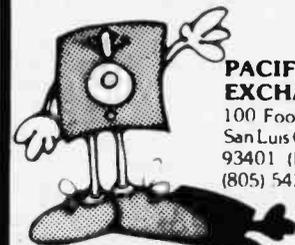


Phone orders are welcome.
 201/267-1117

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)

STRETCH THE POWER

Of Your HP-85 or Commodore Pet/CBM With TNW's IEEE-488 Bus System Building Blocks...



TNW-2000

TNW's RS-232 SERIAL INTERFACES

Connect your PET/CBM to any RS-232 Serial Printer, Plotter, CRT Terminal, Modem, or other device.

TNW-1000	ONE CHANNEL OUTPUT ONLY	\$129
TNW-2000	ONE CHANNEL INPUT AND OUTPUT	\$229
TNW-232D	TWO CHANNELS, INPUT & OUTPUT, 12 RS-232 CONTROL SIGNALS	\$369

TURN YOUR PET INTO A TERMINAL

Access Timesharing Systems and Bulletin Boards with TNW's Pterm Software and full service telephone modem:

TNW-103	AUTO ANSWER/AUTO DIAL USE WITH DAA	\$389
----------------	---------------------------------------	--------------

Pterm also works with acoustical couplers and other modems interfaced to the PET with the TNW-2000 or TNW-232D. Electronic mail and TWX Terminal programs also available. All units are addressable IEEE-488 devices, complete with power supply cabinet, full documentation and one year warranty.

TNW CORPORATION

3351 Hancock St. • San Diego, CA., 92110 (714) 225-1040
TWX910-335-1194
Visa/Mastercharge Welcome • Dealer inquiries invited

Apple en castellano

Tercer Medio presenta su sistema administrativo (T.M.A.) para Apple II*

Diseñado de acuerdo con los principios contables aceptados en todos los países de habla hispana.

APLICACIONES COMERCIALES Y CIENTIFICAS

- CONTABILIDAD GENERAL
- CUENTAS POR COBRAR

Diario General	Catálogo de Cuentas
Resumen del Diario	Listado de Transacciones
Consulta parcial al Diario	Antigüedad de Saldos
Mayor General	Saldos por Vencer
Balance de Comprobación	Relación de Cobranzas
Balance General	Relación de Pagos
Ganancias y Pérdidas	Estado de Cuentas
Catálogos de Cuentas	Consultas varias por pantalla
Consultas por pantalla	

- INVENTARIO Y FACTURACION
- CONTROL DE BANCOS
- PERT/CPM
- CUENTAS A PAGAR
- CONTROL DE COSTO DE OBRAS

VENTAJAS DEL SISTEMA T.M.A.

- Son completamente conversacionales.
- El chequeo de la información es instantáneo.
- Los reportes impresos o por pantalla guardan los formatos generalmente aceptados.
- Están pensados para adaptarse a cualquier empresa.
- Toda la información está instantáneamente disponible.
- Precisión Expandida.
- Números de hasta ± 999.999.999.99

Tercer Medio Sistema de Información C.A.

APARTADO DE CORREOS 62533
CARACAS 1060-A - VENEZUELA
TELEX: 27.876 - CPBTH-VE.
TELEFONOS: 283.60.88 - 284.74.68

*Apple es marca registrada por APPLE COMPUTER INC

DIGIAC

MAPS 1000

**MP/M'S
HARDWARE
PARTNER**

**The Digiac MAPS-1000 MP/M* Universal Support Module has been designed to meet the total demands required by Digital Research's MP/M multi-user, multi-tasking operating system. All input/output, interrupt generation for task switching, and disk bootstrapping are resident functions on the MAPS-1000.*

**The MAPS-1000 has been designed with all the following powerful features:*

- Four (4) independent RS-232C Serial Communication channels
- One 8 bit TTL parallel port
- On-board phantom controlled disk boot prom/monitor
- Power on jump capability
- Crystal controlled MP/M interrupt generation Logic
- On board extended memory bank switching Logic

* MAPS-1000 fully assembled and tested price... \$425.00

DIGIAC CORPORATION
175 Engineers Road
Smithtown, New York 11787
Phone (516) 273-8600
MP/M is a trademark of the
Digital Research Corporation

DIGIAC
CORPORATION

Software Received

This following is a list of software packages that have been received by BYTE Publications during the past month. The list is correct to the best of our knowledge, but it is not meant to be a full description of the product or the forms in which the product is available. In particular, some packages may be sold for several machines or in both cassette and floppy-disk format; the product listed here is the version received by BYTE Publications.

This is an all-inclusive list that makes no comment on the quality or usefulness of the software listed. We regret that we cannot review every software package we receive. Instead, this list is meant to be a monthly acknowledgment of these packages and the companies that sent them. All software received is considered to be on loan to BYTE and is returned to the manufacturer after a set period of time. Companies sending software packages should be sure to include the list price of the packages and (where appropriate) the alternate forms in which they are available.

Apple

ABM, graphics arcade game for the Apple II. Floppy disk, \$24.95. Muse, 330 N Charles St, Baltimore MD 21201.

Action Sounds and Hi-Res Scrolling, sound and graphics utility for the Apple II. Floppy disk, \$15.95. Avant-Garde Creations, POB 30161, Eugene OR 97403.

Animal Bingo, nonviolent strategy game for the Apple II. Floppy disk, \$9.95. Avant-Garde Creations (see above).

Apex Handy Disk #1, disk utilities for the Apex Operating System (on the Apple II). Floppy disk, \$39. Apparat Inc, 4401 S Tamarac Pky, Denver CO 80237.

Asteron, game for the Apple II. Floppy disk, \$27.50. Western Microdata Enterprises Ltd, POB 633, Postal Station G, Calgary, Alberta, T3A 2G1, Canada.

Courseware Magazine, education programs and documentation for the Apple II. Cassette, \$12.95 for a single issue or \$50 for 5 issues. *Courseware Magazine*, School of Business, California State University, Fresno CA 93740.

CRAE 2.0 (Co-Resident Apple Editor 2.0), Applesoft program editor for the Apple II. Floppy disk, \$24.95. Highlands Computer Services, 14422 S E 132nd St, Renton WA 98055.

The Creativity Life Dynamic Book, graphics-, music-, and poetry-generation game for the Apple II.

Floppy disk, \$19.95. Avant-Garde Creations (see above).

Jungle Safari, graphics game for the Apple II. Floppy disk, \$9.95. Avant-Garde Creations (see above).

Masterdisk, disk-examination utility for the Apple II. Floppy disk, \$29.95. Masterworks Software Inc, POB 7000-285, Rolling Hills Estates CA 90274.

MCAT 2.0, disk-catalog utility for the Apple II. Floppy disk, \$19.95. Highlands Computer Services (see above).

The Meaning Life Dynamic, graphics-game package for the Apple II. Floppy disk, \$15.95. Avant-Garde Creations (see above).

The Mine Fields of Normalcy, strategy game for the Apple II. Floppy disk, \$9.95. Avant-Garde Creations (see above).

Mystery Code, strategy game for the Apple II. Floppy disk, \$9.95. Avant-Garde Creations (see above).

Oldorf's Revenge, fantasy game for the Apple II. Floppy disk, \$19.95. Highlands Computer Services (see above).

Personal Property Inventory, cataloging utility for the Apple II. Floppy disk, \$19.95. Hayden Book Company Inc, 50 Essex St, Rochelle Park NJ 07662.

The Prisoner, strategy game for the Apple II. Floppy disk, \$29.95. Edu-Ware Services Inc, 22035 Burbank Blvd, Suite 223, Woodland Hills CA 91367.

Sentence Diagramming, teaching program for the Apple II. Floppy disk, \$19.95. Avant-Garde Creations (see above).

Star Avenger, graphics arcade game for the Apple II. Floppy disk, \$27.50. Western Microdata Enterprises Ltd (see above).

Tarturian, fantasy game for the Apple II. Floppy disk, \$24.95. Highlands Computer Services (see above).

VU #3, VisiCalc-based utility for the Apple II. Floppy disk, \$69.95. Progressive Software, POB 273, Plymouth Meeting PA 19462.

XPLO, programming language for the Apple II. Floppy disk, \$79. Apparat Inc (see above).

TRS-80

Attack Force w/Sound, graphics arcade game for the TRS-80. Cassette, \$14.95. Big Five Software, POB 9078-185, Van Nuys CA 91409.

Beef Cattle Least-Cost Ration Program, cost-analysis program for the TRS-80. Cassette, \$5. Agricultural Software Consultants Inc, 1706 Santa Fe, Kingsville TX 78363.

Blackjack Master, blackjack strategy game for the TRS-80. Floppy disk, \$24.95. Hayden Book Company Inc, 50 Essex St, Rochelle Park NJ 07662.

Galaxy Invasion, graphics arcade game for the TRS-80. Cassette, \$14.95. Big Five Software (see above).

Personal Property Inventory, cataloging utility for the TRS-80. Floppy disk, \$14.95. Hayden Book Company Inc (see above).

Starclash, strategy game for the TRS-80. Floppy disk, \$16.95. Hayden Book Company Inc (see above).

CP/M

Communications Software Package, utility for CP/M systems. Floppy disk, \$60. Datastat Systems Inc, 631 B St, San Diego CA 92101.

Datastar, key-to-disk data-entry program for the CP/M

operating system. Floppy disk, \$350. MicroPro International Corporation, 1299 Fourth St, San Rafael CA 94901.

Pascal/M, programming language for the CP/M system. Eight-inch floppy disk, \$175. Sorcim, POB 32505, San Jose CA 95152.

Supersort I, record-sorting utility for the CP/M operating system. Floppy disk, \$250. MicroPro International Corporation (see above).

WordMaster, video-based text editor for the CP/M operating system. Floppy disk, \$150. MicroPro International Corporation (see above).

WordStar, word-processing program for the CP/M operating system. Floppy disk, \$495. MicroPro International Corporation (see above).

Other Computers

Budget Manager, personal-utility program for the APF Imagination Machine. Cassette, \$19.95. APF Electronics, 1501 Broadway, New York NY 10036.

Full Screen Editor, text-manipulation program for the Heath H-89. Floppy disk, \$24.95. Heath Company, Benton Harbor MI 49022.

Jinsam 8.0, data-base-management program for the Commodore CBM 8032. Floppy disk, \$175. Jini Micro-Systems Inc, POB 274, Kingsbridge Sta, Bronx NY 10463.

Personal Business Machine, personal-utility program for the APF Imagination Machine. Cassette, \$29.95. APF Electronics (see above).

Ramscan, memory diagnostic test for the Atari 800. Floppy disk, \$15. Axlon Inc, 170 N Wolfe Rd, Sunnyvale CA 94086.

Space, Size, and Surface Guide, personal-utility program for the APF Imagination Machine. Cassette, \$29.95. APF Electronics (see above). ■

BYTE's Bits

Results of "What Is It?" Contest

In the April 1980 BYTE, we announced a contest. In the "What's New?" section, on page 247, we printed a picture of an anonymous mechanical device and challenged readers to identify it. The first person to respond with the correct answer was to receive the device as a prize.

Tony Caloggero of Nahant, Massachusetts, won the contest. It is called Stepdozer, a product of the Gakken Company of Japan. The Stepdozer is part of a line of mechanical toys known as Space Mechanimals.

Other readers sent in varying descriptions of the beastly. Several readers stated that it was part of a cash register. One reader gave a specific description as a 1903 C L Smith adding machine, with

the battery pack thrown in as a "red herring." Another reader guessed several possibilities: "a doughnut dunker, an automatic pitchfork, or a piece of my spaceship." Yet another suggested that it was a model of an oil pump. These descriptions were slightly off the mark.

Several readers came closer, by describing it generically as "a walking machine." One reader said that he recognized it instantly as a "Rien de Toot," and we received one letter identifying the device as a "mechanical Trojan horse."

Finally, we would like to quote extensively from a reader in University, Alabama, who wrote:

Good heavens, any economist worth his salt knows the answer—it's a portable widget, with a self-contained power source. It's

used as a product example in almost every freshman economics course in the country. Get with it—you folks are slipping! Next time, show us

something really hard to guess, like an inversely truncated framistan!

Only if we can find one. ■

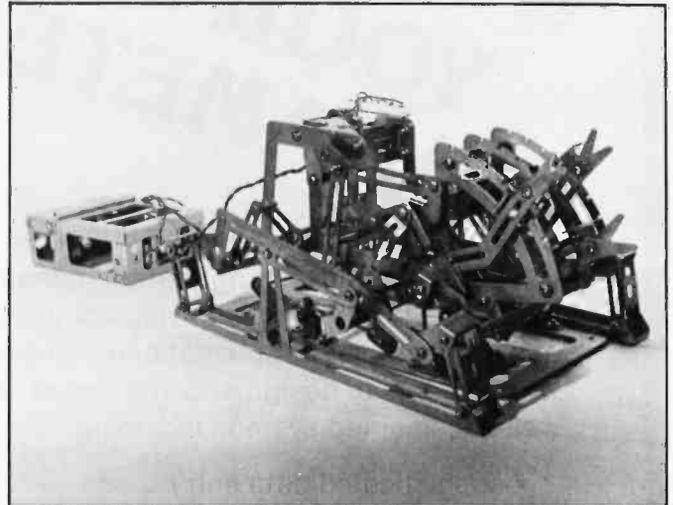


Photo 1: A Stepdozer for Tony Caloggero. He guessed it, he got it.

Radio Shack®

COLOR

COMPUTER

PROGRAMS



Graphic Games
Space-Action-Invaders

Programmer's Tool Kit
Write your own programs easier



Many, many more!
Books • Memory • Accessories

Shipping from stock

Call or Write:



COMPUTERWARE™

Dept. C • Box 668
6809 Specialists Encinitas, CA 92024 • (714) 436-3512

Computerware is a trademark of Computerware.
Radio Shack is a registered trademark of Tandy Corp.

**DISK DRIVE WOES?
PRINTER INTERACTION?
MEMORY LOSS?
ERRATIC OPERATION?**



Don't Blame The Software!

Power Line Spikes, Surges & Hash could be the culprit!
Floppies, printers, memory & processor often interact! Our unique ISOLATORS eliminate equipment interaction AND curb damaging Power Line Spikes, Surges and Hash.

- ISOLATOR (ISO-1) 3 filter isolated 3-prong sockets; Integral Surge/Spike Suppression; 1875 W Maximum load, 1 KW load any socket \$62.95
- ISOLATOR (ISO-2) 2 filter Isolated 3-prong socket banks; (6 sockets total); Integral Spike/Surge Suppression; 1875 W Max load, 1 KW either bank \$62.95
- SUPER ISOLATOR (ISO-3), similar to ISO-1 except double filtering & Suppression \$94.95
- ISOLATOR (ISO-4), similar to ISO-1 except unit has 6 Individually filtered sockets \$106.95
- ISOLATOR (ISO-5), similar to ISO-2 except unit has 3 socket banks, 9 sockets total \$87.95
- CIRCUIT BREAKER, any model (add-CB) Add \$ 8.00
- CKT BRKR/SWITCH/PILOT (-CBS) Add \$16.00

Master Charge, Visa, American Express
Order Toll Free 1-800-225-4876
(except AK, HI, MA, PR & Canada)

ESP Electronic Specialists, Inc.

171 South Main Street, Natick, Mass. 01760
Technical & Non-800. 1-617-655-1532

WORK WITHIN YOUR OWN PARAMETERS

THE CONFIGURABLE BUSINESS SYSTEM™
is a parameter-driven information manager that makes the business of applying computers easier and more efficient. A pre-defined framework gives you the tools to design and implement your own well-documented system, including:

- sophisticated data entry
- concise data-based management system
- user customized job streams and menus
- personalized report generation

User training and support is minimized by a comprehensive operating manual. CBS Disks can fit any 8080 or Z80 computer with CP/M.*

Disks and manual, \$395. Manual only, \$40.

Your DMA representative can tell you about DMA.DOS, our CP/M compatible operating system, and ASCOM, an Asynchronous Communication Control Program.

DMA • WE SPEAK YOUR LANGUAGE

DYNAMIC MICROPROCESSOR ASSOCIATES
545 Fifth Avenue
New York, New York 10017
Telephone: (212)687-7115

MasterCharge and VISA accepted.
We ship prepaid and COD orders.
Shipping and handling charges extra.

CP/M* is a Trademark of Digital Research Corp.

This publication
is available
in microform.



University Microfilms International

Please send additional information
for _____

Name _____

Institution _____

Street _____

City _____

State _____ Zip _____

300 North Zeeb Road
Dept. P.R.
Ann Arbor, Mi. 48106
U.S.A.

30-32 Mortimer Street
Dept. P.R.
London W1N 7RA
England

The business information you need at the turn of a key.

Datadex is a new interactive business management system designed for the Apple personal computer. It's from IUS, the people who brought you EasyWriter™ and who are bringing you new products for office automation, education, and development systems.

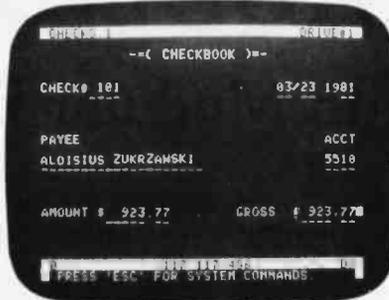
Datadex is short for **data index**. It lets you put all your business data into your Apple the way you like to see it and manipulate it any way you want. **It adapts to your way of doing business.**

Want to generate a sales report? Just press four keys and fill in the blanks. That puts your sales data into the computer. Now, your report: **Datadex designs it for you**, based on what you've entered. Nothing to it. That's **power!**

You can do the same with phone lists, mailing lists, dealer names or inventories.

They all enter Datadex and form your own personal data base.

Want to find a company but don't know how to spell its name? Try something that sounds close, and our **Soundex** routine will find it. It is very forgiving on typos and extra spaces.



Soundex helped us find Mr. Zukrzawski when we were balancing our checkbook. We weren't sure how to spell Al's name, so searched for Al Z and found him. Instantly. The check register and several other applications are free with Datadex.

Want a specific piece of information, like sales for January 14-21? Inquire Datadex and the answer comes up on the screen right now. And right.

Want a report of all sales in ZIP code areas starting with 9? Sure. Just ask it to print a report.

But seeing is the only way to believe. Get a demonstration of Datadex at your local Apple dealer. See the personal computing power it can bring to your office and home. If you've looked at a VisiCalc-type program, see Datadex before you buy.

By the way, about IUS. We're the Apple of software. We got there by giving you great products and super support. We provide customer service over the phone. Professionally written documentation. And products that are never outdated, only updated. Information Unlimited Software, Incorporated, 281 Arlington Ave., Berkeley, CA 94707. (415) 525-9452.



Does your other software have auto system configuration and auto report generation?

Datadex does. You don't have to be a computer expert to get results!

PUT DATADEx™ IN YOUR APPLE.



Datadex is a trademark of Sonoma Softworks.
EasyWriter is a trademark of Cap'n Software.
Apple is a trademark of Apple Computer Inc.
VisiCalc is a trademark of Personal Software, Inc.

PADDLES

Interfacing with Modular Breadboards

Roger J Combs and Paul E Field
Department of Chemistry
Virginia Polytechnic Institute
and State University
Blacksburg VA 24061

Often, microcomputer interfacing is a simple task requiring only a basic knowledge of digital electronics. The availability of breadboarding sockets has made building and testing of digital electronics circuits relatively easy. (Breadboard sockets considered here are the E & L Instruments SK-10 and the AP Products Super Strip.) The ease of digital-circuit testing with breadboards can be extended to microcomputer interfacing by use of *functional modules* which plug into these breadboards. We call these modules PADDLEs (Peripheral Analog/Digital Device-Logic Extensions).

Breadboarding sockets have made building and testing digital electronics relatively simple.

The various PADDLE modules perform the following functions: address decoding for device selection, D/A (digital-to-analog) conversion, A/D (analog-to-digital) conversion, displaying data, and debouncing switches. Once you have built these circuits in modular form, you will not have to build them from scratch for every breadboard project, and you will not have to use valuable breadboard space that could otherwise be delegated to the project at hand.

It is best to avoid constructing modules so complex that their use becomes cumbersome and their utility limited. For this reason, we shall consider building PADDLEs to perform only those functions which are often called for in digital circuits and which are easily integrated into prototype interface circuitry.

We have found a minimum configuration of five PADDLEs most useful both for interfacing projects and for instruction. These consist of (1) a set of three switch-debouncing circuits, (2) a set of eight logic switches having a latched-pulse output for interrupt generation, (3) a dual seven-segment display, (4) an A/D-D/A converter and comparator for either analog-to-digital or digital-to-analog conversion, and (5) a device decoder capable of generating eight unique outputs from an 8-bit input.

A single 8-bit address decoder PADDLE can be used to select devices, provided the microcomputer uses accumulator I/O (input/output). In order to decode a 16-bit memory address, two decoder PADDLEs would be necessary. Though the PADDLEs can be used with other microprocessors, our focus is on the 8080 family. In the following text we consider each of these PADDLEs in terms of function and design.

Pulser PADDLE

This PADDLE (see figure 1) generates a digital pulse, either positive or negative, that is devoid of the bouncing (momentary intermittent contact) always found in mechanical switches. This is done by the use of an RS (set-reset) flip-flop. Often an RS flip-flop is constructed from two NAND gates; however, the same result can be obtained by the use of two inverters. Either a positive or negative pulse is available at the output of each RS flip-flop. With a single type-7404 hex inverter, three RS flip-flops can be constructed (rather than two using a single 7400 quad NAND gate).

The operation of an RS flip-flop constructed from either inverters or NAND gates is controlled by the current-sinking ability of a TTL (transistor-transistor logic) device output, since a floating input connected to an output that is low will also be pulled low. These pulsers are a means of manually generating signals that can be used to enable or clear such devices as monostable multivibrators (one-shots), counters, latches, and so on.

Logic Switch PADDLE

As the name implies, the device in figure 2 allows definition of a logic 1 or 0 on each of eight parallel lines. A single-pulse switch is also provided to generate an interrupt pulse that is latched by a 7474 D-type latch. Each of the eight lines is three-state buffered and enabled by the same external pulse that clears the D latch. Used with an 8080A microprocessor, the output line marked P can be tied to INT (the processor's interrupt line) and the input-enable signal, labeled \bar{E} , can be connected to the microprocessor's interrupt-acknowledge line, INTA. This allows the PADDLE to function as an interrupting device. Once INT has been accepted, \bar{INTA} will gate the instruction defined by the logic switches (usually a special-restart subroutine call, RST X) onto the data bus.

Number	Type	+5 V	GND
IC1	7404	14	7

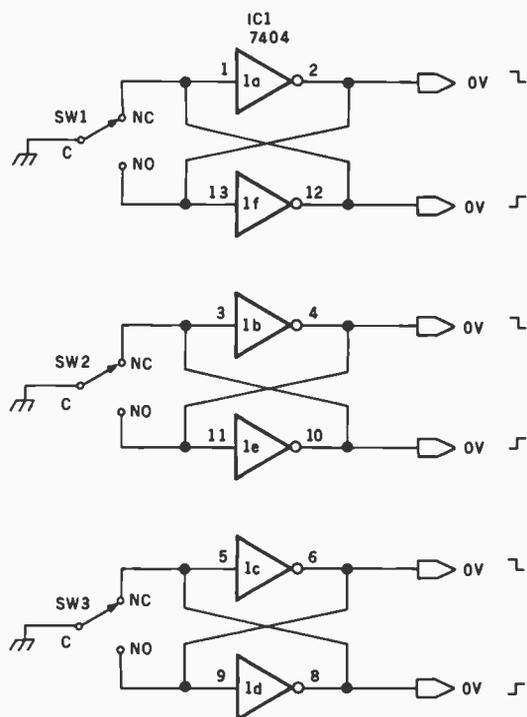


Figure 1: Schematic of a PADDLE for manually producing bounceless pulses. SW1 thru SW3 are momentary-contact switches; A thru F are sections of a 7404 hex inverter integrated circuit.

Octal	BOC
377	7.7.
246	4.6
135	3.5.
012	1.2

Table 1: Examples of BOC (binary/octal code) coding using two seven-segment displays and their decimal points to represent an 8-bit number.

A short program to test this function using RST 4 is given in listing 1. Alternately, the PADDLE can be used as an input device to the accumulator (by properly using \bar{E} with device decoding), or \bar{E} can be tied to ground and the logic switches used as individual switches.

Display PADDLE

This device (see figure 3) displays an 8-bit word on seven-segment LED (light-emitting diode) displays in either the BCD (binary-coded-decimal) format or a BOC (binary/octal-code) format. The BCD format is actually the hexadecimal display obtained with the 7447 seven-segment decoder. Since the upper six digits of this code are not particularly useful, or at least not easily memorized, we have devised the BOC format in order to display an 8-bit word using the two seven-segment displays and their associated decimal points.

Number	Type	+5 V	GND
IC1	7474	14	7
IC2	74368	16	8
IC3	74368	16	8

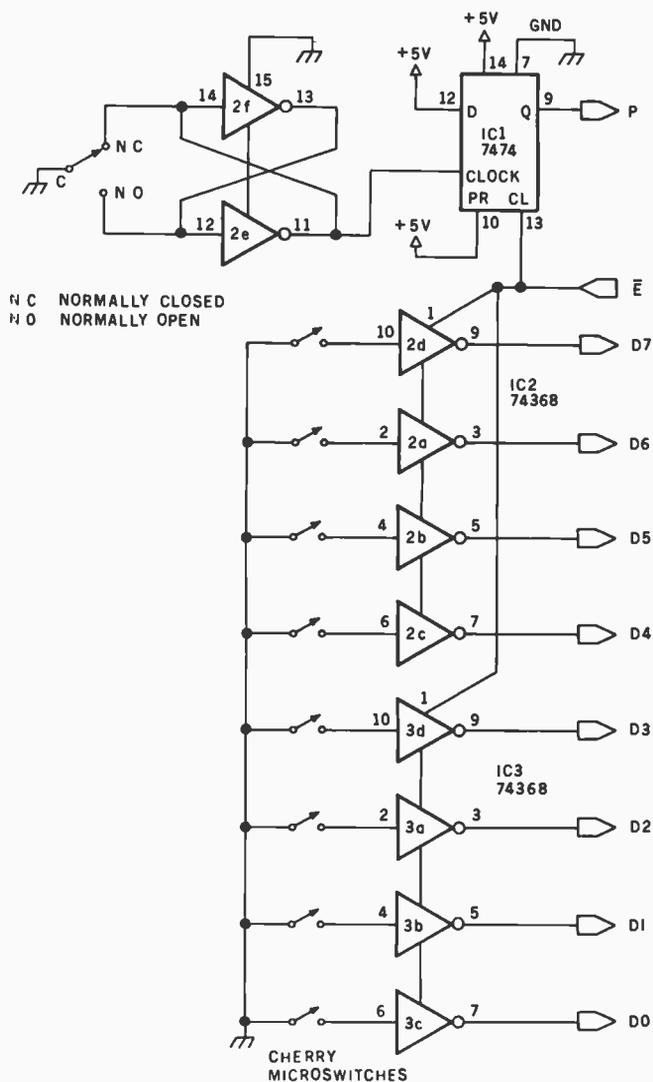


Figure 2: This PADDLE circuit permits the sending of 8 bits of data to a processor by functioning as either an interrupt or an input device. Switch C is of the momentary variety, while the eight data switches are SPST (single pole, single throw).

Listing 1: Routine to exhibit function of the Logic Switch PADDLE as an interrupt device. An indefinite delay is generated by use of EI (enable interrupts) followed by HLT (halt). Each time an interrupt is generated the display will increment by one.

```

AGAIN,   SUB A   /CLEAR ACCUMULATOR
         INR A
         OUT
         DISPLAY
         EI
         HLT   /INTERRUPT IS ENABLED

000 040, POP H   /RESTORE STACK POINTER
         JMP   /RST 4 MUST BE JAMMED ON DATA BUS
         AGAIN /AT TIME OF INTA IN ORDER TO RETURN
         PAGE  /TO NEW DELAY

```

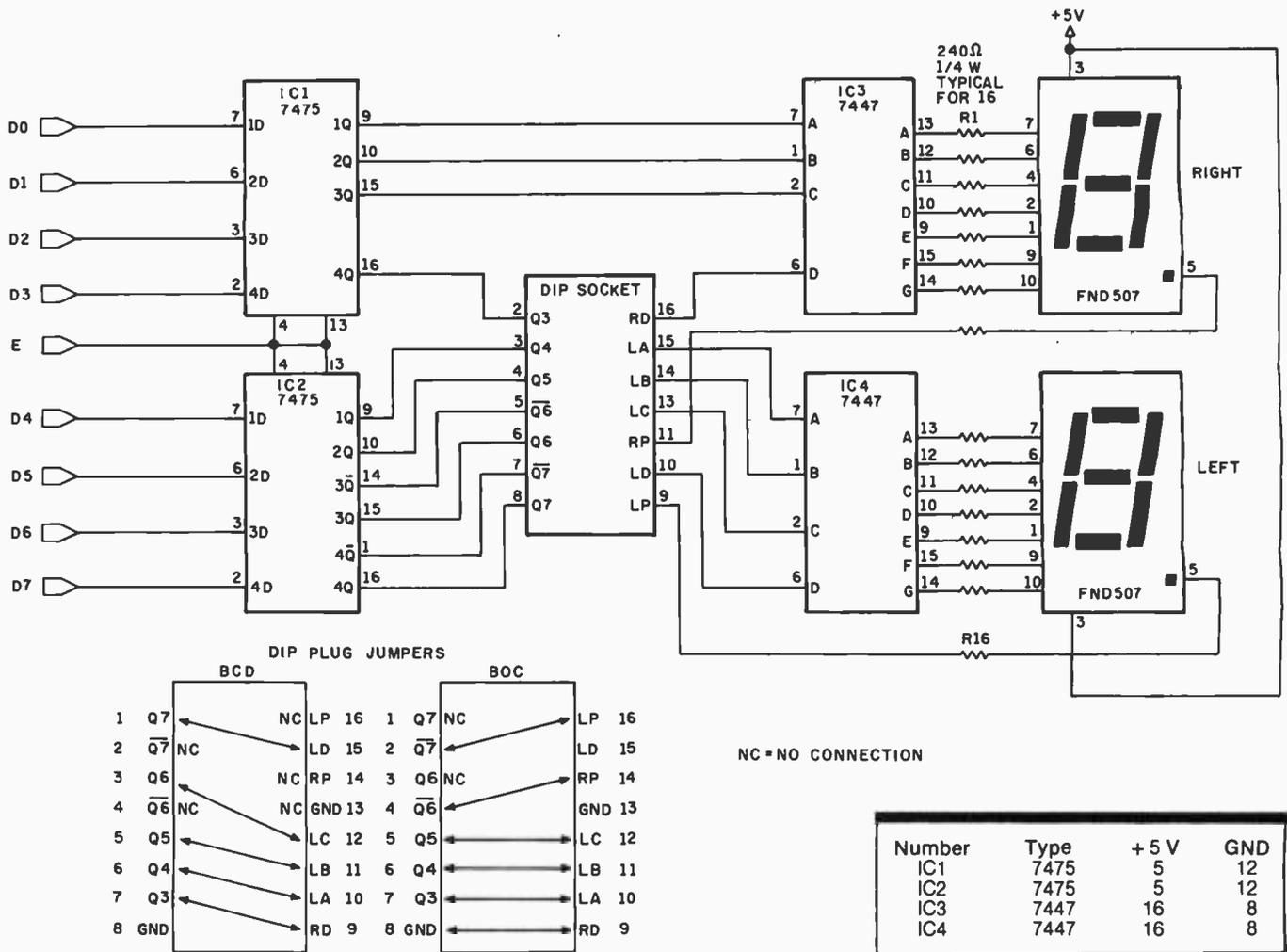


Figure 3: Binary data on lines D0 thru D7 can be displayed on two seven-segment LED (light-emitting diode) displays in either BCD (binary-coded-decimal) or BOC (binary/octal-code) format (see text) using the Display PADDLE. Resistors R1 thru R16 are 240-ohm 1/4 W.

Binary/octal-code format is *binary* in the sense that the two most significant bits are displayed on the decimal points, and it is *octal* since the remaining six bits are displayed as two octal digits on the seven-segment displays. BOC represents a substantial advantage over normal numeric display because only two rather than three displays and decoders are required. Although one could monitor the eight lines using alphanumeric hexadecimal displays, these are much more expensive than seven-segment displays with decimal points.

The ability to use the displays in either a BCD or BOC format is selected by using one of two jumper-wired dual-inline plugs inserted into a 14-pin DIP (dual-inline package) socket. The eight data-input lines, D0 thru D7, are brought to a pair of 7475 quad D latches. The outputs of the latches, Q0 thru Q7, Q6, and Q7, are routed via the DIP plug to obtain the selected display format. In either configuration, signals from Q0 thru Q2 bypass the DIP plug and connect directly to the three least significant inputs of the 7447 decoder-driver for the right-hand display.

In the BCD configuration, the DIP plug directs Q3 to the MSB (most significant bit) input of IC3, the right-hand 7447, and Q4 thru Q7 to the appropriate inputs of

IC4, the left-hand 7447. The decimal points of the displays are not connected.

In the BOC configuration, the DIP plug directs Q3 thru Q5 to IC4, grounds the MSB inputs of both 7447s, and connects Q7 and Q6 directly to the left- and right-hand decimal points of the FND 507 LED displays. Use of the logical complements of Q6 and Q7 is necessary because the FND 507 is a common-anode display.

On the PADDLE module, the gating inputs to the 7475 quad D latches are tied together and labeled E (enable). When E is at logic 1, the data present on lines D0 thru D7 is displayed; on the 1-to-0 transition it is latched. In this manner the Display PADDLE can be used as an output device (provided proper address decoding is implemented to allow the 7475s to latch the data bus at the correct time).

A/D-D/A PADDLE

The PADDLE in figure 4 can be used as either an A/D (analog-to-digital) converter or a D/A (digital-to-analog) converter. It consists of the following: a 7404 hex inverter, two 7475 quad D latches, a 1408L8 8-bit D/A converter, a 741 operational amplifier (op amp), and a 311 voltage comparator. Because the latter three devices re-

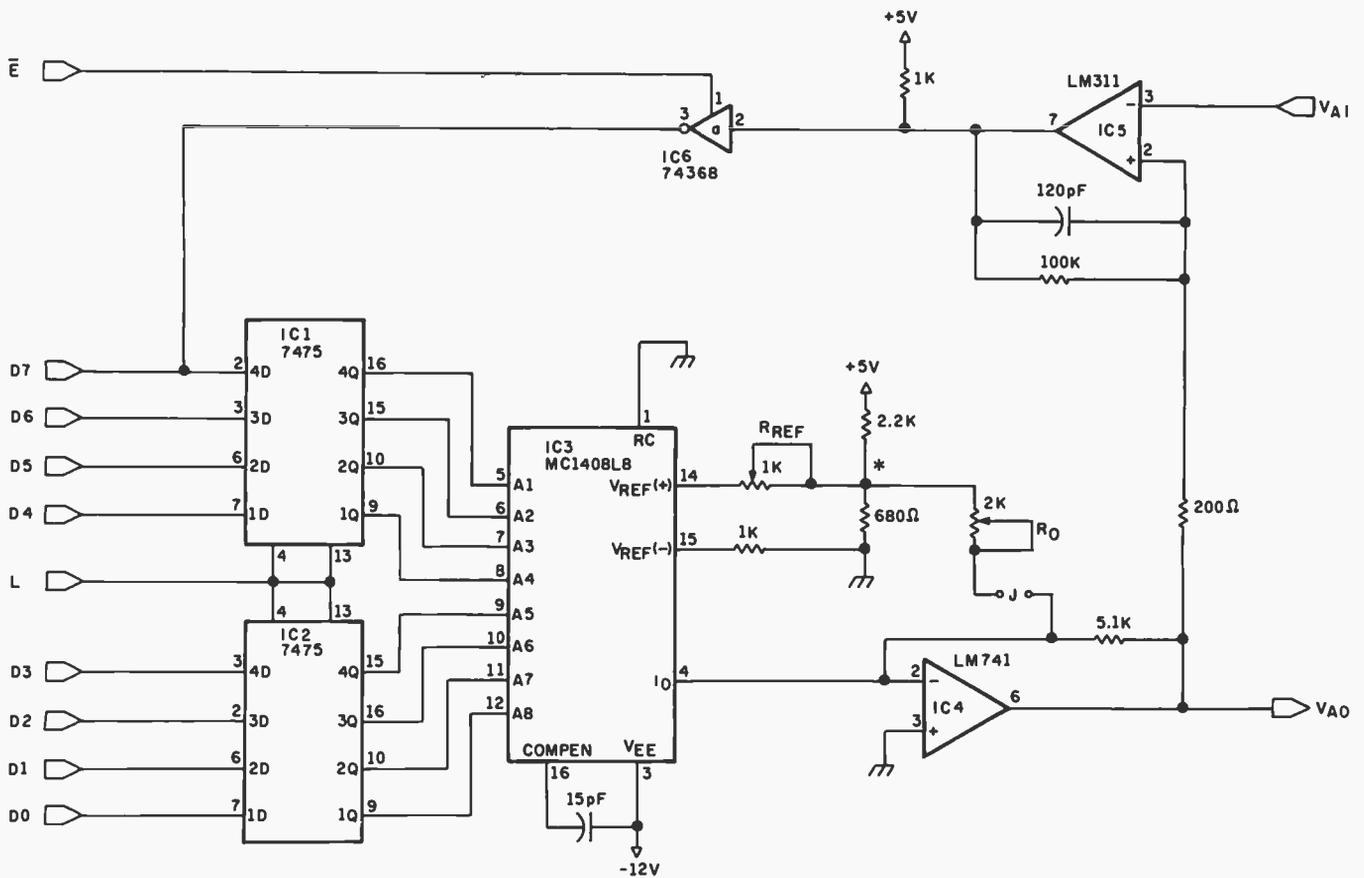


Figure 4: Analog-to-digital and digital-to-analog conversion of data is performed by the A/D-D/A PADDLE in conjunction with the SAP program in listing 2. V_{AI} and V_{AO} are the analog input and output lines, respectively. The asterisk indicates the voltage reference point; jumper J allows generation of negative output voltages. IC 6 is one section of a 74368 integrated circuit.

Number	Type	+5 V	GND	-12 V	+12 V
IC1	7475	5	12		
IC2	7475	5	12		
IC3	MC1408L8	13	2		
IC4	LM741			4	7
IC5	LM311		1	4	8
IC6	74368	16	8		

quire +12 V and -12 V, wire-insertion sockets labeled +V and -V are provided on the PADDLE for connection to an external power supply.

Let us first consider the use of this PADDLE as a D/A converter and note its limitations. The PADDLE is designed so that once an 8-bit word is latched by the 7475s, the 1408 D/A converter converts this byte into a proportional current. The 741 operational amplifier connected to the output of the D/A converter serves as a current-to-voltage converter. When the jumper shown in figure 4 is *not* inserted, the D/A converter is in a unipolar mode and can generate voltages between 0 and the positive external power-supply voltage. In the unipolar mode, the voltage range is dependent upon the reference current supplied to the D/A converter and the amplifier feedback resistance at the output of the D/A converter. The calculation of this voltage is based on the digital value of the 8 bits D0 thru D7:

$$V_{AO} = \frac{V_{ref}}{R_{ref}} R_f \left(\frac{D0}{2} + \frac{D1}{4} + \frac{D2}{8} + \frac{D3}{16} + \frac{D4}{32} + \frac{D5}{64} + \frac{D6}{128} + \frac{D7}{256} \right)$$

where R_{ref} is the resistance provided by a 1 k-ohm potentiometer and R_f is 5.1 K-ohms (from the amplifier feedback resistor). Note that V_{ref} at the node labeled with the asterisk in figure 4 is determined by the voltage-divider circuit and is calculated to be 1.18 V. As R_{ref} is reduced to zero, the voltage output goes to a minimum value of approximately +4.0 V. Based on the previous equation, we can infer that an impedance of about 500 ohms exists at pin 14 of the 1408L8.

To use the D/A converter in a bipolar mode requires insertion of a jumper on the PADDLE. This jumper connection is made between two wire-insertion sockets. It introduces an offset current via R_0 that permits negative output voltages to be obtained. Note that R_{ref} as defined can be interpreted as a *scaling* factor because it approximately defines the range of voltage values possible at the output V_{AO} .

This only approximately defines the range in the bipolar mode because of the parallel resistance of R_0 introduced into the voltage-divider circuit. Because the inverting input of the operational amplifier is at virtual ground, the resistance from V_{ref} to ground now becomes the 2.2 k-ohms of potentiometer R_0 in parallel with the 680-ohm resistor. Introducing the offset current (V_{ref}/R_0)

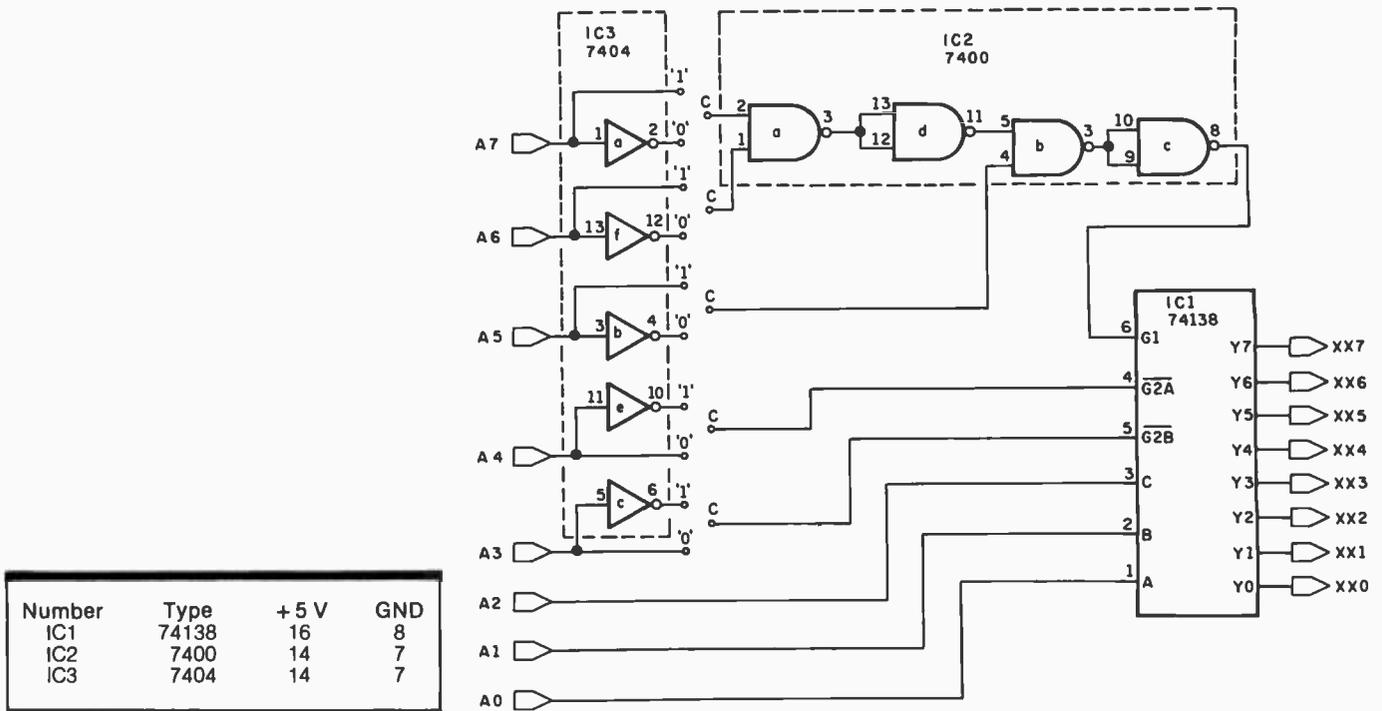


Figure 5: Jumpers located at C allow the 8-Bit Address Decoder PADDLE to decode any eight consecutive addresses out of a possible 256.

yields the bipolar voltage:

$$V_{AO} = \frac{V_{ref} R_f}{R_0} \left(\frac{D_0}{2} + \frac{D_1}{4} + \frac{D_2}{8} + \frac{D_3}{16} + \frac{D_4}{32} + \frac{D_5}{64} + \frac{D_6}{128} + \frac{D_7}{256} \right) - \frac{V_{ref}}{R_0} R_f$$

As a result of the reference voltage's dependence on R_0 , both the offset and scaling potentiometers must be adjusted to give a voltage symmetric about 0 V. The resolution of the D/A converter in either unipolar or bipolar mode is one part in 256, or 0.4%.

Now let us consider use of the PADDLE as an A/D converter. This is accomplished by using a software routine in conjunction with the D/A converter and the

Listing 2: SAP, the successive-approximation program. Also see figure 6.

```

SAP,   SUB A           MOV A,B
       LXI B          XRA C
       000Q          MOV C,A
       200Q          NEXT, MOV A,B
       MVI D         RAR
       010Q          MOV B,A
ADC,   ORA B          MOV A,C
       MOV C,A       DCR D
       OUT          INZ
       DAC          ADC
       IN           PAGE
       FLAG         RET
       ANI         WAIT, NOP
       200Q        JMP
       JNZ         NEXT
       WAIT        PAGE
       PAGE

```

voltage-comparator integrated circuit. The 311 voltage comparator compares the analog input voltage, V_{AI} , to a reference voltage, V_{AO} , supplied by the D/A converter, derived from a program-generated digital input. The selection of inputs to the voltage comparator with V_{AI} at pin 3 and V_{AO} at pin 2 of the LM311 (IC5) is based on impedance matching (ie: pin 2 is a high-impedance input and avoids loading the analog-signal source).

Now the two voltages are compared in relative magnitude and the result is reflected in the output (pin 7) of the comparator. If V_{AI} is greater than V_{AO} the output will be at the negative saturation voltage; conversely, if V_{AI} is less than V_{AO} , the output will be at the positive saturation voltage. Because the LM311 has an open-collector output, the output voltage is made TTL-compatible by adding a pull-up resistor tied to +5 V.

The output is tied to D7 of the data bus through a three-state buffer, thus allowing the signal to be monitored by SAP (a successive-approximation program, given in listing 2, with the flowchart shown in figure 6). A logic state of 1 at D7 indicates that an output byte (ie: V_{AO}) is too low, while a logic 0 indicates that the byte is too high.

SAP starts with the most significant bit and either sets or clears it depending upon the status of D7. This process of setting or clearing successive bits is continued until all 8 bits have been tested. Therefore, if the analog input voltage is constant over the duration of the SAP execution time, it can be measured to within 0.4%. SAP takes eight steps to adjust V_{AO} regardless of the value of V_{AI} . Thus, the rate of conversion is constant in this particular software version of an A/D converter. Calculating the maximum rate of conversion requires computation of the SAP execution time because each SAP step allows sufficient settling time for the D/A converter.

8-Bit Device Decoder PADDLE

This PADDLE uses one 7404 hex inverter, one 7400 quad NAND gate, and a 74138 3-to-8-line decoder (see figure 5). It allows generation of device-select pulses for use in accumulator I/O typical of the 8080 family of microprocessors. As a decoder, the PADDLE provides unique decoding for eight adjacent device codes from XX0 to XX7 over the range of 256 devices. This is done by

jumpers in wire-insertion sockets on the PADDLE, which select unique decoding for A7 thru A3 (or A15 thru A11) of the address bus lines.

Once a device code is generated, it must be ORed (off of the PADDLE module) with either $\overline{I/OR}$ (referred to as \overline{IN}) or $\overline{I/OW}$ (\overline{OUT}) to create a device-select pulse for input or output, respectively. \overline{IN} and \overline{OUT} are obtained by NANDing the appropriate latched status bit with the control pulses DBIN (input) or WR (output) on an 8080 processor. In terms of the S-100 bus, \overline{IN} is defined as $sINP$ (pin 46) NANDed with $pDBIN$ (pin 78), while \overline{OUT} is \overline{PWR} (pin 77) inverted and NANDed with $sOUT$ (pin 45).

Construction Details

The printed-circuit layouts for the five PADDLEs are presented in figure 7. Each board is 3 inches long and either 1½ or 2 inches wide. The extra section of the Display PADDLE which supports the seven-segment display at a comfortable viewing angle is 1½ inches long.

The component layouts for the PADDLEs are given in figure 8. Because the layouts are for single-sided copper foil, all jumpers, as well as all other components, were run parallel to the edges of the PADDLE, with none of the jumper wires crossing. Note that the pins for power and ground must be carefully aligned for insertion into the breadboard. The power bus is assumed to be the outer strip on the breadboard.

All circuit-board holes were drilled with a #65 drill bit (with the exception of holes for wire-insertion sockets; these required a #55 drill bit). The small switches used for the pulsers required that slots be cut with the wheel-cutter blade of a Dremel tool. Marks are provided on the switch pads for guide holes to be drilled at each end of the slots.

It was found convenient to mount the Display, 8-Bit Address Decoder, and A/D-D/A PADDLEs on the side of the breadboard away from the experimenter, while the Logic Switch and Pulser PADDLEs were plugged into the breadboard on the side nearest the experimenter (see photo 1). This accounts for the manner in which the PADDLEs were labeled in figure 7.

With this arrangement, switches and pulsers are close at hand and easy to manipulate, while the display is positioned to face the experimenter and the wire-insertion sockets and their associated jumpers are out of the way.

Once the circuit boards are etched, drilled, and tinned, the following steps provide the most systematic approach for assembly:

1. Spray-paint the component side of the board with enamel.
2. Label component side with transfer letters.
3. Spray labels with clear acrylic coating.
4. Insert wire jumpers; solder and trim leads.
5. Insert resistors; solder and trim leads.
6. Insert and solder IC sockets.
7. Insert and solder potentiometers.
8. Insert capacitors; solder and trim leads.
9. Using either wire-wrap posts or #24 gauge wire, mount breadboard-insertion pins so that they extend 0.3 inches below the board, solder, and trim flush on component side.
10. Insert and solder wire-insertion sockets.

Text continued on page 356

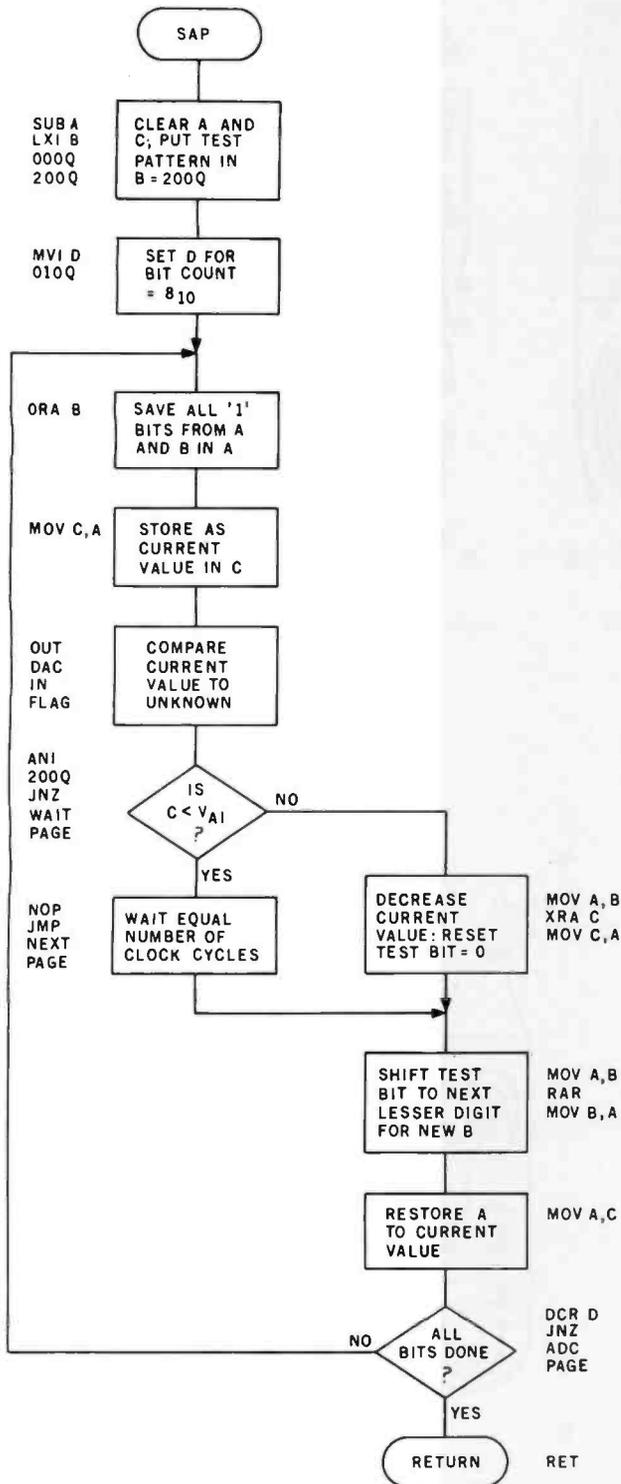
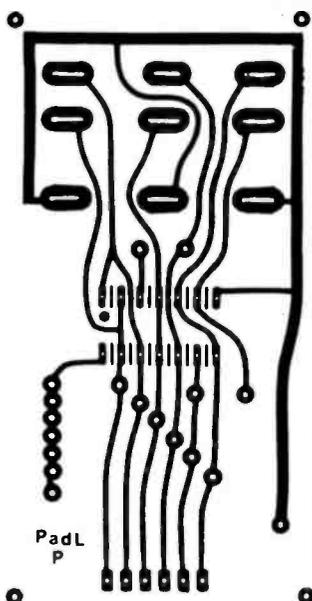
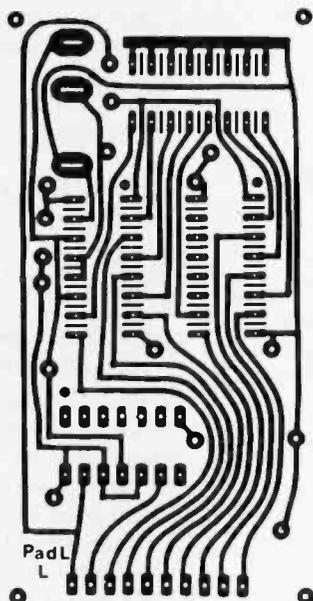


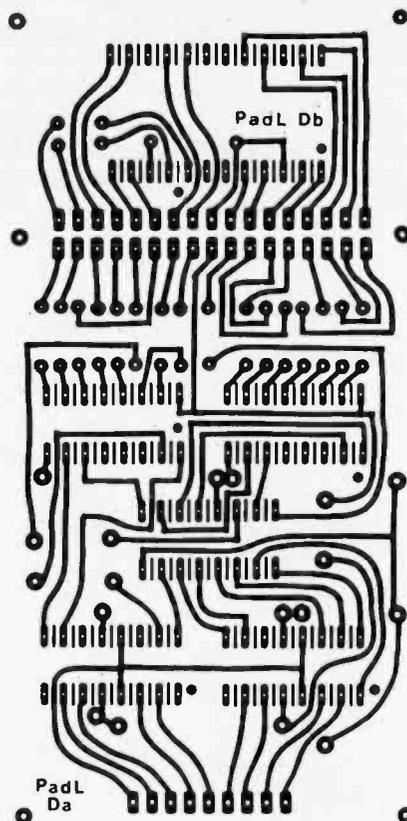
Figure 6: A flowchart of SAP, the successive-approximation program of listing 2. The 8080 code is shown with each flowchart step.



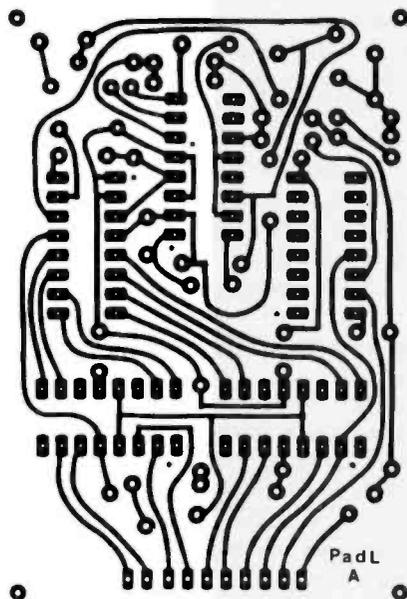
(a) Pulser PADDLE



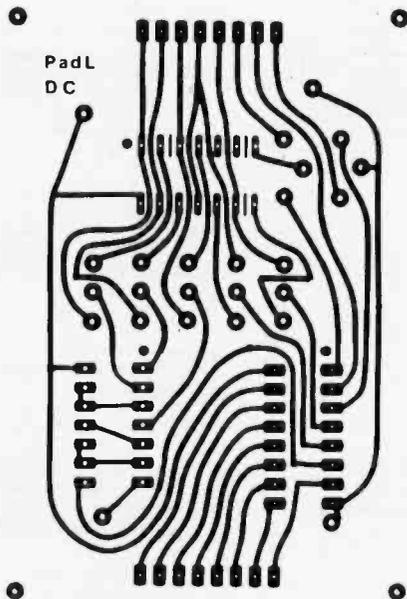
(b) Logic Switch PADDLE



(c) Display PADDLE

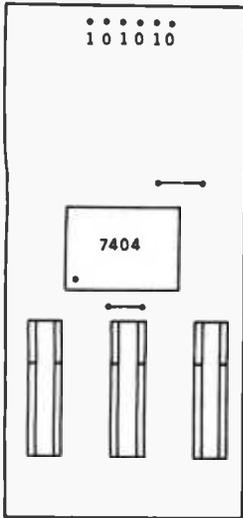


(d) A/D-D/A PADDLE

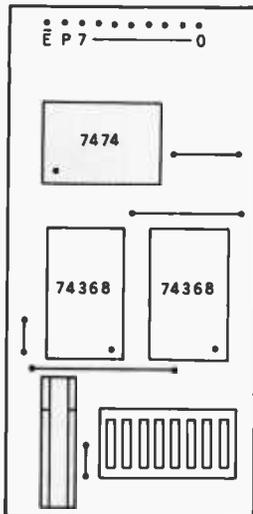


(e) 8-Bit Address Decoder PADDLE

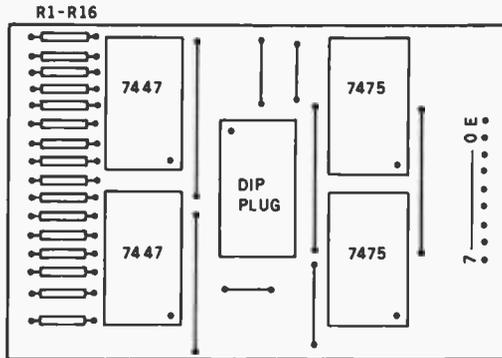
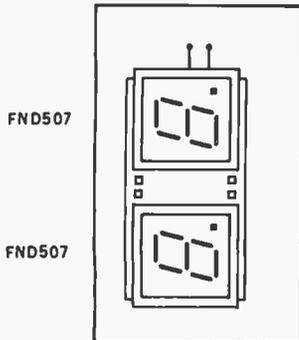
Figure 7: Full-size printed-circuit-board patterns for the five PADDLEs.



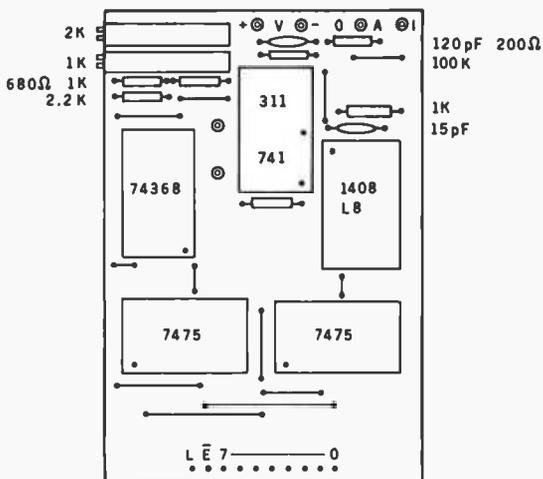
(a) PULSER PADDLE



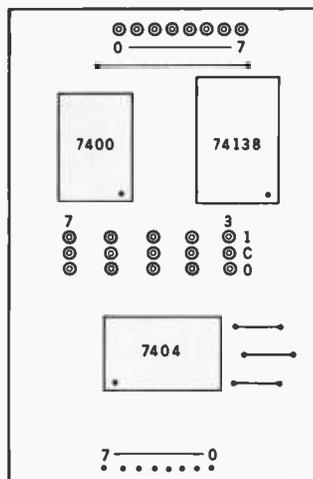
(b) LOGIC SWITCH PADDLE



(c) DISPLAY PADDLE



(d) A/D-D/A PADDLE



(e) ADDRESS-DECODER PADDLE

Figure 8: Component view of the individual PADDLES.

CLOSE OUT!



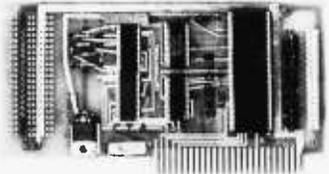
GTC-101 Terminals

We're overstocked on these powerful, reliable standard data terminals. The GT-101 is Z-80 based with standard printer port, user-settable clock, 8 user-programmable function keys and much more! Order Today! Limited Quantities.

Reg. \$999.00

Clearance Price Only **\$795**

NEW



CTA ADC-16C 16 Channel Variable A-D Board!

Can be used for Position/Pressure/Photo-electric/and Temperature Measurements, and as a computerized Volt/Ohm meter. Board is shipped with operating manual, software, and a test conductor. For use with Apple II/III.

Introductory Price **179⁹⁵**

NOTE: Soon To Be Available - CTA's new 16K Memory Board!

CTA COMPUTER TECHNOLOGY ASSOCIATES

118 Castellano
El Paso, Texas 79912
(915) 581-3500

Visa/MasterCard/Diner's Club Accepted.

TO ORDER: Send check, money order or credit card number and exp. date to Computer Technology Associates, 5812 Cromo Drive, Suite 102, El Paso, Texas 79912. Personal or company checks require two weeks to clear. Credit card users can call with card information.

SHIPPING: We ship terminals PREPAID by motor freight. Air and express delivery are available on all products.

There is no handling charge.

Pulser PADDLE: Total	\$5.93
1 7404	0.18
1 14-pin IC socket	0.20
3 Cherry Microswitch	1.85
Logic Switch PADDLE: Total	\$2.37
1 7474	0.35
2 74368	0.69
1 14-pin IC socket	0.20
2 16-pin IC socket	0.22
Display PADDLE: Total	\$7.87
2 7447	0.59
2 7475	0.49
2 FND 507	0.99
2 DIP plugs (16 pin)	0.70
5 16-pin IC sockets	0.22
1 24-pin IC socket	0.38
16 240-ohm, 1/4 W resistors	0.05
A/D-D/A PADDLE: Total	\$14.10
2 7475	0.49
1 74368	0.69
1 LM311	0.90
1 741	0.35
1 MC1408L8	5.75
5 16-pin IC sockets	0.22
6 wire insertion sockets	0.23
Resistors:	
1 680 ohm, 1/4 W	0.05
1 1 K, 1/4 W	0.05
1 2.2 k-ohm, 1/4 W	0.05
1 5.1 k-ohm, 1/4 W	0.05
1 100 k-ohm, 1/4 W	0.05
1 1 k-ohm potentiometer	1.35
1 2 k-ohm potentiometer	1.35
Device Code PADDLE: Total	\$7.17
1 7400	0.16
1 7404	0.18
1 74138	0.69
2 14-pin IC sockets	0.20
1 16-pin IC socket	0.22
24 wire insertion sockets	0.23

Table 2: Components necessary for each PADDLE and their approximate costs.

Listing 3: Program to log 256 points of an analog signal by calling SAP and then display the resultant conversions, used in conjunction with the PADDLE setup in figure 10.

```

LXI H      /INITIAL ADDRESS OF DATA TABLE
TABLE
PAGE
LAD, CALL  /CONVERSION SUBROUTINE
      SAP  /RETURN WITH VALUE IN C
PAGE
MOV M,C   /PUT POINT IN TABLE
INR L     /NEXT TABLE POSITION
JNZ      /LOGGED 256 POINTS?
LAD      /NO
PAGE
DISC, MOV A,M /YES:GET POINT FROM TABLE
      MVI D  /SET DELAY FOR DISPLAY
      IDH
STALL, OUT  /DISPLAY POINT
      DAC
      DCR D  /COUNTDOWN
      JNZ   /DELAY DONE?
      STALL /NO
PAGE
INR L     /NEXT TABLE POSITION
IMP      /ENDLESS DISPLAY
DISC
PAGE

```

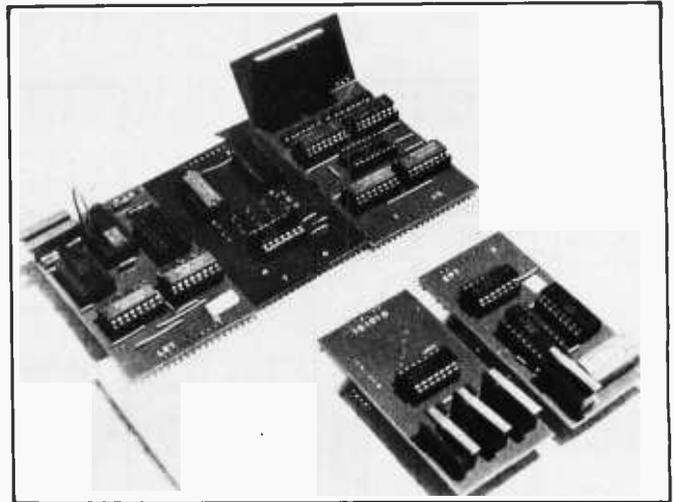


Photo 1: Complete PADDLEs mounted on a breadboard socket. Starting at bottom center and moving counter-clockwise: Pulser, Logic Switch, Display, 8-Bit Address Decoder, and A/D-D/A.

Text continued from page 353:

Table 2 lists the components necessary for each PADDLE module and their approximate costs.

Experiments Using PADDLES

This quintet of PADDLES defines a set of circuitry that is indispensable for most interfacing projects. Cost is minimal compared to the benefit derived from the modules. As stated above, usually only a few additional logic gates are required in order to use the PADDLES as peripheral devices. Although we leave their applications to the needs and imagination of the user, a few elementary applications are described here. We have already discussed how to implement the Logic Switch PADDLE as a vectored-interrupt device to enter an RST instruction.

A second application for a simple I/O circuit can be constructed using the Address Decoder, Display, and Logic Switch PADDLES as shown in figure 9. This circuit requires only four additional gates and an inverter for device-select-pulse generation. A program to test the circuit would contain a loop with instructions to receive input from the Logic Switch and send output to the Display.

A third application uses the A/D-D/A and Address Decoder PADDLES to log and display 256 points of a 4 V peak-to-peak sine wave (100 Hz, see figure 10). A main program and subroutine are given in listing 2 and listing 3. Note that the successive-approximation program of listing 2 uses a subroutine that is discussed under the A/D-D/A PADDLE. The conversion rate from analog to digital can be found by calculating the execution time per point of the log-analog-data program. With an 8080A microprocessor operating at 2 MHz, this time is calculated to be 0.41 ms per point. (Displaying this signal on an oscilloscope in an undistorted digital form requires the same rate of display as conversion; this is done by use of the D register as a delay counter in the display-conversion program.) ■

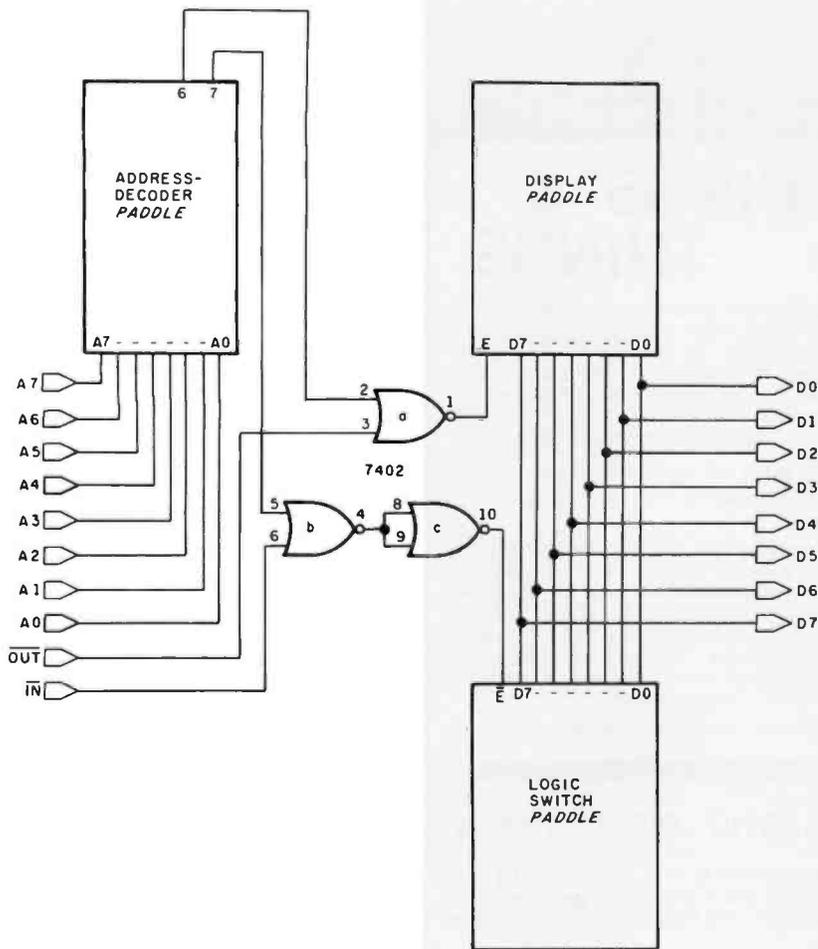


Figure 9: Configuring three PADDLEs as an I/O (input/output) device for an 8080-type system requires a single 7402 inverter.

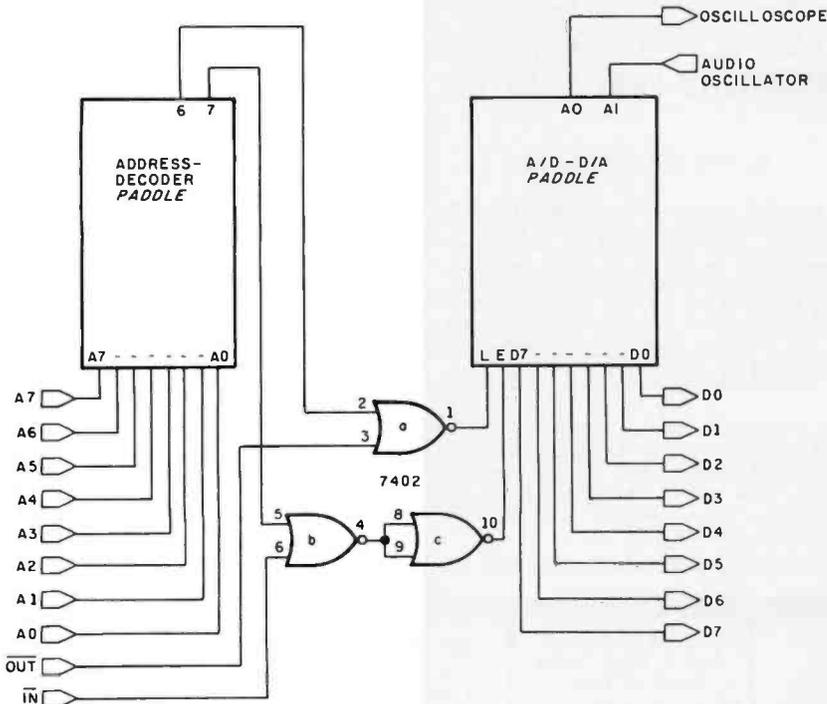
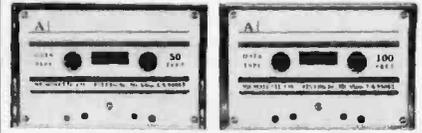


Figure 10: PADDLE configuration to convert the output of an audio oscillator to digital form and back to analog for display on an oscilloscope.

MICROSETTE CASSETTES



C-10 C-20
COMPUTER CASSETTES



C-60 C-90
AUDIO CASSETTES

Microsette, the undisputed industry leader in short cassettes for micro-computer applications also offers equally high grade audio cassettes at budget prices. Credit card buyers may phone (415) 968-1604.

LOOK AT OUR PRICES

Length	10 Pack	50 Pack
C-10	\$ 7.50	\$32.50
C-20	\$ 9.00	\$39.00
C-60	\$13.50	\$57.50
C-90	\$17.50	\$77.50

UPS shipment in Cont. USA incl.
We can not ship to P.O. Boxes

Length	Qty.	Price	Total
SUBTOTAL			
Calif. Cust. add Sales Tax			
TOTAL			

Check or money order enclosed
Charge to: Visa Master Card
Account No. _____

Expiration Date _____

SIGNATURE _____

MICROSETTE CO.
475 Ellis Street
Mt. View, CA 94043



META TECHNOLOGIES



26111 Brush Avenue, Euclid Ohio 44132
CALL TOLL FREE 1-800-321-3552 TO ORDER
IN OHIO, call (216) 289-7500 (COLLECT)

FILE BOX DISKETTE STORAGE SYSTEM



\$24⁹⁵ for 5 1/4" disks
\$29.95 . . . for 8" disks

MTC brings you the **ULTIMATE** diskette storage system, at an affordable price. Storing 50 to 60 diskettes, this durable, smoke-colored acrylic unit provides easy access through the use of index dividers and adjustable tabs. Unique lid design provides dust-free protection and doubles as a carrying handle.

'RINGS' & THINGS

Help prevent data loss and media damage due to improper diskette centering and rotation with the **FLOPPY SAVER™** reinforcing hub ring kit. 7-mil mylar rings install in seconds. Kit is complete with centering tool, pressure ring, 25 adhesive backed hub rings and instructions.

HUB RING KIT for 5 1/4" diskettes . \$10.95
REFILLS (50 Hub Rings) \$ 5.95

Protect your expensive disk drives and your valuable diskettes with our diskette drive head cleaning kit. The kit, consisting of a pair of special "diskettes", cleaning solution and instructions, can be used for 52 cleanings. Removes contamination from recording surfaces in seconds without harming drives.

CLEANING KIT for 5 1/4" drives . . . \$24.95

DISKETTES

Single Sided, Soft-Sector'd 5 1/4-inch,
(for TRS-80™) Mini-floppy

\$21⁹⁵ box of 10

These are factory fresh, absolutely first quality (no seconds!) mini-floppies. They are complete with envelopes, labels and write-protect tabs in a shrink-wrapped box.

PLAIN JANE™

DISKETTES
The Beautiful Floppy
with the Magnetic Personality™

Thousands of people have switched to this low-cost alternative. These quality diskettes are packaged in a plain white box . . . no fancy printing, fancy names or fancy labels, not even our own (labels cost money). Trust us.

PLAIN JANE™ Diskettes \$21.95
10 boxes of 10 (each box)\$21.50

VERBATIM'S PREMIUM DISKETTES AT
AFFORDABLE PRICES

DATALIFE™

Seven data-shielding improvements mean greater durability and longer data life. These individually, 100% error-free certified diskettes feature thicker oxide coating, longer-lasting lubricant, improved liner, superior polishing and more! Meets or exceeds IBM, Shugart, ANSI, ECMA and ISO standards. Reinforcing HUB RINGS help prevent data loss and media damage, reducing errors.

Buy the best . . . buy DATALIFETM.

VERBATIM DATALIFETM DISKETTES

5 1/4-inch (box of 10)
MD525-01 \$26.95
10 boxes of 10 (each box)\$25.95

8-inch FLOPPIES
Single-Density, FD34-1000 . . \$33.95
Double-Density, FD34-8000 . \$43.95

CALL FOR INFORMATION ON
OTHER PRODUCTS

MICROPARAPHERNALIA DISKETTES (box of ten)

5 1/4" PLAIN JANETM \$21.95
5 1/4" DATALIFETM MD 525-01 . . \$26.95
8" DATALIFETM FD34-1000 . . . \$33.95
8" DATALIFETM FD34-8000 . . . \$43.95

NEWDOS by APPARAT

NEWDOS/80 ★ SPECIAL \$129.95
NEWDOS + to
NEWDOS/80 UPGRADE CALL
NEWDOS + with ALL UTILITIES
35-track \$69.95
40-track \$79.95

BOOKS

TRS-80™ DISK
AND OTHER MYSTERIES . . \$19.95
MICROSOFT™ BASIC DECODED \$29.95
1001 THINGS TO DO WITH YOUR
PERSONAL COMPUTER . . . \$ 7.95

PLASTIC LIBRARY CASES (not shown)

An economical form of storage for 10 to 15 diskettes, and is suitable for your bookshelf! Case opens into a vertical holder for easy access.

5 1/4-inch diskette case \$3.50
8-inch diskette case \$3.95

Let Your TRS-80™ Test Itself With THE FLOPPY DOCTOR & MEMORY DIAGNOSTIC

by THE MICRO CLINIC

A complete checkup for your Model I. THE FLOPPY DOCTOR completely checks every sector of 35- or 40-track disk drives. Tests motor speed, head positioning, controller functions, status bits and provides complete error logging. THE MEMORY DIAGNOSTIC checks for proper write/read, refresh, executability and exclusivity of all address locations. Includes both diagnostics and complete instruction manual.
SYSTEM DIAGNOSTICS \$19.95

An improved version of the SYSTEM DIAGNOSTICS above. Designed for single or double density, 35-, 40-, 77-, or 80-track disk drives. Includes new and modified tests. Features THE FLOPPY DOCTOR, Version 3.0.
SYSTEM DIAGNOSTICS-V3 . . \$24.95

TRS-80 is a trademark of the Radio Shack Division of Tandy Corporation. DATALIFE is a trademark of VERBATIM. PLAIN JANE, AIDS-I, AIDS-III, CALCS-III, CALCS-IV, MERGE-III are trademarks of MTC.
©1981 by Metatechnologies Corporation, Inc.

**MOST ORDERS
SHIPPED WITHIN
ONE BUSINESS DAY**
Products damaged in
transit will be exchanged.

**PRICES IN EFFECT
April 1, 1981 THRU
April 30, 1981,**
Prices, Specifications,
and Offerings subject to
change without notice.

WE ACCEPT
• VISA
• MASTER CHARGE
• CHECKS
• MONEY ORDERS
• C.O.D.
8104

• Add \$3.00 for shipping
& handling
• \$3.00 EXTRA for C.O.D.
• Ohio residents add 6 1/2%
sales tax.

What's New?

PUBLICATIONS

UPTREND

UPTREND is written and designed to help owners of Personal Software's programs increase their productivity. It includes how-to articles on program usage, questions and answers, information on the programs themselves, and letters and interviews with program users. The publication is sent to owners of Personal Software's programs, and it is available at computer retail stores selling the company's products. Contact Personal Software Inc, 1330 Bordeaux Dr, Sunnyvale CA 94086, (408) 745-7841.

Circle 400 on inquiry card

1980 APL Users Meeting Proceedings

The proceedings of the October 1980 APL users meeting are available from I P Sharp Associates. The book is comprised of 52 papers read at the meeting. The subjects covered are APL resources, APL for financial applications and economic forecasting, international networks, personnel and record-handling systems, in-house APL timesharing services, APL techniques and programming tools, teaching APL, and more. The price is \$18 per copy. Contact I P Sharp Associates Ltd, Publications Department, 145 King St W, Toronto, M5H 1J8, Canada, (416) 364-5361. In the US, address I P Sharp Associates Inc, 1200 First Federal Plz, Rochester NY 14614, (716) 546-7270.

Circle 401 on inquiry card

Music and Microprocessors

Hal Chamberlin's Musical Applications of Microprocessors provides coverage of digital microprocessor-sound and music synthesis. This book discusses linear techniques for microprocessor applications, musical applications for 16-bit microprocessors, and all phases of waveform shaping and filtering. Waveform charts, nomographs, and sample control and generation programs written in BASIC are provided to inspire experimentation and application. It is published by Hayden Book Company Inc, 50 Essex St, Rochelle Park NJ 07662, (201) 843-0550. The cost is \$24.95.

Circle 402 on inquiry card

H H Smith Catalog



H H Smith Inc, a manufacturer of electronic components and hardware, has published Catalog 810 for design engineers and purchasing agents. Printed-circuit board supports, cable clamps, and spacers are among the items featured. Contact H H Smith Inc, 812 Snediker Ave, Brooklyn NY 11207, (212) 272-9400.

Circle 403 on inquiry card

Micro Media Magazine

This bimonthly magazine provides software reviews, graphic art, advertisements, articles, and more for the Heath H-8, -88, -89, and Zenith Z89 computers. The magazine comes in an interesting format: on a floppy disk.

Subscriptions are \$11.95 for a single issue and \$55 for a year. Micro Media supports its subscribers by making the magazine available in both Benton Harbor and Microsoft BASIC, as well as HDOS or CP/M disk formats. Contact Micro Media at POB 402286, Garland TX 75040, (800) 527-4830, ext 101; in Texas (800) 442-4884, ext 101.

Circle 404 on inquiry card

TRS-80 Users Software News

CIE People's Software News is free to TRS-80 users. The publication has news of the activities at People's Software, where public-domain software is distributed for a copying charge. The price for a cassette of programs is \$10.95. The current 5-tape library contains 206 programs, for \$54.75. Contact the Computer Information Exchange Inc, POB 159, San Luis Rey CA 92068, (714) 757-4849. Circle 405 on inquiry card

H-8 Programming for Beginners

This book, written by Don Inman, Ron Santore, and Bob Albrecht, is designed for Heathkit H-8 users. Computer terms are defined for beginners, and each chapter tests the reader's knowledge by challenging him or her to write a short program or subroutine. The book is a short programming course that explains assembly language and serves as an introduction to Benton-Harbor BASIC. It is available for \$8.95 from the Dillithium Press, 30 N W 23rd Pl, Portland OR 97210, (503) 243-1160.

Circle 406 on inquiry card

Software Buyer's Guide

The Official Software Buyer's Guide is published each January and July. It contains listings of software for business applications, word processing, operating systems, games, and general programs for many microcomputers. For information on space deadlines, advertising rates, and availability, contact OSBG, Listing Department, POB 18278, Reno NV 89511, (702) 356-8400.

Circle 407 on inquiry card

Where Do New Products Items Come From?

The information printed in the new products pages of BYTE is obtained from "new product" or "press release" copy sent by the promoters of new products. If in our judgment the information might be of interest to the personal computing experimenters and homebrewers who read BYTE, we print it in some form. We openly solicit releases and photos from manufacturers and suppliers to this marketplace. The information is printed more or less as a first-in first-out queue, subject to occasional priority modifications. While we would not knowingly print untrue or inaccurate data, or data from unreliable companies, our capacity to evaluate the products and companies appearing in the "What's New?" feature is necessarily limited. We therefore cannot be responsible for product quality or company performance.

What's New?

SYSTEMS

Small Business System from Systel



The REPORT/80 is a portable business system for less than \$10,000. It combines the 8085 and Z80 microprocessors, 64 K bytes of memory, a keyboard; a 12-inch, 80-column by 25-line video display, two 5-inch floppy-disk drives, a 9 by 7 dot-matrix printer, and two RS-232C serial ports in a single unit. CP/M is included. Systel offers a selection of business programs as an option. The Model 11 has a suggested retail price of \$8950, and includes two double-sided, double-density drives. The Model 15 has two double-sided, quad-density drives, and costs \$9950. For more information, contact Systel Computers Inc, 20370 Town Center Ln, Cupertino CA 95014, (408) 253-0992.

Circle 408 on inquiry card

6800/6809 Development Systems Can Offer 2-Megabyte Storage

The Scoutsystem development systems from SSB (Smoke Signal Broadcasting) are for 6800/6809 microprocessors. They provide 2 megabytes of floppy-disk storage and up to 64 K bytes of programmable memory. The series features a video display, dual 5- or 8-inch disk drives, plus SSB's Hunter debugging package, which allows memory, register, and stack contents to be inspected and changed. Software includes a macro-assembler that provides relocatable code. An MDOS conversion package permits files generated under it to be read by SSB's DOS68 or DOS69 and vice versa. A text editor and text processor are available. The EPROM (erasable programmable read-only memory) programmer can handle 1 K-, 2 K-, or 4 K-byte EPROMs. An optional in-circuit emulator allows the host system to be tied into the target system. The Scoutsystem series also contains a diagnostic routine for identifying failed integrated circuits. Prices for the Scoutsystem series range from under \$5700 to \$7745. Contact Smoke Signal Broadcasting, 31336 Via Colinas, Westlake Village CA 91362, (213) 889-9340.

Circle 409 on inquiry card

6809 Board for the Apple II

The Mill is a 6809 microprocessor board that plugs into the Apple II. It can be used in manufacturing or laboratory process-control monitoring and concurrent programming tasks. Users can run existing 6502 programs, 6809 programs, or any software reassembled for the 6809 from existing 6800 source code. In operation, the 6809 and 6502 run concurrently, with the 6809 acting as the bus master during the 6502's bus accesses. Typically, the 6809 commands 80% of the available bus time for memory accesses and data transfers. The 6502 can stop the 6809 for time-critical I/O operations. Sections of 6502 programs can be recoded into 6809 machine language. The FLEX operating system can be employed with the Mill. The Mill features directly addressable stacks and the position independence of code, and it allows the Apple II to be used in a multiprogramming mode. The Mill is available from Stellation Two, POB 2342, Santa Barbara CA 93120, for \$275.

Circle 411 on inquiry card

16 Megabytes of Storage on the QT

QT System+ can be used for accounting, word-processing, and scientific applications. It features a Z80 microprocessor, two 8-inch floppy-disk drives, a controller for double-sided, double-density 5- and 8-inch drives, and a Televideo 920C video terminal. There are 48 K bytes of dynamic programmable memory (expandable to 64 K bytes), a 2 K-byte monitor program and Disk BIOS (Basic I/O Subsystem) on an EPROM, two RS-232C ports, two parallel ports, a real-time clock, and the CP/M 2.2 or the MP/M operating systems.

The QT System+ comes in two versions. The 1-megabyte, single-sided, double-density system sells for \$4295. The 2-megabyte, double-sided, double-density unit is priced at \$4995. For complete details, contact QT Computer Systems Inc, 15620 S Inglewood Ave, Lawndale CA 90260, (800) 421-5150; in California (213) 970-0952.

Circle 412 on inquiry card

Systems from Zeda

The 520 series of portable microcomputers feature a Z80A microprocessor, a video display, floppy-disk drive, and detachable keyboard. The series can be powered by standard 110 VAC current, 12 VDC, or optional internal batteries. You can order your system with either a 5-, 9-, or 12-inch video screen (ie: the Models 525, 529, or 522, respectively). The series has 48 K bytes of programmable memory, 2 K bytes of video programmable memory, a double-density floppy-disk-drive controller, and a 200 K-byte drive. A 400 K-byte quad-density drive is available. Up to three drives can be added to the system. A Centronics printer port, an RS-232C serial port, and a bar-code-reader port for a Hewlett-Packard HEDS-3000 digital wand are provided. The CP/M-compatible

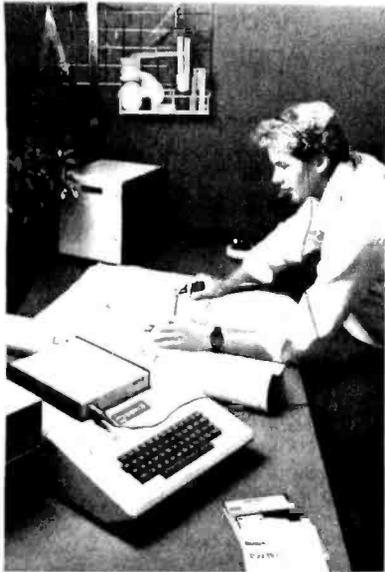


ZEDOS operating system has all the CP/M and CDOS+ system calls, plus ZEDOS calls. A status line displays a program counter; disk-error information; a low-power indicator; a type-ahead buffer; system idle, screen frozen, and printer activated flags; and disk status. The prices are \$4495 for the 522, \$3995 for the 525, and \$4195 for the 529. Contact Zeda Computers International Ltd, 1662 W 820 North, Provo UT 84601, (801) 377-9948.

Circle 410 on inquiry card

What's New?

PERIPHERALS



Voice-Entry Terminal for the Apple II

The VET/2 voice-entry terminal plugs into any slot of a 48 K-byte Apple II. A direct keyboard link allows the user to choose keyboard or voice input at any time. Once a word has been entered into the program, whenever it is spoken, the function is performed. The VET/2 is supplied with preprocessor, interface board, software with demonstration programs, noise-canceling headset microphone, and a user's manual. The price is \$895 from Scott Instruments, 815 N Elm, Denton TX 76201, (817) 387-9514.

Circle 413 on Inquiry card

Connect Your Selectric to a Computer

The Escon interface system includes all the electronics, connectors, and instructions necessary to convert an IBM Selectric typewriter into an output printer. Units have been designed for S-100 systems, and RS-232C serial, parallel, and IEEE-488 interfaces. No drilling or modification is required. The typewriter can still be used in a normal fashion, and its eligibility for IBM warranty and service will not be affected. Printing speed is 15 cps (characters per second), which is approximately 160 words per minute. Prices range from \$595 to \$675. For details, contact Ipx International Inc, 16140 Valerio St, Van Nuys CA 91406, (213) 781-0020.

Circle 414 on Inquiry card

Floppy-Disk Drives from Commodore

The 8060 series of 8-inch floppy-disk drives includes the CBM 8062, which can store 3.2 megabytes of data, and the CBM 8061, which handles up to 1.6 megabytes. The 8061 reads and writes one side of the disk, while the 8062 handles both sides. The drives and operating system are compatible with the IBM 3740 format and Commodore's other drives. For more information, contact Commodore Business Machines Inc, 950 Rittenhouse Rd, Norristown PA 19403, (215) 666-7950.

Circle 415 on inquiry card



Video Terminal from Perkin-Elmer

The Perkin-Elmer Model 550S is a block mode/editing video-display unit. Three modes allow for conversational timesharing, transaction processing, and test manipulation or software development. The 550S offers an optional second page of scrolling memory. The 24-line screen windows into 48 lines by 80 columns of text. The standard keyboard has 83 keys, including a numeric pad and four program function keys. A serial printer port is standard, as well as automatic on/off host control over terminal block transmissions and half intensity, blink, nondisplay, and protected features. Transmission types included are: send all, send unprotected only, send line, send page, and send from home to stop code. The 550S is priced at \$1189. Contact Perkin-Elmer, Terminals Division, 360 Rt 206 South, Flanders NJ 07836, (201) 229-6800.

Circle 416 on inquiry card



Pitch Analyzer for Speech Synthesis

The Visi-Pitch extracts and measures vocal pitch in real time. The device provides visual or numerical descriptions of pitch variability, speech rhythm, and intonation contours. It can be used in the testing of speech synthesis and recognition systems, and in speech therapy. The Visi-Pitch interface can transfer frequency or period information to 8-bit parallel inputs. The period data is generated after each pitch period, and frequency data is generated every 0.5 seconds. The data output is 3-state 8-bit parallel. The price for the unit is \$2410 from Kay Elemetrics Corporation, 12 Maple Ave, Pine Brook NJ 07058, (201) 227-2000.

Circle 417 on Inquiry card

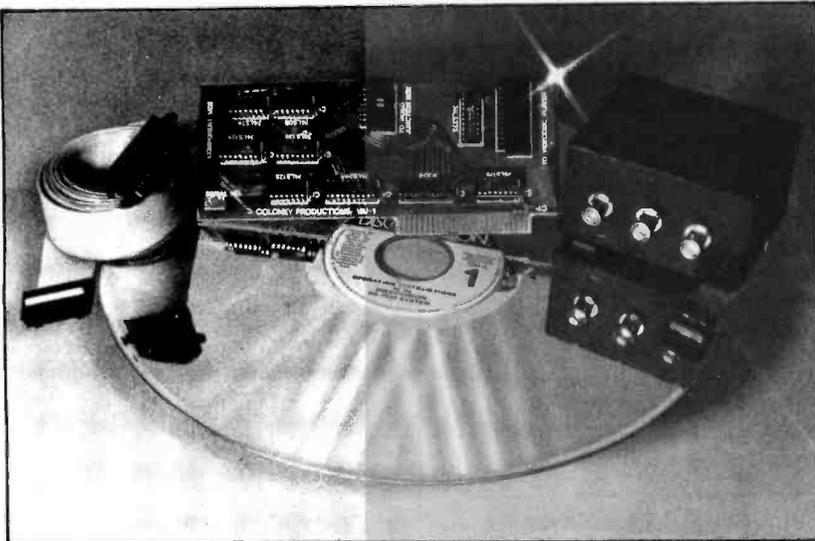
16 K-Byte Memory Card for the Apple II

RAMCard provides the Apple II 48 K computer with 16 K bytes of programmable memory. It's compatible with Microsoft's SoftCard. It can be used with all software available for the SoftCard, but it cannot be used in addition to the Apple Language Card. The price of the RAMCard is \$195. For more details, contact Microsoft Consumer Products, 400 108th Ave NE, Suite 200, Bellevue WA 98004, (206) 454-1315.

Circle 418 on Inquiry card

What's New?

PERIPHERALS



Videodisk-to-Apple Interface

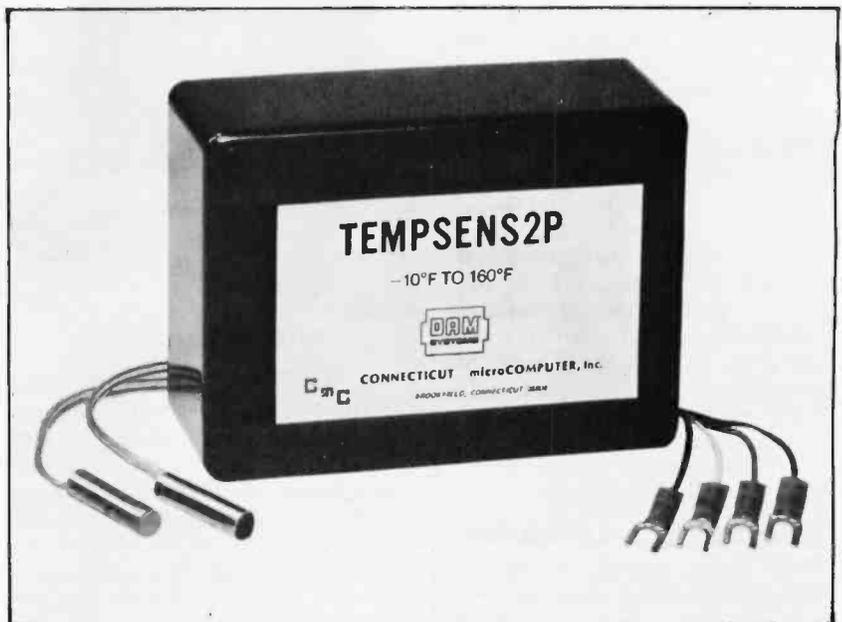
The Coloney VAI-1 interface board fits inside the Apple and allows complete control of the DiscoVision industrial videodisk player. In addition, the package provides circuitry to switch computer- or disk-generated video on a single television monitor. The package sells for \$525, and includes a manual, a controller card, junction box for video connections, control subroutines in assembly language and Pascal, cables, and a demonstration program. For additional information, contact Coloney Productions, 1248 Blountstown Hwy, Tallahassee FL 32304, (904) 575-0691.

Circle 419 on inquiry card

Microcomputer-Compatible Temperature Probes

Tempsens provides direct temperature input for a variety of microcomputers, including the PET, the Apple II, and the TRS-80. Operating within a temperature range of -24°C to 72°C (-10°F to $+160^{\circ}\text{F}$), each Tempsens module provides two temperature probes to the CmC (Connecticut microComputer) AIM16 analog input module using a CmC MANMOD1. The MANMOD1 will accept input from up to 8 Tempsens modules, for a total of 16 individual probes. The suggested retail price of a 2-probe Tempsens is \$49.95. Contact Connecticut microComputer Inc, 34 Del Mar Dr, Brookfield CT 06804, (203) 775-4595.

Circle 420 on inquiry card



Light Pen for OSI Computers

The L C S Light Pen Kit designed for OSI (Ohio Scientific) computers features a coiled cord and an easily disconnected plug. The light pen is manufactured by Lewis Computer Systems, and is distributed by Faragher Associates Inc, 7635 W Bluemound Rd, Milwaukee WI 53213, (800) 558-0870. The suggested list price is \$29.95.

Circle 421 on inquiry card

Color-Graphics Board for Heath Microcomputers

The HA-8-3 color-graphics board can be used with the Heath H-8 and All-In-One computers. The board uses a TI-9918 color video-display-generator integrated circuit. An AY-3-8910 programmable sound-generator circuit is also included. Four X,Y joystick consoles can be used with the board; each console has 4 bits of parallel I/O.

A socket is provided for an AMD-9511 arithmetic processor circuit. The HA-8-3 can be used with most video monitors as well as other video accessories utilizing NTSC composite color video. Demonstration software on a 5-inch floppy disk is included. The board sells for \$395. Contact Heath Company, Department 350-590, Benton Harbor MI 49022, (616) 982-3210.

Circle 422 on inquiry card

What's New?

MISCELLANEOUS

This Black-Hole Diode Is User-Transparent



Another new addition in the small-components market is the 7N-∞ BHD (black-hole diode). This device has two inputs and no output. Care must be taken to shield this component appropriately or it may absorb the unit it is placed in. The 7N-∞ will accept any voltage or current value. It is useful for GI (garbage-in) applications. Due to the light-absorption qualities of the device, we could not provide a photograph. Contact Spatial Regression Ltd, POB 463, Paulborough NH 03458.

Circle 423 on inquiry card

Software for the Hayes Micromodem II

Datacomm is a data-communications-software package for use with the Hayes Micromodem II for Pascal-equipped Apple II microcomputers. Datacomm consists of a terminal program that allows data and program exchange. It uses the Apple's Pascal routines for ease and accuracy, and Hayes Micromodem II routines are used so that a programmer can include data-communications commands in his or her Pascal program. Datacomm is available in retail computer stores for \$50. Contact Hayes Microcomputer Products Inc, 5835 Peachtree Corners E, Norcross GA 30092, (404) 449-8791.

Circle 424 on inquiry card

Low-Power 16 K-Byte Memory Board for S-100 Systems

This 16 K-byte programmable memory board for S-100-bus systems uses 650 mA at +5V, 90 mA at +12V, or 16 mA at -5V. Each 4 K-byte block is addressable to any 4 K boundary. The board uses NEC (Nippon Electric Company) UPD 410 D integrated circuits. This static memory board costs \$350 in kit form, or \$385 assembled. Contact Shell Electronics Company, M/S 1429, Sun Valley CA 91352, (213) 767-5597.

Circle 425 on inquiry card

S-100 Error-Correcting Board

This 4 MHz S-100 error-correcting board monitors 64 K bytes of existing system programmable memory and intervenes to correct bus data before it is accepted by the microprocessor. The board corrects 1-bit memory errors and flags all 1- or 2-bit errors. All operations are performed through on-board hardware. The board immediately corrects memory problems, and latched displays show the address and bit in error. The price is \$1295 from Correlation Systems, 81 Rockinghorse Rd, Rancho Palos Verdes CA 90274.

Circle 426 on inquiry card

Z80 Monitor In an EPROM

SSM Microcomputer Products has a Z80 monitor in a single-voltage 2716 EPROM. Supporting SSM's CB2 Z80 microcomputer board, the monitor allows operators to display, substitute, or fill memory; perform hexadecimal arithmetic; establish two program breakpoints; set and examine registers; assign I/O devices; and input and output data to or from a port. The monitor can scan its memory and set its stack to avoid replacement or reprogramming of the EPROM. Documentation and software listings are provided with the monitor, which is priced at \$89. Contact SSM Microcomputer Products, 2190 Paragon Dr, San Jose CA 95131, (408) 946-7400.

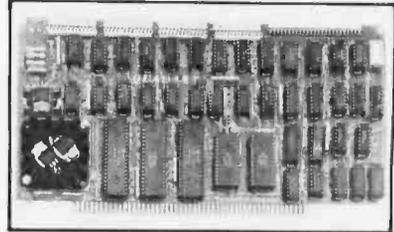
Circle 427 on inquiry card

Apple II Display Board

The Apple II Display Board has a run-stop, single-step switch that simplifies identification of shorted lines between address or data bits and shows individual steps for teaching computer logic. The board has 16 address LEDs (light-emitting diodes), 8 data LEDs, and 1 ready LED. All lines are buffered. The board sells for \$49.95 assembled and tested, \$42.95 for the kit, and \$25.95 for the bare board. Contact John Bell Engineering, POB 338, Redwood City CA 94064, (415) 367-1137.

Circle 428 on inquiry card

Serial-Communications Card for S-100 Systems



Cromemco's Quadart serial-communications S-100 interface card has four serial channels. Any channel can support asynchronous or synchronous byte- or bit-mode communication protocols under software control. Handshaking is provided. The Quadart can connect an S-100 microcomputer and an IBM-type machine using Bisync or SDLC protocol. A loopback feature provides the capability to connect data from one channel or modem to another, or allows any modem/channel combination to be used. Data rates range from 0 to 300 k bps (bits per second). The interface supports the interrupt structure of the Z80A microprocessor. The Quadart has real-time clocking capability. Control for the board is from the C-Bus provided by Cromemco's Model IOP processor computer. The Quadart serial-communications board is available for \$595. The IOP costs \$695. For information, contact Cromemco Inc, 280 Bernardo Ave, Mountain View CA 94043, (415) 964-7400.

Circle 429 on inquiry card

WordCheck Spots Misspellings In Documents and Letters

WordCheck interacts with Word-Pro 3 or 4 word-processing programs and checks every word for spelling or typographical errors. The program contains approximately 2000 of the most commonly used words and suffixes. Words that do not match this list appear on the screen. If you wish, these words can then be added to a 1000-word auxiliary spelling list. WordCheck is available for CBM and PET 32 K-byte microcomputers with floppy-disk drives. The list price is \$200 from Micro Computer Industries Ltd, 1520 E Mulberry, Suite 110, Fort Collins CO 80524, (303) 221-1955.

Circle 430 on inquiry card

What's New?

MISCELLANEOUS



Copy Stands for Computer Terminals

The Keyboard Companion copy stands keep work directly in front of the operator. They fit most terminals with detachable keyboards, including the Apple II. The units can support a telephone book and other heavy reference manuals or manuscripts. Installation is quick and easy. Prices begin at \$19.95 for the 16-inch model. For information, contact PKay Corporation, POB 11463, Costa Mesa CA 92627, (714) 548-2081.

Circle 431 on inquiry card

Zilog's New Microcomputer Systems

The MCZ 2/19 features a Z80A microprocessor, 64 K bytes of programmable memory, and 2.4 megabytes of floppy-disk storage that can be expanded to 4.8 megabytes with additional disk drives. The MCZ 2/49-1 system includes the MCZ 2/19 plus a video-display terminal, Zilog's RIO 3 operating system, and COBOL or BASIC. Zilog also has PLZ and a variety of business-application software packages available. In 50-unit quantities, the MCZ 2/49-1 costs \$5890, and the MCZ 2/19 is \$5270. For details, contact Zilog, 10340 Bubb Rd, Cupertino CA 95014, (408) 446-4666.

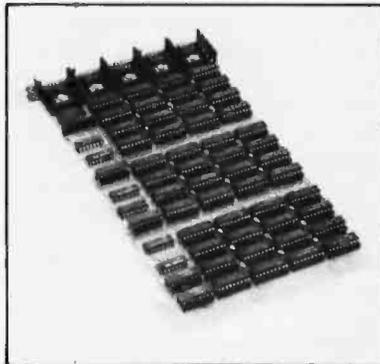
Circle 432 on inquiry card



Noise-Emitting Diode from LOUD

The 3N120DB NED (noise-emitting diode) is a new development in indiscreet electronics. It is pictured in a DO-4 case. It is a low-voltage, high-power device with a +3dB signal-to-noise ratio. The NED is available from LOUD Electronics, POB 463, Wheelborough NH 03458.

Circle 433 on inquiry card



Memory Board for SS-50 Bus Works with 1-Megabyte Memory Systems

A 24 K-byte static programmable memory board for SS-50 bus systems, the M24SS is available in 8 K-, 16 K-, and 24 K-byte configurations. The board is organized in 8 K-byte segments that can be located at any 8 K-byte boundary of a 64 K-byte memory space. The board uses standard 2114 integrated circuits. Access time is 300 ns. The 8 K-byte configuration is \$199.95, the 16 K- is \$349.95, and the 24 K- is \$499.95. A memory expansion kit is available for \$139.95. For complete details, contact Percom Data Company, 211 N Kirby, Garland TX 75042, (800) 527-1592; in Texas (214) 272-3421.

Circle 434 on inquiry card

Control AC Circuit Devices from Your Apple II

This I/O (input/output) interface board for the Apple II can operate up to 256 BSR System X-10 AC control modules. Input communications come from the X-10 command console and temperature and security input modules, which will soon be available from Intelligent Control Systems. On-board software is provided to handle the AC I/O. The software also coordinates the background schedule-control process and sets, reads, and displays the real-time clock. Four selectable interrupt rates allow the simultaneous running of machine-language programs in the background and other programs in foreground. A rechargeable battery powers the clock when the Apple is off. The price is \$185 from Intelligent Control Systems Inc, POB 14571, Minneapolis MN 55414, (612) 699-4342.

Circle 435 on inquiry card

Multitasking System for Dynabyte 5000 Microcomputers

DOS Level 4 is a multitasking operating system for Dynabyte's Series 5000 microcomputers. This CP/M- and MP/M-compatible system is available on all Dynabyte microcomputers. It can handle up to 8 terminals and 16 printers, and any single terminal can run up to 8 simultaneous jobs. Any printer can be accessed from any terminal, and each terminal can have or share a single system spooler. Memory capacity is 400 K bytes.

DOS Level 4 supports MBASIC, CBASIC, COBOL, FORTRAN, PL/I, and Pascal. The package includes interfacing software, a driver for a modem, and a utility to help programmers create interface drivers for special peripherals. For information, contact Dynabyte Inc, 115 Independence Dr, Menlo Park CA 94025, (800) 227-8300; in California (415) 329-8021.

Circle 436 on inquiry card

What's New?

MISCELLANEOUS

Release Wire Ties



Courtesy Plastics has wire ties that feature release levers molded into locking heads. Squeezing this lever allows the tie to be adjusted or removed without damaging it. The tie can be reused later. These ties may be installed by hand or machine. They come in sizes for bundles up to 5 cm (2 inches) in diameter. The Release Wire Tie has a tensile strength of 50 lbs. For complete details, contact Courtesy Plastics, 250 Alice St, Wheeling IL 60090, (312) 541-7900. Circle 437 on inquiry card

Apple Users' Work Collected in Catalog

The Special Delivery Software Catalog program offers a selection of user-written programs for the Apple computer. This catalog program is designed by Apple to encourage people outside the company to develop software and to make their applications programs available to other Apple users. The first catalog contains 12 programs, including a personal-finance manager, a BASIC teaching program, stepwise multiple regression, programs for learning geometry and measurement, games, a Pascal animation package, a Pilot animation program, electronic music, and a US geography package. Software prices are in the \$35 to \$150 range. Apple plans to update the catalog three times annually. To order the free catalog or the software from it, call (800) 538-3088; in California call (800) 662-9256. To submit programs for evaluation by Apple, write to Special Delivery Software, 10260 Bantley Dr, Cupertino CA 95014. Circle 438 on inquiry card

Color Graphics Printer

The Model IS8001 is a color graphics printer produced by PrintaColor Corporation. The device contains a microprocessor and features a twelve-nozzle, three-color ink-jet printhead that can print seven colors using two- or three-color overlays. The print head has a resolution of 100 dots per inch. The microprocessor enables the unit to present minimal burden to the host computer. The IS8001 can print on 14 $\frac{1}{8}$ -inch paper with 70 characters per line. For further details on this \$6000 color printer, contact PrintaColor Corporation, 5965 Peachtree Corners E, Norcross GA 30071, (404) 448-2675.

Circle 439 on Inquiry card

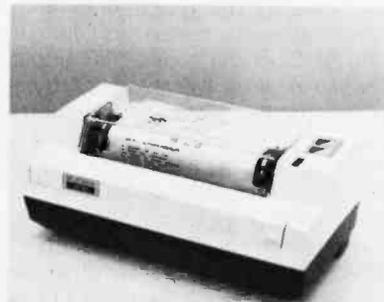


Touch-Sensitive Kits for Video Displays

Interaction Systems Inc's touch-sensitive add-on kits can be attached to any 12- or 15-inch (diagonal) video screen. Data can be entered on the screen by touching the appropriate area of the screen. The kits utilize a capacitance-sensitive faceplate, which is mounted in front of the video screen. Software and firmware allow the computer to identify and interpret the changes in capacitance. The faceplate interface uses a Z80 microprocessor. Custom configurations are available. The kits are priced under \$300 in OEM (original equipment manufacturer) quantities. Contact Interaction Systems Inc, 24 Munroe St, Newtonville MA 02160, (617) 244-6825.

Circle 440 on Inquiry card

Inexpensive Dot-Matrix Printer



The GP-80M is an 80-column, 5 by 7 dot-matrix printer having an upper- and lowercase ASCII (American Standard Code for Information Interchange) set, double-width characters, and dot graphics modes. The print-head life is 30 million characters. Print speed is 30 cps (characters per second), with original-plus-two copies capabilities and adjustable tractors to accommodate paper widths up to 8 inches. It measures 171 by 328 by 127 mm (7 by 13 by 5 inches) and weighs 2.5 kg (5 $\frac{1}{2}$ lbs). Parallel and serial interfaces are available. The suggested retail price is \$425. Contact Watson, Burton, and Associates, Port POB 122, Yokohama 231-91, Japan, Telex 3822596.

Circle 441 on Inquiry card

Plug Centronics 737 Printer into the H89/Z89

This interface board allows the Centronics 737 printer to be used with the Heath/Zenith H89/Z89 microcomputer. It plugs into either machine's internal bus, and can use any of the four decoded I/O ports. The HDOS device driver provides access to the printer's features, which include underscoring; elongated, proportional, condensed, or standard print fonts; sub- and superscripting; backspace; and half or full, forward or reverse line feeds. The interface and HDOS device driver together are \$64.95. Separately, the driver is \$14.95, and the interface is \$54.95. Order from FBE Research Company Inc, POB 68234, Seattle WA 98168.

Circle 442 on Inquiry card

What's New?

MISCELLANEOUS

Universal Peripheral Controller for the Z8000

Zilog's Z8090 Universal Peripheral Controller (Z-UPC) is designed for distributed processing and multitasking applications. The Z-UPC does arithmetic tasks, translation and formatting of data, and controls I/O (input/output) devices. It features 2 K bytes of internal ROM (read-only memory), externally expandable from 2 to 4 K. Also included is a 256-byte register file, three programmable 8-bit I/O ports, two counter/timers, and six levels of internal prioritized interrupts. The device is offered in four other versions, and all are priced at \$117.36 each, in sample quantities of 10 to 99. For additional details, contact Zilog, 10340 Bubb Rd, Cupertino CA 95014, (408) 446-4666.

Circle 443 on inquiry card

Atari 400 and 800 Screen Printer

The Macrotronics screen-printer package enables users to print an Atari 400's or 800's screen display onto a Trendcom 200 or IDS 440G Paper Tiger printer. Text, graphs, and drawings can be printed, and the image can be printed in gray-scale, black-and-white, and reversed image. LPRINT and LIST"P:" commands are used to print. The package includes a connector assembly with a cable and a 3 K-byte auto-loading program on floppy disk and cassette. Listings of sample programs are included in the user's manual. The package is priced at \$139, from Macrotronics Inc, 1125 N Golden State Blvd, Suite G, Turlock CA 95380, (209) 667-2888.

Circle 444 on Inquiry card

Novation Has LSI Modem Modules

These modem modules can operate at rates up to 1200 bps (bits per second) and are designed for building-block applications within computers or terminals. The modules can provide Bell 202 half-duplex, Bell 103 answer/originate, CCITT European Standards V.21 or V.23, ViewData European Network, and interface with the deaf teletypewriter (TTY) network. Contact Novation, 18664 Oxnard St, Tarzana CA 91356, (213) 996-5060.

Circle 445 on inquiry card



Extremely Fast Schottky PROMs

Using a titanium/tungsten technique, Monolithic Memories Inc has developed a series of fast Schottky 1 K- and 2 K-bit bipolar PROMs (programmable read-only memories). These devices use a programming technique that doesn't require a separate programming pin. Available in 256- by 4-bit, and 516- by 4-bit configurations, the PROMs feature PNP inputs for low-input current, full Schottky clamping, and three-state or open-collector outputs. They operate

at 45 ns for commercial and 55 ns for military devices. In lots of 100, each 63S140/1 commercial 1 K-bit PROM costs \$5; the military 53S140/1 is \$7.50. In similar quantities, the 2 K-bit PROMs are \$7.50 and \$11.25 each. Contact Monolithic Memories Inc, 1165 E Arques Ave, Sunnyvale CA 94086, (408) 739-3535.

Circle 446 on inquiry card

Fujitsu America's 8-Inch Winchester Disk Drives

The Model 2311 8-inch Winchester disk drive stores 48 megabytes and the Model 2312 84 megabytes; both feature a 20 ms access time. The 2311 uses two hard disks for storage, and the 2312 stores its 84 megabytes on four disks, utilizing 589 cylinders at 20 K bytes per track. An SMD interface with data-separation circuitry and internally selectable fixed- and variable-length sector formats are provided. The price of the 48-megabyte 2311 is \$3195 in OEM (original equipment manufacturer) quantities of 100, and the 84-megabyte 2312 drive is \$3795 in the same quantities. The Fujitsu Model 2301 floppy-disk drive stores 11.7 megabytes and is priced at \$1660 in OEM quantities of 100. The 2302 floppy-disk drive stores 23.4 megabytes and is priced at \$2095 in OEM quantities. For additional information, contact Fujitsu America Inc, 2945 Oakmead Village Ct, Santa Clara CA 95051, (408) 727-4300.

Circle 448 on Inquiry card

TI Extended BASIC and Memory Expansion Unit

TI Extended BASIC is an expanded version of the resident BASIC in Texas Instruments' TI-99/4 microcomputer. It features ACCEPT AT and DISPLAY AT statements, sprites (programmable moving objects), subprograms, and error-handling functions. Multiple statements can be written on the same line with tail-end remarks. Complex IF...THEN...ELSE statements can also be written.

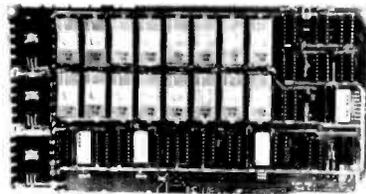
The Memory Expansion Unit is exclusively designed for use with Extended BASIC or UCSD Pascal, Version IV, which is newly available. The unit adds 32 K bytes of programmable memory to the 16 K bytes resident in the TI-99/4. For more information, contact Texas Instruments Inc, Consumer Relations, POB 53, Lubbock TX 79408, (800) 858-4565; in Texas (800) 692-4279.

Circle 447 on Inquiry card

DIGITAL RESEARCH COMPUTERS

(214) 271-3538

32K S-100 EPROM CARD NEW!



\$74.95
KIT

USES 2716's
Blank PC Board - \$34
ASSEMBLED & TESTED
ADD \$30

SPECIAL: 2716 EPROM's (450 NS) Are \$11.95 EA. With Above Kit.

KIT FEATURES:

1. Uses +5V only 2716 (2Kx8) EPROM's.
2. Allows up to 32K of software on line!
3. IEEE S-100 Compatible
4. Addressable as two independent 16K blocks.
5. Cromemco extended or Northstar bank select.
6. On board wait state circuitry if needed.
7. Any or all EPROM locations can be disabled.
8. Double sided PC board, solder-masked, silk-screened.
9. Gold plated contact fingers.
10. Unselected EPROM's automatically powered down for low power.
11. Fully buffered and bypassed.
12. Easy and quick to assemble.

32K SS-50 RAM

\$379.00 KIT

For 2MHZ
Add \$10

Blank PC Board
\$50

For SWTPC
6800 - 6809 Buss

Support IC's
and Caps
\$19.95

Complete Socket Set
\$21.00

Fully Assembled,
Tested, Burned In
Add \$30

NEW!

At Last! An affordable 32K Static RAM with full 6809 Capability.

FEATURES:

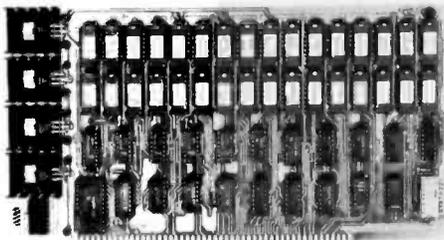
1. Uses proven low power 2114 Static RAMs.
2. Supports SS50C - EXTENDED ADDRESSING.
3. All parts and sockets included.
4. Dip Switch address select as a 32K block.
5. Extended addressing can be disabled.
6. Works with all existing 6800 SS50 systems.
7. Fully bypassed. PC Board is double sided, plated thru, with silk screen.

16K STATIC RAM KIT-S 100 BUSS

PRICE CUT!

\$199.95
KIT

FOR 4MHZ
ADD \$10



KIT FEATURES:

1. Addressable as four separate 4K Blocks.
2. ON BOARD BANK SELECT circuitry (Cromemco Standard!) Allows up to 512K on line!
3. Uses 2114 (450NS) 4K Static Rams.
4. ON BOARD SELECTABLE WAIT STATES
5. Double sided PC Board, with solder mask and silk screened layout. Gold plated contact fingers
6. All address and data lines fully buffered.
7. Kit includes ALL parts and sockets.
8. PHANTOM is jumpered to PIN 67
9. LOW POWER: under 1.5 amps TYPICAL from the +8 Volt Buss
10. Blank PC Board can be populated as any multiple of 4K.

BLANK PC BOARD W/DATA-\$33
LOW PROFILE SOCKET SET-\$12
SUPPORT IC'S & CAPS-\$19.95
ASSEMBLED & TESTED-ADD \$35

**OUR #1 SELLING
RAM BOARD!**

16K STATIC RAM SS-50 BUSS

PRICE CUT!

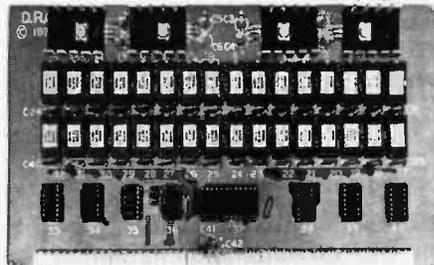
\$195 KIT

FULLY STATIC!

FOR 2MHZ
ADD \$10

FOR SWTPC
6800 BUSS!

ASSEMBLED AND
TESTED - \$35



KIT FEATURES:

1. Addressable on 16K Boundaries
2. Uses 2114 Static Ram
3. Fully Bypassed
4. Double sided PC Board. Solder mask and silk screened layout
5. All Parts and Sockets included
6. Low Power: Under 1.5 Amps Typical

BLANK PC BOARD—\$35 COMPLETE SOCKET SET—\$12
SUPPORT IC'S AND CAPS—\$19.95

NEW! STEREO! S-100 SOUND COMPUTER BOARD NEW!

At last, an S-100 Board that unleashes the full power of two unbelievable General Instruments AY3-8910 NMOS computer sound IC's. Allows you under total computer control to generate an infinite number of special sound effects for games or any other program. Sounds can be called in BASIC, ASSEMBLY LANGUAGE, etc.

KIT FEATURES:

- TWO GI SOUND COMPUTER IC'S
 - FOUR PARALLEL I/O PORTS ON BOARD
 - USES ON BOARD AUDIO AMPS OR YOUR STEREO.
 - ON BOARD PROTO TYPING AREA.
 - ALL SOCKETS, PARTS AND HARDWARE ARE INCLUDED.
 - PC BOARD IS SOLDERMASKED, SILK SCREENED, WITH GOLD CONTACTS.
 - EASY QUICK AND FUN TO BUILD WITH FULL INSTRUCTIONS
 - USES PROGRAMMED I/O FOR MAXIMUM SYSTEM FLEXIBILITY.
- Both Basic and Assembly Language Programming examples are included.

SOFTWARE:

SCL™ is now available! Our Sound Command Language makes writing Sound Effects programs a SNAP! SCL™ also includes routines for Register-Examine-Modify, Memory-Examine-Modify, and Play-Memory. SCL™ is available on CP/M compatible diskette or 2708 or 2716. Diskette - \$24.95 2708 - \$19.95 2716 - \$29.95. Diskette Includes the source. EPROM'S are ORG at E000H.

COMPLETE KIT!

\$84.95

(WITH DATA MANUAL)

BLANK PC
BOARD W/DATA
\$31

4K DYNAMIC RAM BLOWOUT! SAME AS INTEL 2107B!

4K RAMS AT AN UNBELIEVABLE 50¢ EACH!!!

Prime, new, National Semi., 1979 date coded, full spec. parts. N.S. #MM5280-5N. Same as INTEL 2107B-4, T.I. TMS4060, NEC uPD411, etc. We bought a HUGE QTY. from a West Coast Distributor at truly DISTRESS PRICES! One of the most popular and reliable RAM's ever made. These parts have been used by almost all Major Computer Main Frame Mfg. the world over! Arranged as 4K x 1, 270 NS Access Time, 22 Pin Dip. These units DO NOT use multiplexed addressing, thus making REFRESH and other timing very simple. See INTEL MEMORY DESIGN HANDBOOK for full application notes. The NAT. SEMI. MEMORY DATA BOOK is available at most Radio Shack Stores. Prime units in original factory tubes!

#5280-5N 4096 BITS x 1 270 NS ACCESS

8 FOR \$4.95 32 FOR \$16

FACTORY CASE (450 PCS) — \$180

Sockets Special: 22 Pin Low Profile (With Purchase of 5280's) 8 FOR \$1.

(With Pin Out Data)

COMPUTER PARTS SPECIALS

74LS175 - .99	8035 Intel Single Chip CPU 6.95
74LS240 - 1.19	Signetics 2901 4 Bit Slice - 6.95
74LS241 - 1.19	AMD 2903 4 Bit Super Slice - 12.50
74LS244 - 1.19	AMD 29705 Dual Port RAM - 8.95
74LS373 - 1.29	Intel 2716-1 (350 NS) - 12.95

NEW! G.I. COMPUTER SOUND CHIP

AY3-8910. As featured in July, 1979 BYTE! A fantastically powerful Sound & Music Generator. Perfect for use with any 8 Bit Microprocessor. Contains: 3 Tone Channels, Noise Generator, 3 Channels of Amplitude Control, 16 bit Envelope Period Control, 2-8 Bit Parallel I/O, 3 D to A Converters, plus much more! All in one 40 Pin DIP. Super easy interface to the S-100 or other busses. **\$11.95 PRICE CUT!**

SPECIAL OFFER: \$14.95 each Add \$3 for 60 page Data Manual.

TERMS: Add \$1.50 postage. We pay balance. Orders under \$15 add 75¢ handling. No C.O.D. We accept Visa and MasterCard. Tex. Res. add 5% Tax. Foreign orders (except Canada) add 20% P & H. Orders over \$50, add 85¢ for insurance.

Digital Research Computers
(OF TEXAS)

P.O. BOX 401565 • GARLAND, TEXAS 75040 • (214) 271-3538

ALL SALES ARE MADE SUBJECT TO THE TERMS OF OUR 90 DAY LIMITED WARRANTY. A COPY OF THIS WARRANTY IS AVAILABLE FREE, ON REQUEST.

What's New?

SOFTWARE

CP/M for Heath Microcomputers

Heath H-8 and H-89 All-In-One computers can now have the CP/M operating system. Three operating system modules (BIOS, BDOS, CCP) are included with Heath CP/M. Utilities included are a two-pass 8080 assembler; a text editor; an 8080 debugger with traced execution and disassembly; a file dump; system generation and relocation; programs to display file sizes and disk usage, set file class, assign physical and logical devices, display system parameters, copy files between devices, and convert internal HEX files into memory images. Full source code is provided. The Heath CP/M operating system comes on 5- and 8-inch floppy disks for \$150. For details contact, Heath Company, Department 350-620, Benton Harbor MI 49022, (616) 982-3210.

Circle 449 on inquiry card

Accountant's Software

DATAWRITE is a CP/M-based client-write-up program for accountants. It supports floppy- and hard-disk drives and incorporates expanded account-number structures, several journal options, and complete report-writing capabilities. For details on DATAWRITE, contact Datavord Inc, 1404 140th Pl NE, Bellevue WA 98007, (206) 643-2050.

Circle 450 on inquiry card

Interface CBASIC With Assembly-Language Programs

CBASIC, Version 2, incorporates a function that allows assembly-language packages to be interfaced with CBASIC programs. It permits trace outputs to the console when a line-printer statement is in effect. It provides for 255 characters to be entered in response to an input statement. A backslash within a data statement is treated as a literal character rather than a continuation character. CBASIC features 14-digit accuracy for business applications, and is implemented as a compiler. It allows a text editor to be used. CBASIC, Version 2, was developed by Compiler Systems, POB 145, Sierra Madre CA 91024, (213) 355-1063.

Circle 451 on inquiry card

Cribbage for the TRS-80

Cribbage Master plays a strong game, pegging its own points in play and never missing an opportunity to score—especially on points you miss. The program shows the order of the cards as played for in-play pegging. All entries are made by a single key-stroke. Cribbage Master is designed for the TRS-80 16 K-byte Level II. It is available from Manhattan Software, POB 35, Pacific Palisades CA 90272, (213) 454-8290, for \$12.95.

Circle 452 on inquiry card

Software for Z80, 8080, and 8085 Systems

The ZAPS software system has assemblers and disassemblers for Z80, 8080, and 8085 systems. An editor, loader, and the use of Intel and Zilog-Mostek mnemonics are also featured. The system requires any Z80 processor with a North Star floppy-disk drive, and 48 K bytes of programmable memory. The price is \$100 from Conentropy, POB 316, Yonkers NY 10704.

Circle 453 on inquiry card

6800 Diagnostics and Disk Repair

Technical Systems Consultants Inc has a memory-diagnostic and disk-repair package for the 6800 microprocessor. The programs run under the 6800 FLEX operating system. Included in the memory diagnostics are a 0s and 1s test, a random pattern test, walking bit tests, a dynamic programmable-memory dropout test, and a convergence test.

The disk-repair portion contains utilities that operate on a FLEX-formatted floppy disk. There are three diagnostic utilities that report unreadable sectors and structural inconsistencies among files, two utilities for recovering data, a utility to remove bad or intermittent sectors from the free space, a program to retrieve deleted files, a single-sector read/write/modify routine, and a copy utility which ignores CRC (cyclic redundancy check) errors. This package is available on 5- or 8-inch floppy disk for \$75. Contact Technical Systems Consultants Inc, POB 2570, 1208 Kent Ave, West Lafayette IN 47906, (317) 463-2502.

Circle 454 on inquiry card

Three Versions of FORTH for OSI

Starstruck Software has fig- (FORTH Interest Group) compatible FORTH for OSI (Ohio Scientific) C8P dual floppy-disk-drive systems. A line editor, commands for the OS65D operating system, and a record of unused dictionary space are featured. This version costs \$79.95. Contact Back to Basic Computer Center, #43 Cross Keys Shopping Center, Florissant MO 63033, (314) 873-4495.

OSI-FORTH 2.0 runs under the OS-65D3 operating system, and has access to all commands and resources. A 6502 assembler and a text editor are included. OSI-FORTH 2.0 runs on C2, C3, C4, and C8 systems. It is supplied on 5- or 8-inch floppy disks, and has a suggested price of \$79.95. For details, contact Technical Products Company, POB 12983, University Sta, Gainesville FL 32604.

TEK-AIDS' OS65U fig-FORTH uses the OS65U operating system and runs coresident with BASIC, allowing FORTH modules to be integrated into existing programs. OS65U will run on OSI 48 K-byte systems with dual disk drives or hard-disk and multi-user configurations. The price for this system is \$250. Contact the Software Federation Inc, 44 University Dr, Arlington Hts IL 60004, (312) 259-1355.

Circle 455 on inquiry card

New Games for the Apple II

The Apple now has three new high-resolution-graphics games written in machine language: Asteron, Star Avenger, and Shooting Gallery. They run on the Apple II under all versions of DOS (disk operating system) and on the Language System. Each game is supplied on a disk and requires 48 K bytes of memory. Shooting Gallery costs \$22.50, and the others are priced at \$27.50. Contact Western MicroData Enterprises Ltd, POB G33, Postal Station G, Calgary, Alberta, T3A 2G1, Canada.

Circle 456 on inquiry card

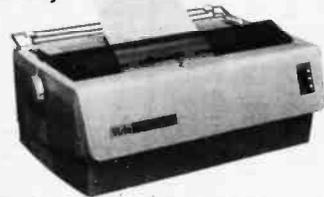
**Immediate
Shipment
V-300 Printer**

VISTA.....

Your Supermarket For Add-ons and Peripheral Products

Vista V-300 Daisy Wheel Printer

Letter Quality



- Print Wheel — Industry standard 96-character Daisy Wheel (Including the extended-life dual plastic wheels)
- Printable columns (136)
- Proportional, bi-directional printing
- Interface — Industry standard parallel (RS232-C optional)
- Service - Prompt maintenance/service agreements available nationwide
- Warranty - 90 days parts and labor, one year parts only

V-300-25	\$1895.00
V-300-45	\$2195.00
Tractor Option	\$ 300.00

Vista V-100 Printer\$745.00

- 9 x 7 dot matrix
- 125 cps bi-directional print speed
- 136 column
- Industrial quality

Vista Music Machine 9

- NEW! Uses latest State of the Art LSI Technology
 - Requires only one slot for 9 voices!
 - Uses three AY3-8910's to produce 9 voices
 - Plays music generated by the ALF board
 - APPLE II™ compatible
 - ALF™ software required
- Price:**
\$129.95

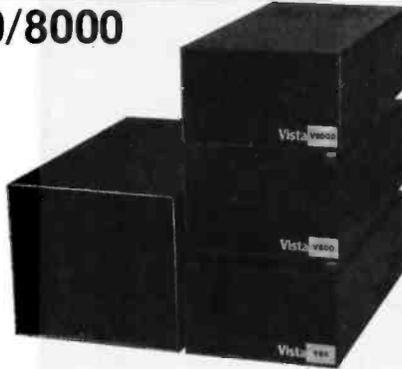
Add On Drives

MPI B51	40 Track, Double Density 204K	\$275.00
MPI B52	Dual Head, Double Density 408K	\$375.00
Siemens	FDD 100-5 40 Track Double Density 204K	\$275.00
Siemens	FDD 100-8 8" Single Sided Drive	\$448.00
Shugart	801R Single Sided Drive ...	\$448.00

The Vista V80/800/8000 Family Disk Drive System

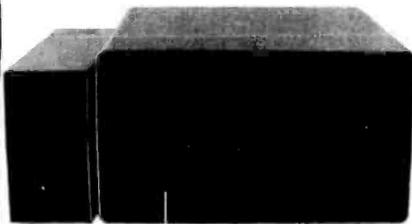
- Full compatible with TRS-80, Heath/Zenith
- 120 Day Warranty
- 40 Track Patch at NO CHARGE

V-80 Single drive system (102K)	\$ 395.00
V-80 Two drive system (204K)	\$ 770.00
V-800 Single drive, B52 drive (204K) .	\$ 595.00
V-800-2 Double drive, B52 drives (408K)	\$1175.00
V-8000 Single drive, B92 drive (408K)	\$ 775.00
V-8000-2 Double drive B92 drives (816K)	\$1450.00



The Vista Model II

Totally Compatible with the TRS-80™
Model II



- Provides one, two or three drives
- Adds up to 1.5 million bytes of on-line storage
- 120 day warranty
- Does everything Radio Shack's expansion system will do... for less!

Single drive (non-expandable)	\$ 900.00
Single drive expansion system	\$1000.00
Two drive expansion system	\$1550.00
Three drive expansion system	\$2100.00
Additional drives alone	\$ 525.00

Other Products

1. 16K RAM upgrade Kits \$ 49.95
2. NEW DOS 80 \$149.00
3. LNW 80 (computer board) \$ 86.95
4. LNW expansion board \$ 66.95
5. H.C. Pennington books:
TRS-80 DISK AND OTHER MYSTERIES \$ 18.95
MICROSOFT BASIC DECODER AND
OTHER MYSTERIES \$ 27.95

The Vista V-200 for Exidy

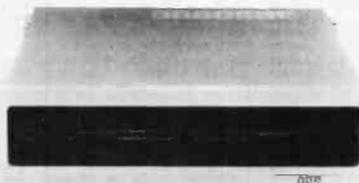
- Completely packaged system, tested and ready to plug in
 - Includes: power supply, two 40 track drives, case, double density controllers, and all cabling and total CP/M™ documentation.
 - Storage capacity from 400K to 1.2 meg.
 - System software-VISTA CP/M Disk Operating System and BASIC-E Compiler recorded on 5 1/4" diskettes
- Price: Starting as low as
\$1199.00

S-100 version as low as
\$699.00



NEW

The Vista V-1000 Floppy Disk Drive Subsystem



- Storage capacity from 0.5 to 40 megabytes
- Industrial quality cabinet with die cast front bezel
- Meets all UL and OSHA standards
- Additional Savings! Front and rear retma rail mounts provided at no extra charge (no external slides)
- Desk or rack mountable
- Features modular construction with removable sub-assembly that allows easy cabinet positioning and mounting
- Drives pull out for easy service and maintenance

Cabinet	\$ 395.00
Cabinet with (2) single sided drives	\$1595.00
(Includes power supply and cable)	
Cabinet with (2) double sided drives	\$2295.00
(Includes power supply and cable)	

- Deluxe chassis with internal slide allows easy access for drive positioning and mounting.
- Built to mechanically and electrically accommodate single sided drives, double sided drives — including, the most popular 8-inch Winchester and Shugart floppy disk drives, and 8-inch streaming tape cartridge units.

The Vista Computer Company

1317 E. Edinger Avenue, Santa Ana, California 92705, (714) 953-0523

CALL TOLL-FREE 800-854-8017

Vista

*TRS-80 is a registered trademark of Radio Shack, a Tandy Corporation
™ Apple is a registered trademark of Apple Computer Co.
™ CP/M is a registered trademark of Digital Research

2N TRANSISTORS

2N508A	8.80	2N5450	7.78
2N5085	2.81	2N5273	5.51
2N5087	3.07	2N5274	6.55
2N5088	3.40	2N5276	7.99
2N5089	4.14	2N5278	8.48
2N5092	5.23	2N5281	9.28
2N5094	6.15	2N5278	10.66
2N5095	7.05	2N5279	12.45
2N5098	7.86	2N5284	1.86
2N5099	8.46	2N5285	9.80
2N5100	9.88	2N5288	1.80
2N5101	11.80	2N5289	3.33
2N5102	12.71	2N5290	3.19
2N5103	17.30	2N5291	2.93
2N5104	19.80	2N5292	3.99
2N5105	20.00	2N5293	3.72
2N5106	20.00	2N5294	3.33
2N5107	20.00	2N5295	3.33
2N5108	20.00	2N5296	3.33
2N5109	20.00	2N5297	3.33
2N5110	20.00	2N5298	3.33
2N5111	20.00	2N5299	3.33
2N5112	20.00	2N5300	3.33
2N5113	20.00	2N5301	3.33
2N5114	20.00	2N5302	3.33
2N5115	20.00	2N5303	3.33
2N5116	20.00	2N5304	3.33
2N5117	20.00	2N5305	3.33
2N5118	20.00	2N5306	3.33
2N5119	20.00	2N5307	3.33
2N5120	20.00	2N5308	3.33
2N5121	20.00	2N5309	3.33
2N5122	20.00	2N5310	3.33
2N5123	20.00	2N5311	3.33
2N5124	20.00	2N5312	3.33
2N5125	20.00	2N5313	3.33
2N5126	20.00	2N5314	3.33
2N5127	20.00	2N5315	3.33
2N5128	20.00	2N5316	3.33
2N5129	20.00	2N5317	3.33
2N5130	20.00	2N5318	3.33
2N5131	20.00	2N5319	3.33
2N5132	20.00	2N5320	3.33
2N5133	20.00	2N5321	3.33
2N5134	20.00	2N5322	3.33
2N5135	20.00	2N5323	3.33
2N5136	20.00	2N5324	3.33
2N5137	20.00	2N5325	3.33
2N5138	20.00	2N5326	3.33
2N5139	20.00	2N5327	3.33
2N5140	20.00	2N5328	3.33
2N5141	20.00	2N5329	3.33
2N5142	20.00	2N5330	3.33
2N5143	20.00	2N5331	3.33
2N5144	20.00	2N5332	3.33
2N5145	20.00	2N5333	3.33
2N5146	20.00	2N5334	3.33
2N5147	20.00	2N5335	3.33
2N5148	20.00	2N5336	3.33
2N5149	20.00	2N5337	3.33
2N5150	20.00	2N5338	3.33
2N5151	20.00	2N5339	3.33
2N5152	20.00	2N5340	3.33
2N5153	20.00	2N5341	3.33
2N5154	20.00	2N5342	3.33
2N5155	20.00	2N5343	3.33
2N5156	20.00	2N5344	3.33
2N5157	20.00	2N5345	3.33
2N5158	20.00	2N5346	3.33
2N5159	20.00	2N5347	3.33
2N5160	20.00	2N5348	3.33
2N5161	20.00	2N5349	3.33
2N5162	20.00	2N5350	3.33
2N5163	20.00	2N5351	3.33
2N5164	20.00	2N5352	3.33
2N5165	20.00	2N5353	3.33
2N5166	20.00	2N5354	3.33
2N5167	20.00	2N5355	3.33
2N5168	20.00	2N5356	3.33
2N5169	20.00	2N5357	3.33
2N5170	20.00	2N5358	3.33
2N5171	20.00	2N5359	3.33
2N5172	20.00	2N5360	3.33
2N5173	20.00	2N5361	3.33
2N5174	20.00	2N5362	3.33
2N5175	20.00	2N5363	3.33
2N5176	20.00	2N5364	3.33
2N5177	20.00	2N5365	3.33
2N5178	20.00	2N5366	3.33
2N5179	20.00	2N5367	3.33
2N5180	20.00	2N5368	3.33
2N5181	20.00	2N5369	3.33
2N5182	20.00	2N5370	3.33
2N5183	20.00	2N5371	3.33
2N5184	20.00	2N5372	3.33
2N5185	20.00	2N5373	3.33
2N5186	20.00	2N5374	3.33
2N5187	20.00	2N5375	3.33
2N5188	20.00	2N5376	3.33
2N5189	20.00	2N5377	3.33
2N5190	20.00	2N5378	3.33
2N5191	20.00	2N5379	3.33
2N5192	20.00	2N5380	3.33
2N5193	20.00	2N5381	3.33
2N5194	20.00	2N5382	3.33
2N5195	20.00	2N5383	3.33
2N5196	20.00	2N5384	3.33
2N5197	20.00	2N5385	3.33
2N5198	20.00	2N5386	3.33
2N5199	20.00	2N5387	3.33
2N5200	20.00	2N5388	3.33

PREMIUM QUALITY

2N3438	1.80	2N3793	.26	2N4174	10.30	2N4858A	1.94	2N5170	3.68	2N5990	3.80
2N3437	1.80	2N3798	4.90	2N4183	6.30	2N4859	1.81	2N5171	7.74	2N5991	4.30
2N3438	2.00	2N3797	4.90	2N4184	6.35	2N4860	1.81	2N5172	2.00	2N5994	.70
2N3439	1.40	2N3798	5.00	2N4185	6.60	2N4860A	1.90	2N5179	1.40	2N6014	.70
2N3440	1.30	2N3799	5.40	2N4186	6.80	2N4861	1.90	2N5190	1.40	2N6015	.60
2N3441	1.40	2N3806	4.12	2N4187	7.10	2N4870	.94	2N5191	9.00	2N6027	.60
2N3442	1.80	2N3807	5.12	2N4188	7.55	2N4871	8.4	2N5192	1.05	2N6028	.80
2N3443	1.80	2N3808	5.60	2N4189	8.05	2N4878	6.88	2N5193	8.65	2N6029	6.94
2N3444	1.80	2N3809	5.90	2N4190	10.30	2N4890	2.08	2N5194	8.85	2N6030	7.30
2N3445	1.80	2N3810	8.12	2N4191	68.20	2N4895	3.20	2N5195	1.20	2N6031	8.40
2N3446	1.80	2N3811	5.70	2N4200	96.20	2N4898	3.80	2N5196	9.88	2N6032	24.00
2N3447	1.80	2N3812	5.70	2N4201	118.40	2N4899	4.50	2N5197	9.88	2N6033	27.00
2N3448	1.80	2N3813	27.40	2N4202	152.50	2N4898	1.10	2N5198	2.70	2N6034	1.20
2N3449	1.80	2N3814	27.40	2N4203	176.20	2N4899	2.08	2N5199	2.9	2N6035	1.30
2N3450	1.80	2N3815	27.40	2N4204	208.00	2N4900	2.30	2N5219	19	2N6036	1.40
2N3451	1.80	2N3816	31.00	2N4208	3.90	2N4901	2.20	2N5220	20	2N6037	1.02
2N3452	1.80	2N3817	35.50	2N4209	4.80	2N4902	3.10	2N5221	21	2N6038	1.10
2N3453	1.80	2N3818	43.10	2N4212	2.10	2N4903	3.20	2N5222	35	2N6039	1.20
2N3454	1.80	2N3819	43.10	2N4213	2.60	2N4904	3.50	2N5223	19	2N6040	1.30
2N3455	1.80	2N3820	43.10	2N4214	2.90	2N4905	3.20	2N5224	32	2N6041	3.00
2N3456	1.80	2N3821	43.10	2N4215	3.80	2N4906	3.50	2N5225	20	2N6042	3.00
2N3457	1.80	2N3822	43.10	2N4216	8.00	2N4912	1.88	2N5226	20	2N6043	2.50
2N3458	1.80	2N3823	43.10	2N4217	6.70	2N4913	1.48	2N5227	19	2N6044	2.50
2N3459	1.80	2N3824	43.10	2N4218	12.40	2N4914	1.88	2N5228	17	2N6045	2.50
2N3460	1.80	2N3825	43.10	2N4219	12.40	2N4915	2.38	2N5229	4.52	2N6046	2.30
2N3461	1.80	2N3826	43.10	2N4220	1.40	2N4916	8.0	2N5230	8.39	2N6047	2.30
2N3462	1.80	2N3827	19	2N4221	1.60	2N4917	9.0	2N5231	6.34	2N6048	2.60
2N3463	1.80	2N3828	22.30	2N4222	1.60	2N4918	9.0	2N5232	3.80	2N6049	2.60
2N3464	1.80	2N3829	25	2N4223	1.58	2N4922	4.70	2N5233	3.80	2N6050	2.60
2N3465	1.80	2N3830	25	2N4224	1.58	2N4923	6.10	2N5234	3.80	2N6051	2.60
2N3466	1.80	2N3831	25	2N4225	1.58	2N4924	6.10	2N5235	3.80	2N6052	2.60
2N3467	1.80	2N3832	25	2N4226	1.58	2N4925	6.10	2N5236	3.80	2N6053	2.60
2N3468	1.80	2N3833	25	2N4227	1.58	2N4926	6.10	2N5237	3.80	2N6054	2.60
2N3469	1.80	2N3834	25	2N4228	1.58	2N4927	6.10	2N5238	3.80	2N6055	2.60
2N3470	1.80	2N3835	25	2N4229	1.58	2N4928	6.10	2N5239	3.80	2N6056	2.60
2N3471	1.80	2N3836	25	2N4230	1.58	2N4929	6.10	2N5240	3.80	2N6057	2.60
2N3472	1.80	2N3837	25	2N4231	1.58	2N4930	6.10	2N5241	3.80	2N6058	2.60
2N3473	1.80	2N3838	25	2N4232	1.58	2N4931	6.10	2N5242	3.80	2N6059	2.60
2N3474	1.80	2N3839	25	2N4233	1.58	2N4932	6.10	2N5243	3.80	2N6060	2.60
2N3475	1.80	2N3840	25	2N4234	1.58	2N4933	6.10	2N5244	3.80	2N6061	2.60
2N3476	1.80	2N3841	25	2N4235	1.58	2N4934	6.10	2N5245	3.80	2N6062	2.60
2N3477	1.80	2N3842	25	2N4236	1.58	2N4935	6.10	2N5246	3.80	2N6063	2.60
2N3478	1.80	2N3843	25	2N4237	1.58	2N4936	6.10	2N5247	3.80	2N6064	2.60
2N3479	1.80	2N3844	25	2N4238	1.58	2N4937	6.10	2N5248	3.80	2N6065	2.60
2N3480	1.80	2N3845	25	2N4239	1.58	2N4938	6.10	2N5249	3.80	2N6066	2.60
2N3481	1.80	2N3846	25	2N4240	1.58	2N4939	6.10	2N5250	3.80	2N6067	2.60
2N3482	1.80	2N3847	25	2N4241	1.58	2N4940	6.10	2N5251	3.80	2N6068	2.60
2N3483	1.80	2N3848	25	2N4242	1.58	2N4941	6.10	2N5252	3.80	2N6069	2.60
2N3484	1.80	2N3849	25	2N4243	1.58	2N4942	6.10	2N5253	3.80	2N6070	2.60
2N3485	1.80	2N3850	25	2N4244	1.58	2N4943	6.10	2N5254	3.80	2N6071	2.60
2N3486	1.80	2N3851	25	2N4245	1.58	2N4944	6.10	2N5255	3.80	2N6072	2.60
2N3487	1.80	2N3852	25	2N4246	1.58	2N4945	6.10	2N5256	3.80	2N6073	2.60
2N3488	1.80	2N3853	25	2N4247	1.58	2N4946	6.10	2N5257	3.80	2N6074	2.60
2N3489	1.80	2N3854	25	2N4248	1.58	2N4947	6.10	2N5258	3.80	2N6075	2.60
2N3490	1.80	2N3855	25	2N4249	1.58	2N4948	6.10	2N5259	3.80	2N6076	2.60
2N3491	1.80	2N3856	25	2N4250	1.58	2N4949	6.10	2N5260	3.80	2N6077	2.60
2N3492	1.80	2N3857	25	2N4251	1.58	2N4950	6.10	2N5261	3.80	2N6078	2.60
2N3493	1.80	2N3858	25	2N4252	1.58	2					

DATA PRECISION

A DIVISION OF ANALOGIC CORPORATION

MODEL	DESCRIPTION	PRICE
175	3 1/2 Digit Portable D.M.M.	\$219.00
245	4 1/2 Digit Portable D.M.M.	385.00
248	4 1/2 Digit Portable True RMS D.M.M.	385.00



100-Hour Mini-Portable 4 1/2-Digit LCD Multimeter

- 25 Ranges, including five each AC and DC, both voltage and current, plus five resistance ranges!
- Sensitivities of 10µV, 10nA, 100mΩ, and maximum readings of 100 volts (500 AC), 2A, 20 megohms • Basic accuracy of ±0.03%, supported by lab-grade T.C. — typically, ±(0.003% rdg. + 0.001% rmg.)
- Rechargeable 100-hour battery portability, plus line operation (while charging) • Big, clear, high-contrast 0.43" high LCD readout, readable anywhere you can see to work — including bright sunlight!

MODEL 255		\$295.00
258	4 1/2 Digit Portable True RMS D.M.M.	385.00
585	8 Digit Portable 250MHz Frequency Counter	395.00

3 1/2 Digit - LCD Display DIGITAL MULTIMETER

- Unique Audible "Eyes-Off" multi-testing • Fast testing without taking your eyes off the circuit you're probing • Continuity Test works on three lowest resistance ranges • Repetitive Alarm warns of AC overload or accidental applications of AC voltage to DC inputs • Single-tone alarm on negative DC overvoltage • Also tests logic levels — logic transistors — relay or switch opening and closing — diode and transistor junctions — event occurrences.

MODEL 936 \$190.00

Capacitance Meter

- Easy to use - plug in capacitor, push range button and read the value to 0.1%
- 0.5 in. liquid crystal display
- Exclusive "Charge/Dvolt" measurement circuit (patent pending) holds ±0.1% basic accuracy for a full year.
- Up to 200 hrs operation on standard 9V Batt.
- 8 easy pushbutton ranges cover 0.1pf to 1999 microfarads.
- Best of all it's easy on the budget - only

MODEL 938 \$185

0.1° Resolution, LCD Display TEMPERATURE METER

- WIDE-RANGING — (-) 65°C to +150°C/(-) 185° to 302°F • ACCURATE — ± 4°C/± 0.7°F over most of range • FAST — 8 seconds to 95% of final change in reading • VERSATILE — switch-selectable resolution (0.1° or 1°) and degrees C or F • HANDY — easy to carry, hold, use, read • TOUGH — takes everyday field use yet maintains calibration • COMPLETE — includes full-measurement range probe • USED EVERYWHERE — internal 9V battery or line operation (115AC, 47-63 Hz) with optional battery eliminator.

MODEL 940 \$195.00

1350	3 1/2 Digit Bench D.M.M.	215.00
1351	3 1/2 Digit Bench D.M.M. with 20A current range	205.00
1750	3 1/2 Digit Bench/Portable True RMS and dB D.M.M.	360.00
2480	4 1/2 Digit Bench/Portable D.M.M.	330.00
2480R	4 1/2 Digit Bench/Portable True RMS D.M.M.	350.00
5740	7 Digit 100MHz Multifunction Counter	325.00
5800	8 Digit 520MHz Bench/Portable Frequency Counter	485.00
5801	8 Digit 520MHz Bench/Portable Frequency Counter	525.00
5845	8 Digit 150MHz Multifunction Counter	340.00



SIGNETICS The Instructor 50 Desktop Computer

Includes everything you need to write, run and debug machine-language programs. Housed in one compact package.



SORCERER COMPUTER SPEAKS YOUR LANGUAGE
 FEATURES: 280 — 4K ROM — 32K RAM — Dual Channel I/O — 30 Lines of 64 Characters 84 Data Lines Characters and 64 User Defined Characters — 512 x 240 Graphics Resolution — Edge Card Connection to 100 Bus — Serial and Parallel I/O.
 Reg. Our Price
 Part No. OP1002-2 32K \$1395.00 \$1016.00

HAMEG



10 Megahertz
HM307
 SINGLE TRACE
 OSCILLOSCOPE

- IDEAL SERVICE INSTRUMENT
- TIME BASE 0.2 µs — 2.0 s/cm
- LPS-TRIGGER ■ COMPACT
- BUILT-IN COMPONENT TESTER

Only \$404.25



20 Megahertz
HM312
 DUAL TRACE
 OSCILLOSCOPE

- 10 x 8 cm DISPLAY
- LPS-TRIGGERING
- BANDWIDTH DC — 20MHz
- TRIGGERING up to 30MHz
- FULL X — Y OPERATION

Only \$580.00

50 Megahertz

HM512
 DUAL TRACE
 OSCILLOSCOPE

- SWEEP DELAY
- DELAY LINE
- BRIGHT DISPLAY
- BANDWIDTH DC — 50MHz
- TRIGGERING up to 70MHz
- AFTER TRIGGER DELAY LINE
- OVERSCANNING INDICATION
- IDEAL FOR COMMUNICATIONS AND DATA PROCESSING

Only \$1485.00

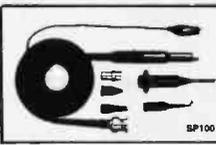
50 Megahertz

HM812
 DUAL TRACE STORAGE
 OSCILLOSCOPE

- 50 MHz DUAL TRACE PLUS VARIABLE PERSISTENCE
- DELAYED SWEEP WITH AFTER DELAY TRIGGERING
- STORAGE OF SINGLE-SHOT-SIGNALS "AUTOMATIC STORE"
- LED INDICATION FOR OVERSCAN, SINGLE SHOT, TRIGGER ACTION DELAY MODE, "AUTOMATIC STORE"

Only \$4035.00

Universal Oscilloscope



Probe
 \$36.00

SWITCHABLE X1 and X10 Attenuation Factor
 KEY ADDITIONAL FEATURES: • 100MHz bandwidth • Heavy duty tip • Break resistant center conductor • Slender, flexible cable • 6ft. cable length • Wide compensation range • Fits all scopes • Ground reference can be activated at tip • Includes SPRUNG HOOK, I.C. TIP, BNC ADAPTOR, INSULATING TIP and TRIMMER TOOL ACCESSORIES.

NO DISCOUNT COUPON FOR ITEMS ON THIS PAGE CALL FOR QUOTE ON QUANTITY DISCOUNTS

KEITHLEY

3 1/2 Digit Hand-Held DIGITAL MULTIMETER

MODEL 130 — 0.6% basic DCV accuracy • 25 ranges and 5 functions: DC volts, AC volts, DC amps, AC amps and ohms • Auto zero and auto polarity • Low battery indicator and much much more \$115.00

MODEL 131 — 0.25% basic DCV accuracy • 25 ranges and 5 functions: DC volts, AC volts, DC amps, AC amps and ohms • Diode test • Auto zero and auto polarity • Low battery indicator and much more \$134.00



4 1/2 Digit LCD Hand-Held DIGITAL MULTIMETER

0.05% DCV accuracy • 4 1/2-digit resolution • 5 functions • Easy to read, 0.6" LCD display • 100-hour life from an alkaline battery • Annunciator warns user when 10% of battery life remains • Reliable rotary switches clearly display range and function • Fully protected from overload: 1000V max DCV, 1000V peak ACV and 300V max Ohms • 10A current range • ACV bandwidth to 20KHz
 MODEL 135 \$219.00

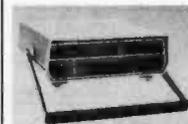


4 1/2 Digit Bench/Portable DIGITAL MULTIMETER

MODEL 176 — 0.6% accuracy below 20VDC and 20KHz AC • 20000 count display • 0.6" LCD display • 5 Functions: DC volts, AC volts, DC amps, AC amps and ohms • 1 Function and range annunciators • 1000 hour battery life typical
 MODEL 176 \$249.00

MODEL 178 — 0.04% basic accuracy • 20000 count display • 0.6" LED display • 1400V input protection • Easy to use • 3 Functions: DC volts, AC volts, ohms \$249.00

1304 Carrying Case \$10.00
 1766 Battery Eliminator 40.00
 1788 Rechargeable Battery Pack 79.00



4 1/2 Digit LCD Bench/Portable DIGITAL MULTIMETER

• 2000 count display • 0.6" LCD display • Function and range annunciators • 5 Functions: DC volts, DC amps, AC volts, AC amps and ohms • Fully protected • 1-year battery life from alkaline battery • Quality and performance
 The Keithley 169 provides full capability for many general purpose applications. Solid-state used functions have been eliminated to keep the price/performance ratio high.
 MODEL 169 \$169.00

SYM-1 NEW LOW PRICE

↓
 \$239.00

KIM-1 MICRO-COMPUTER

Fully Assembled & Tested
 \$179.00

FLUKE HANDHELD and BENCH/PORTABLE DMM's

MODEL 8020A \$179
 MODEL 8024A \$219
 MODEL 8022A \$139
 MODEL 8050A \$349



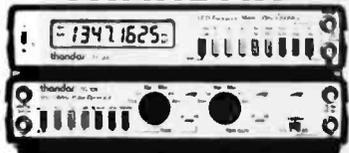
ANCRONA

STORES DO NOT ACCEPT MAIL ORDERS
MAIL ORDER
 P.O. BOX 220BY CULVER CITY, CA 90230

PHONE ORDERS (213) 641-4064

Minimum Order \$10.00 Add \$2.00 to cover postage and handling. Master Charge and VISA welcomed. Please include your charge card number, order number and expiration date. Some items are subject to prior sale. Not responsible for typos. Store pricing may vary from Mail Order pricing. We reserve the right to substitute manufacturers.

THANDAR



Pulse Generator (left on bottom)

- Independent Period and Pulse Width Controls
- Period Range 200ns — 200µs (5MHz — 5Hz)
- Pulse Width Range 100ns — 100µs
- Variable 50Ω and Fixed TTL Outputs
- TTL Output Capable of Driving 20 Standard TTL Loads
- Can Be Operated in Triggered, Gated, Manual One-Shot or Manual Gated Modes
- Complement Switch Inverts Both Outputs

TG105 Only \$219.00

Frequency Meter (left on top)

- 10Hz — 200MHz (Resolution 1ppm across measurement range) • 5 Selectable Gate Times • Input Better than 30mV rms Across Full Range and Better than 10mV rms from 20Hz — 100MHz • 1/2" 8-Digit LCD Display • Automatically Positioned Decimal Point
- Totalize Mode For Frequencies Up To 20MHz
- 1MHz Int. Timebase Available via Rear Panel Socket
- Indicates Units Being Measured (KHz or MHz)

TF200 Only \$394.00
 TP600 600MHz Prescaler Only \$98.00

VISIT A STORE NEAR YOU TODAY - We stock a large selection of Technical Books, Discrete Components, Integrated Circuits, Test Equipment and Electronic Supplies.

ATLANTA
 3330 Piedmont Rd. N.E.
 Atlanta, GA 30305
 (404) 261-7100

CULVER CITY
 11080 Jefferson Blvd.
 Culver City, CA 90230
 (213) 390-3595

HOUSTON
 2649 Richmond
 Houston, TX 77098
 (713) 529-3489

PORTLAND
 1125 N.E. 82nd Ave.
 Portland, OR 97220
 (503) 254-5541

SANTA ANA
 1300 E. Edinger Ave.
 Santa Ana, CA 92705
 (714) 547-8424

SUNNYVALE
 1054 E. El Camino Real
 Sunnyvale, CA 94087
 (408) 243-4121

TUCSON
 4518 E. Broadway
 Tucson, AZ 85711
 (602) 881-2348

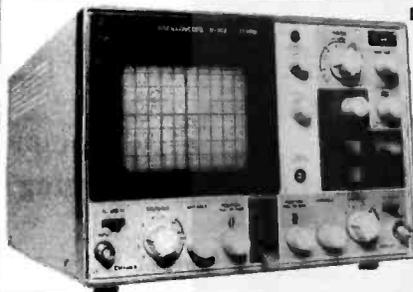
HICKOK

DIGITAL MULTIMETERS



\$79.95

\$89.95



Dual Trace Oscilloscope

HITACHI 30 MHz

- TV sync-separator circuit
- High-sensitivity 1mV/div (5MHz)
- Sweep time magnifier (10 times)
- Z-axis input (Intensity modulation)
- Signal delay line
- X-Y operation
- Trace Rotation

Model V302B

\$995



DMM + VARI-PITCH + LOGI-TRAK =
MX-333
\$235



AP PRODUCTS
Metalized Polyester Capacitors
Series 180 MINIBOX SAMPLER \$26.00

923101... \$79.95
923102... \$124.95
923103... \$124.95



MARK IV LED POWER LEVEL INDICATOR

70 pins
KIT \$31.50

- Display Range -36dB to +5dB
- Floating or Gradual Output Indicating
- Kit Includes transistors, leds, capacitors, resistors, PC Board, and silk screened metal front panel

THE NEW NLS TECHNOLOGY TOUCH/TEST 20



TOUCH/TEST 20 comes complete with test leads, temperature probe, component test adaptor, batteries and charger unit. Order yours TODAY!

ORDER NO.	PRICE
NLS-TT20 LEATHER	\$435
NLS-TT20B CARRYING	\$487
NLS-TT-140 CASE	46

Intersil LED or LCD 3 1/2 DIGIT PANEL METER KITS

BUILD A WORKING DPM IN 1/2 HOUR WITH THESE COMPLETE EVALUATION KITS

Test these new parts for yourself with Intersil's low cost prototyping kits, complete with A/D converter and LCD display (7106) or LED display (7107). Kits provide all materials, incl PC board, for a functioning panel meter.

ICL7106V (LED) ... \$34.45 ICL7107V (LED) ... \$28.70

SD SYSTEMS

Z-80 STARTER SYSTEM

The Z80 Starter Kit by SD Systems uses the powerful Z80 microprocessor as the heart of the complete micro-computer on a single board. Learn a step-by-step introduction to micro-computers with a keyboard and display, audio cassette interface, PROM programmer, wire-wrap expansion area, 4-channel Counter Timer and on Board RAM and PROM. Complete Operation and Instruction Manual included. ZBUG Monitor in ROM.

27004 kit \$399 38007 assem./T. \$531

commodore

Quite Portable Very Affordable and Unbelievable Versatile the PET computer may very well be a lifetime investment....

- Large Keyboard
- Separate Numeric Pad
- Graphics on Keys

16K Order No. 2001-16N. **\$995**

Professional Keyboard Kits!

Models 753 & 756 ASCII Keyboard Kits For Hobby or OEM Microprocessor Users

- Full 128 Character ASCII (768) • 53 Keys, popular ASR-33 format (753) • Plugged 0-10 P.C. Board • Tri-mode MO8 encoding • Two-Key Rollover • MOD/TL/DLT, Compatible outputs • Shift and Alpha Lock (756) • Level and Pulse Strobel (756) • Custom Keycaps • 3 User Definable Keys (753) • Selectable Parity • Low Bounce Keyswitches • And Much More!!!

753K	53 Key phone style keyboard-kit	\$85.95
753A	Same as above assembled	\$79.95
756K	56 Key Full ASCII keyboard kit	\$69.95
756A	Same as above assembled	\$82.95
701	Plastic enclosure for 753/756	\$16.00
702	Steel enclosure for 753/756	\$29.95
753MF	Mounting Frame for 753	\$6.95
756MF	Mounting Frame for 756	\$6.95

CARBON FILM RESISTORS

FULL LEAD • HIGH QUALITY • 5% TOL

10	33	100	330	1.0K	3.3K	10K	33K	100K	330K	1.0M	3.3M
11	36	110	360	1.1K	3.6K	11K	36K	110K	360K	1.1M	3.6M
12	39	120	390	1.2K	3.9K	12K	39K	120K	390K	1.2M	3.9M
13	43	130	430	1.3K	4.3K	13K	43K	130K	430K	1.3M	4.3M
14	47	150	470	1.5K	4.7K	15K	47K	150K	470K	1.5M	4.7M
15	51	160	510	1.6K	5.1K	16K	51K	160K	510K	1.6M	5.1M
16	56	180	560	1.8K	5.6K	18K	56K	180K	560K	1.8M	5.6M
20	82	200	820	2.0K	6.2K	20K	82K	200K	820K	2.0M	6.2M
22	88	220	880	2.2K	6.8K	22K	88K	220K	880K	2.2M	6.8M
24	75	240	750	2.4K	7.5K	24K	75K	240K	750K	2.4M	7.5M
27	82	270	820	2.7K	8.2K	27K	82K	270K	820K	2.7M	8.2M
30	91	300	910	3.0K	9.1K	30K	91K	300K	910K	3.0M	10.0M

1/4 Watt..... \$1.69 per C 1/2 Watt..... \$1.79 per C

ORDER ONLY IN MULTIPLES OF 100 PIECES PER VALUES

1 WATT \$2.15 **2 WATT \$2.10**
20 P/Pack 10 P/Pack

AVAILABLE IN THE FOLLOWING VALUES IN OHMS

3.3	150	300	580	1.5K	3.0K	5.6K	20K	47K	180K	680K
10	180	330	680	1.8K	3.3K	10.0K	22K	56K	220K	1.0M
47	200	390	820	2.0K	3.9K	12.0K	27K	68K	330K	1.0M
100	220	470	1.0K	2.2K	4.7K	15.0K	33K	100K	390K	4.7M
120	270	510	1.2K	2.7K	5.1K	18.0K	39K	150K	470K	10.0M

3 1/2-Digit, LCD-Display DIGITAL MULTIMETER

- HANDY - easy to hold, to carry, to use, to read.
- ACCURATE - basic 0.1% DC accuracy -
- TOUGH - built to take rough everyday field usage and electrical overvoltage ... yet maintain its calibration
- VERSATILE - big, clear, high contrast 3 1/2-digit LCD display, readable anywhere ... a full 0.5" high.
- PORTABLE - Palm-sized, lightweight, operates up to 200 hours on a single 9V transistor alkaline battery.
- EXPANDABLE - uses standard DMM accessories to extend ranges even further.

MODEL 935 \$175.00

ANCORNA

STORES DO NOT ACCEPT MAIL ORDERS

MAIL ORDER

P.O. BOX 2208Y CULVER CITY, CA 90230

PHONE ORDERS (213) 641-4064

Minimum Order \$10.00. Add \$2.00 to cover postage and handling. Master Charge and VISA welcomed. Please include your charge card number, initial bank number and expiration date. Some items are subject to stock sale. Not responsible for typos. Store pricing may vary from Mail Order pricing. We reserve the right to substitute manufacturer.

POWER SUPPLY

5 Volt 3 Amp
APS 5-3

1-9	... \$37.25
10 up	... \$35.55
25 up	... \$34.04

XR2206KB FUNCTION GENERATOR KIT

OPERATES ON EITHER:
SINGLE 12V ±6V SPLIT SUPPLY
OR
BE INCLUDED ON PC BOARD

Only ... \$19.95
POWER SUPPLY NOT INCLUDED.

★ 10% ★ DISCOUNT COUPON

Bring this **COUPON** into one of our stores or mail to our Mail Order address shown below and receive a **10% DISCOUNT** on purchases from this page of \$50.00 or more. Offer **EXPIRES on April 30, 1981**

NAME _____
ADDRESS _____
CITY _____ STATE _____
ZIP _____ PHONE NO. _____

Coupons accepted only with full name and address filled in.

PORTABLE thandar OSCILLOSCOPE

Model SC110 Only \$369

- DC-10MHz
- 2" Diagonal CRT
- SMALL SIZE (10" x 8" x 2")
- ULTRA LOW POWER CONSUMPTION
- LIGHT WEIGHT (2 lbs)
- AUTOMATIC CIRCUIT POWER DOWN FOR UNUSED SECTIONS

HIGH QUALITY CARBON FILM RESISTOR KITS

1/4 Watt - 5% Tolerance

EACH SET CONTAINS 840 RESISTORS

20 each of the following values (in ohms)

1.0Ω	10Ω	100Ω	1.0KΩ	10KΩ	100KΩ	1.0MΩ
1.5Ω	15Ω	150Ω	1.5KΩ	15KΩ	150KΩ	1.5MΩ
2.2Ω	22Ω	220Ω	2.2KΩ	22KΩ	220KΩ	2.2MΩ
3.3Ω	33Ω	330Ω	3.3KΩ	33KΩ	330KΩ	3.3MΩ
4.7Ω	47Ω	470Ω	4.7KΩ	47KΩ	470KΩ	4.7MΩ
6.8Ω	68Ω	680Ω	6.8KΩ	68KΩ	680KΩ	6.8MΩ

RS-14-25 Complete w/Storage Bin \$24.80

NEW 30 MEGAHERTZ PORTABLE, DUAL TRACE MINI-SCOPE

30 MEGAHERTZ Dual Trace \$649.00
15 MEGAHERTZ Dual Trace \$497.00
MS-15 Single Trace \$389.00

with rechargeable batteries and charger.

OPTIONS
MS-230 Leather Case (MS-15/215) \$45.00
MS-230 3.5" x 12.9" (HxL) "WxH.5" (D) 41-181 10 to 1 Probe (10 megohm input) \$30.00
MS-15/215 3 lbs (2.7" Hx8.4" Wx7.5" D) 41-180 Leather Case (MS-230) \$48.00

EXAR

XR-082CP	1.24	25u0100up	1.18	94	79
XR-083CP	1.39	5	1.11	93	
XR-084CP	1.50	1.20	1.00		
XR-085CP	1.59	1.59	1.33		
XR-086CP	1.74	1.40	1.16		
XR-087CP	1.74	1.40	1.16		
XR-088CP	1.74	1.40	1.16		
XR-089CP	2.61	2.09	1.74		
XR-090CP	1.74	1.40	1.16		
XR-091CP	1.95	1.58	1.30		
XR-092CP	1.95	1.58	1.30		
XR-093CP	6.00	4.80	4.00		
XR-094CP	1.11	89	74		
XR-095CP	4.22	3.38	2.81		
XR-096CP	4.22	3.38	2.81		
XR-097CP	10.22	8.18	6.81		
XR-098CP	9.28	7.43	6.18		
XR-099CP	8.08	6.48	5.30		
XR-100CP	1.39	1.11	.93		
XR-101CP	.94	.51	.43		
XR-102CP	1.11	.89	.74		
XR-103CP	.96	.77	.64		
XR-104CP	1.89	1.51	1.28		
XR-105CP	2.01	1.61	1.34		
XR-106CP	2.01	1.61	1.34		
XR-107CP	1.18	.94	.79		
XR-108CP	1.13	.90	.75		
XR-109CP	.84	.67	.56		
XR-110CP	2.57	2.06	1.71		
XR-111CP	1.09	.87	.73		
XR-112CP	1.09	.87	.73		
XR-113CP	13.92	11.14	9.20		
XR-114CP	3.36	2.69	2.24		
XR-115CP	1.18	.94	.79		
XR-116CP	1.18	.94	.79		
XR-117CP	1.16	.94	.79		
XR-118CP	1.18	.94	.79		
XR-119CP	1.18	.94	.79		
XR-120CP	1.18	.94	.79		
XR-121CP	1.18	.94	.79		
XR-122CP	1.18	.94	.79		
XR-123CP	1.18	.94	.79		
XR-124CP	1.18	.94	.79		
XR-125CP	1.18	.94	.79		
XR-126CP	1.18	.94	.79		
XR-127CP	1.18	.94	.79		
XR-128CP	1.18	.94	.79		
XR-129CP	1.18	.94	.79		
XR-130CP	1.18	.94	.79		
XR-131CP	1.18	.94	.79		
XR-132CP	1.18	.94	.79		
XR-133CP	1.18	.94	.79		
XR-134CP	1.18	.94	.79		
XR-135CP	1.18	.94	.79		
XR-136CP	1.18	.94	.79		
XR-137CP	1.18	.94	.79		
XR-138CP	1.18	.94	.79		
XR-139CP	1.18	.94	.79		
XR-140CP	1.18	.94	.79		
XR-141CP	1.18	.94	.79		
XR-142CP	1.18	.94	.79		
XR-143CP	1.18	.94	.79		
XR-144CP	1.18	.94	.79		
XR-145CP	1.18	.94	.79		
XR-146CP	1.18	.94	.79		
XR-147CP	1.18	.94	.79		
XR-148CP	1.18	.94	.79		
XR-149CP	1.18	.94	.79		
XR-150CP	1.18	.94	.79		
XR-151CP	1.18	.94	.79		
XR-152CP	1.18	.94	.79		
XR-153CP	1.18	.94	.79		
XR-154CP	1.18	.94	.79		
XR-155CP	1.18	.94	.79		
XR-156CP	1.18	.94	.79		
XR-157CP	1.18	.94	.79		
XR-158CP	1.18	.94	.79		
XR-159CP	1.18	.94	.79		
XR-160CP	1.18	.94	.79		
XR-161CP	1.18	.94	.79		
XR-162CP	1.18	.94	.79		
XR-163CP	1.18	.94	.79		
XR-164CP	1.18	.94	.79		
XR-165CP	1.18	.94	.79		
XR-166CP	1.18	.94	.79		
XR-167CP	1.18	.94	.79		
XR-168CP	1.18	.94	.79		
XR-169CP	1.18	.94	.79		
XR-170CP	1.18	.94	.79		
XR-171CP	1.18	.94	.79		
XR-172CP	1.18	.94	.79		
XR-173CP	1.18	.94	.79		
XR-174CP	1.18	.94	.79		
XR-175CP	1.18	.94	.79		
XR-176CP	1.18	.94	.79		
XR-177CP	1.18	.94	.79		
XR-178CP	1.18	.94	.79		
XR-179CP	1.18	.94	.79		
XR-180CP	1.18	.94	.79		
XR-181CP	1.18	.94	.79		
XR-182CP	1.18	.94	.79		
XR-183CP	1.18	.94	.79		
XR-184CP	1.18	.94	.79		
XR-18					

Circle 277 on Inquiry card.

LOWEST PRICES
ON THE

TRS-80

Computers

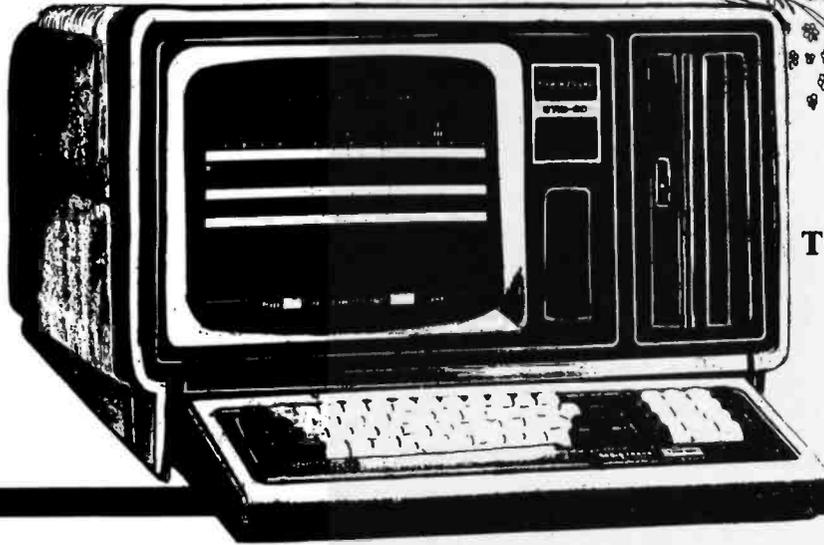
For Business, Learning and Entertainment

Pan American Electronics

INCORPORATED

Radio Shack

AUTHORIZED SALES CENTER



For More Information Call

TOLL FREE ORDER NUMBER

800-531-7466

Texas & Principal NUMBER

512-581-2765

Telex Number 767339

Dept. B, 1117 Conway

Mission, Texas 78572

Circle 278 on Inquiry card.

apple II plus

With 48K of memory!

\$1195

With the purchase of the APPLE II, select from the below SPECIAL PRICING!

- Base₂ Printer... \$599
- Disk II w/cont... \$85
- Disk II... 475
- Ser Printer Cd... 179
- SupRMd... 23
- Way I/O Select... 33
- Video 100 I2... 119
- Firmware Card... 99
- UHF to RCA Cable... 5



apple II / apple II plus

With 64K of memory!

\$1389

APPLE INTERFACE CARDS

- CENTRONIC PRINTER 199
- COMMUNICATIONS Modem & cable 289
- DATA II CONTROLLER 2... 23 199
- INTERCOM BASIC PRINTING 199
- APPLEDOT PRINTING 199
- PARALLEL PRINTER PACKAGE 499
- PARALLEL PRINTER 179
- PROTOPRINT/NOVELL 99

COLOR



\$397.00 MONITOR 13"

VisiCalc

For the Apple and Atari

\$129.00

74LS00	.26	74LS155	1.15
74LS02	.26	74LS158	.75
74LS03	.26	74LS160	.95
74LS04	.26	74LS161	.85
74LS08	.28	74LS162	.95
74LS09	.26	74LS163	1.60
74LS10	.26	74LS164	.65
74LS20	.26	74LS165	.65
74LS21	.28	74LS170	1.75
74LS22	.26	74LS174	.75
74LS26	.49	74LS175	.75
74LS27	.26	74LS190	.75
74LS30	.28	74LS193	.95
74LS32	.32	74LS195	.95
74LS38	.32	74LS196	.85
74LS42	.65	74LS221	1.40
74LS48	.78	74LS240	1.65
74LS51	.25	74LS241	1.65
74LS54	.35	74LS243	1.45
74LS74	.38	74LS244	1.45
74LS75	.60	74LS245	2.25
74LS83	.44	74LS253	.95
74LS85	.95	74LS257	.95
74LS86	.95	74LS258	.95
74LS90	.69	74LS259	2.85
74LS93	.69	74LS279	.44
74LS107	.45	74LS283	1.00
74LS112	.38	74LS293	1.85
74LS113	.48	74LS298	1.20
74LS122	.48	74LS366	.95
74LS123	.95	74LS367	.55
74LS126	.69	74LS368	.55
74LS138	.69	74LS373	1.39
74LS151	.44	74LS374	1.39
74LS153	.44	74LS386	.65

APPLE EXPANSION KIT

16K Memory Add-On

MEMORY ADD-ON KIT INCLUDES INSTRUCTIONS

\$39.00



\$129 12" Leadex Corp

EPROMS

2708 1k x 8	5.95
8 FOR 40.00	
2716 2k x 8	8.95
single p.a.	8 FOR 80.00
2732 4k x 8	24.95
2716 2k x 8	6.95
triple p.a.	

apple clock/calendar

\$124.95

Seconds, minutes, hours, day-of-week (month, days, & years) on board batteries with one year life. Uses MSM5832-crystal controlled. California Computer Systems

SN7400N	.20	SN7440N	.22	SN74141N	.69
SN7402N	.22	SN7442N	.57	SN74151N	.65
SN7404N	.22	SN7443N	.78	SN74153N	.65
SN7408N	.24	SN7445N	.78	SN74154N	1.25
SN7410N	.22	SN7451N	.20	SN74155N	.80
SN7412N	.28	SN7454N	.20	SN74157N	.69
SN7413N	.35	SN7474N	.32	SN74160N	.95
SN7414N	.49	SN7475N	.32	SN74161N	.65
SN7416N	.29	SN7482N	1.05	SN74163N	.85
SN7417N	.29	SN7492N	.50	SN74164N	.87
SN7423N	.28	SN7493N	.48	SN74165N	.87
SN7425N	.25	SN7495N	.60	SN74174N	.95
SN7430N	.23	SN7496N	.70	SN74175N	.89
SN7437N	.29	SN74122N	.39	SN74180N	.75
SN7438N	.24	SN74136N	.95	SN74181N	1.15

MSM5832 MICROPROCESSOR \$745

REAL-TIME CLOCK
The MSM5832 is a monolithic metal-gate CMOS integrated circuit that functions as a real time clock calendar for use in bus oriented microprocessor applications. The on-chip 32.768 Hz crystal controlled oscillator time base is counted down to provide addressable 4-bit 1, 0 data of SECONDS MINUTES HOURS DAY-OF-WEEK DATE MONTH and YEAR Data access is controlled by 4-bit address chip select read write and hold inputs. Other functions include 12M 24M format selection lead year identification and manual 30 second correction.

TRS 80

16K Memory Add-On
\$4395
KIT CONTAINS DIP SWITCHES AND DETAILED INSTRUCTIONS



BUY FIVE OR MORE FOR ... \$16.95 each

CONCORD COMPUTER COMPONENTS

1971 SOUTH STATE COLLEGE ANAHEIM, CALIF. 92806

VISA MASTERCARD CHECK OR M.O. NO COD. CAL RES ADD 6%
MINIMUM ORDER \$10.00 ADD \$1.50 FOR SHIP ON ORDERS UNDER \$50. 5% IF OVER \$50

(714)937-0637

SOROC TECHNOLOGY, INC.



IQ120 \$689



No "Glitches", Surges Or Interference
THE SOROC TURNS AN ORDINARY OUTLET INTO A CONTROLLED FILTERED POWER SOURCE FOR UP TO EIGHT DEVICES.
\$8750

INTRODUCING - - -



REGULAR \$3250.00 LIST
 INTRODUCTORY PRICE ONLY **\$2450.00**

INCLUDING CP/M2.2®
 (Last Month At This Price)

320K
 MINI DRIVES
 SHOWN, 8"
 and 5 1/4" 10MB
 HARD DISK
 OPTIONAL

IMMEDIATE DELIVERY!

1 YEAR PARTS WARRANTY!
 (90 DAYS ON DRIVE PACKAGE, KEYBOARD AND LABOR)

U.S. MICRO SALES S-100-8

CHECK THESE FEATURES!

TERMINAL

- Feather Touch Capacitance Keyboard
- 60 Key Standard ASCII
 PLUS + Hex Keypad
 PLUS + 8 Special Function Keys
 PLUS + 20 Screen Editing Keys
- SOROC Type Screen Attribute Set
- Half Intensity

OPTIONS:

- ◆ Dual 5 1/4" Double Sided MPI B51 (640K) add \$225.00
- ◆ Dual 5 1/4" Double Sided MPI B91 (1.2MB) add \$360.00
- ◆ Dual 8" SIEMANS FDD120-8 Drives (1MB) add \$250.00
- ◆ Dual 8" QUME Double Sided Drives (2MB) add \$625.00

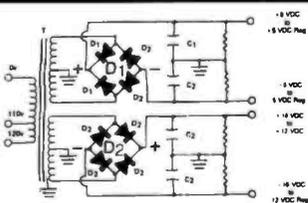
COMPUTER

- 8 Slot S-100
- 64K Dynamic Ram
- 4MHZ Z-80
- Serial Printer Port (150 - 19.2K)
- Double Density Disk Controller
- Programmable Baud Rate
- Programmable Keyboard Set

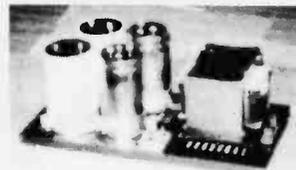
DISK STORAGE

- Dual Double Density
 5 1/4 Single Sided Drives
- DOUBLE SIDED Option
- Double Sided, 77
 Track, Option
- Color Matched Enclosure
- Self Contained Power Supply

U.S. MICRO SALES
 11 EDISON DRIVE ★ NEW LENOX, ILLINOIS 60451 ★ (815) 485-4002



BUILD YOUR OWN LOW COST MICRO-COMPUTER POWER SUPPLIES FOR S-100 BUS, FLOPPY DISKS, ETC.



POWER TRANSFORMERS (WITH MOUNTING BRACKETS)

ITEM NO.	USED IN KIT NO.	PRI. WINDING TAPS	SECONDARY WINDING OUTPUTS			SIZE W x D x H	UNIT PRICE
			2 x 8 Vac	2 x 14 Vac	2 x 24 Vac		
T ₁	1	0V, 110V, 120V	2 x 7.5A	2 x 2.5A	—	3 3/4" x 3 3/4" x 3 3/4"	21.95
T ₂	2	0V, 110V, 120V	2 x 12.5A	2 x 3.5A	—	3 3/4" x 4 3/4" x 3 3/4"	27.95
T ₃	3	0V, 110V, 120V	2 x 9A	2 x 2.5A	2 x 2.5A	3 3/4" x 4 3/4" x 3 3/4"	29.95
T ₄	4	0V, 110V, 120V	2 x 4A	(28V, CT)	48V, CT, @3A	3 3/4" x 3 3/4" x 3 3/4"	22.95
T ₅	—	0V, 110V, 120V	2 x 3A	2 x 2A	—	3" x 3" x 2 1/2"	14.95

POWER SUPPLY KITS (OPEN FRAME WITH BASE PLATE, 3 HRS. ASSY. TIME)

ITEM	USED FOR	@ +8 Vdc	@ -9 Vdc	@ +16 Vdc	@ -16 Vdc	@ +28 Vdc	SIZE W x D x H	UNIT PRICE
KIT 1	15 CARDS SOURCE	15A	—	2.5A	2.5A	—	12" x 5" x 4 1/4"	52.95
KIT 2	SYSTEM SOURCE	25A	—	3A	3A	—	12" x 5" x 4 1/4"	59.95
KIT 3	DISK SYSTEM	15A	1A	2A	2A	4A	14" x 6" x 4 1/4"	67.95

DISK SYSTEM PWR SUPPLY "S3" ASSY. & TESTED, OPEN FRAME, SIZE 10"(W) x 6"(D) x 4 1/4"(H)..... 92.95

UNREGULATED OUTPUTS: +8V @ 12A, ± 16V @ 3A.

REGULATED OUTPUTS: +5V @ 4A, -5V @ 1A, +24V @ 4A, SHORTS PROTECT. IDEAL FOR THE SYSTEM WITH 10 SLOTS MAINFRAME & TWO 8" DISK DRIVES, SUCH AS SHUGART 801R OR SIEMANS FDD 100-8. (OPTION: OVP for +5V @ ADD \$5.00)

DISK DRIVE POWER SUPPLY "R3" ASSY. & TESTED, OPEN FRAME, SIZE: 9"(W) x 6 1/4"(D) x 4 1/4"(H)..... 67.95

SPECS: +5V @ 5A REGUL, OVP, -5V @ 1A REG., +24 @ 5A REG., SHORTS PROTECT. OPTIONS: 1. REPLACE +24V BY +12V
2. ADD ± 12V @ 1A, \$12.00 MORE.

IDEAL FOR 2 SHUGART 801/851 OR SIEMANS FDD 100-8/200-8 DISK DRIVES & ROCKWELL AIM-65.

SHIPPING FOR EACH TRANSFORMER: \$4.75. FOR EACH POWER SUPPLY: \$5.00 IN CALIF. \$7.00 IN OTHER STATES. CALIF. RESIDENTS ADD 6% SALES TAX. OEM WELCOME.



MAILING ADDRESS:
P.O. BOX 4296
TORRANCE, CA 90510

SUNNY INTERNATIONAL
(TRANSFORMERS MANUFACTURER)
(213) 328-2425 MON-SAT 9-6

SHIPPING ADDRESS:
22129 1/2 S. VERMONT AVE
TORRANCE, CA 90502



1771 Junction Avenue
San Jose, California 95112
(408) 295-7247
(408) 295-7171



Yes! We supply **IMSAI** compatible products...

NOTE: "Original" IMSAI parts were purchased at the closing business sale of IMSAI Manufacturing Corp. WW Components also distributes S-100 buss IMSAI compatible parts and boards. As supplies of "original" parts are exhausted, WW reserves the right to supply equivalent compatible parts not made by IMSAI. All items listed as "Assembled & Tested" have been assembled by WW Components and carry a 1 year warranty.

I-8080 S-100 ENCLOSURE Sheet Metal Kit

THE ORIGINAL IMSAI: Mainframe with blue cover, cardguides and hardware spaced for PS-28D Power Supply, up to 22 slot motherboard.

Kit of all metal parts and hardware w/docs **\$115.00**
Thinker Toys WunderBuss20 for above w/o conn. **\$79.00**

MPU-B SBC 8085 CPU

Complete 8085 based CPU including: serial RS-232 port, parallel I/O port 3 MHz operation, 256 bytes memory, ROM monitor, 3 timers, and more.

Assembled & Tested **\$250.00**

PS-28D Power Supply Parts Kit:

Mounts in the I-8080 enclosure, supplies +8V @ 28A, +/- 16V @ 3A, kit includes board, transformer, documentation, and all components.

KIT \$95.50

I-8015 Complete System w/MPU-B

The complete 8085 system, includes MPU-B, RAM III, 10 slot terminated motherboard, PS-28D, and jump start front panel. A complete 64K system!

Assembled & Tested **\$1250.00**

CP/M[®] 2.2 for IMSAI

NOW AVAILABLE - CP/M for the IMSAI floppy disk system. Version 2.2 is available for the DIO-C 8" controller. Others on request. Docs. incl.

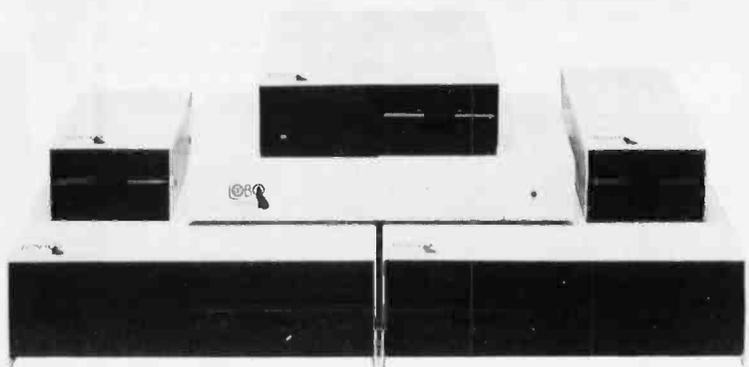
8" Diskette & Manuals **\$175.00**

Ask about documentation, repair service, firmware and software for your system.

TERMS: (1) PREPAID Send check or M.O. for merchandise amount only - we pay the shipping in USA only.
(2) UPS COD or bankcard orders by phone or mail - shipping charges added.
California Residents add 6.5% Sales Tax.

SEE US DOWNSTAIRS AT THE COMPUTER FAIRE

Add-On Disk Drive Subsystems For Apple, TRS-80, S-100 Based Computers



Expansion and enhanced capabilities are key words in achieving full utilization of your computer system. Our complete line of LOBO disk drive subsystems are the ideal, cost-effective way to provide the expansion capabilities you need to meet your system growth requirements. All of our subsystems are complete, thoroughly-tested, 100% burned-in, and feature a 1 year 100% parts/labor warranty.

APPLE

3101	MiniFloppy, 3101 MiniFloppy w/interface card
8101CA	One SA800 in cabinet w/power, DDC* Controller, cable and manual
8202CA	Two SA800 in cabinet w/power, DDC* Controller, cable and manual
5101CA	One SA850 in cabinet w/power, DDC* Controller, cable and manual
5202CA	Two SA850 in cabinet w/power, DDC* Controller, cable and manual *Double Density Controller

S-100 BASED COMPUTERS

MODEL NO.	DESCRIPTION
4101C	SA400 in cabinet w/power
8212C	Two SA801 in cabinet w/power
5212C	Two SA851 in cabinet w/power

GENERAL

MODEL NO.	DESCRIPTION
8212	Two SA801 In cabinet
8212C	Two SA801 In cabinet w/power
5212	Two SA851 In cabinet
5212C	Two SA851 in cabinet w/power

TRS80

MODEL NO.	DESCRIPTION	MODEL NO.	DESCRIPTION
4101C	SA400 in cabinet w/power	C808	Cable for TRS80 Eight-Inch Floppy
8101C II	One SA800 in cabinet w/power for Mod. II	LX80	Double-density expansion interface
8202C II	Two SA800 in cabinet w/power for Mod. II	RS232	Dual Serial Port Option
C802	Cable for Mod. II	16K	16K Byte RAM for LX80 (32KB max.)
C805	Cable for TRS80 MiniFloppy	VTOS	4.0 Disk Operating System

**JR
INVENTORY CO.,**
P.O. Box 185, Santa Ynez, Ca., 93460
(805) 688-8781

STANDARD RS232 CABLES

PART NO.	DESCRIPTION	PRICE
RS232MM9	Male to male 9 ft. cable	24.00
RS232MM18	Male to male 18 ft. cable	29.00
RS232MF9	Male to female 9 ft. cable	29.00
RS232MF18	Male to female 18 ft. cable	34.00
RS232FF9	Female to female 9 ft. cable	34.00
RS232FF18	Female to female 18 ft. cable	39.00
RS232MO9	Male to open 9 ft. cable	18.00
RS232MO18	Male to open 18 ft. cable	23.00
RS232FO9	Female to open 9 ft. cable	24.00
RS232FO18	Female to open 18 ft. cable	29.00

DISK DRIVE POWER CABLES

PART NO.	DESCRIPTION	PRICE
PDC-5	5 1/4" DC Power Connector 24" long	6.00
PAC-8	8" AC Power Connector 24" long	6.00
PDC-8	8" DC Power Connector 24" long	7.00
PAC-8D	8" AC Power Connector for Double Density Disk Drives	6.00

ALL ASSEMBLED - NOT A KIT

DISK DRIVE SIGNAL CABLES

Single 5 1/4" Drive Cable	\$24.00
Dual 5 1/4" Drive Cable	\$29.00
Quad 5 1/4" Drive Cable	\$34.00
Single 8" Drive Cable	\$24.00
Dual 8" Drive Cable	\$32.00
Quad 8" Drive Cable	\$40.00

Please state type connector:
card-edge or socket.

26 Pin Card-edge Connector
to DB25S 2' long **\$19.00**

4116 —	8/\$30.00
(200 ns)	
2708 —	\$6.00
2716 (5V) —	\$9.00
2732 —	\$25.00
2114L3 —	8/\$28.00

CLOCK/CALENDAR FEATURES

- 12/24 Hr. Format
- Month-Day-Year
- Day of Week
- Leap Year Bit
- 4 Interrupts
- +/-30 Sec. Adjust
- Battery Backup
- Simple to Program

S-100 Clock

A&T	\$150
Kit	\$100
Bare Bd.	\$ 60

Apple Clock

A&T	\$150
Kit	\$100
Bare Bd.	\$ 60

TRS-80

A&T Only	\$150
----------	-------

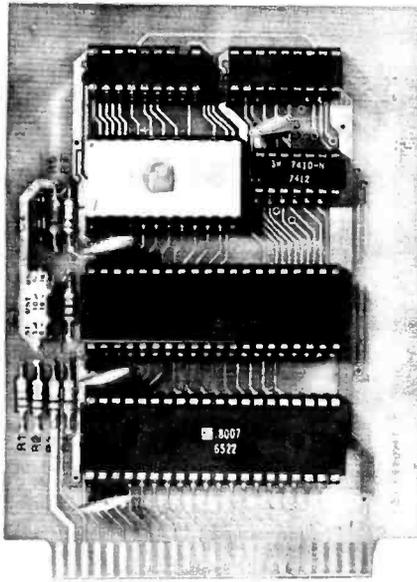
WE ACCEPT MASTER CHARGE, VISA & AMERICAN EXPRESS

LAX COMPUTER PRODUCTS
4728 Manhattan Beach Blvd.
Lawndale, CA 90260
(213) 542-4505

Apple is a Trademark of
Apple Computer Co.
TRS80 is a Trademark
of Tandy Corp.

TERMS: Cash, checks, money orders, credit card.
C.O.D. under \$100.00 add \$2.00 C.O.D. charge.
Minimum shipping & handling charge \$3.00. Prices
subject to change without notice. All sales in
American dollars only.

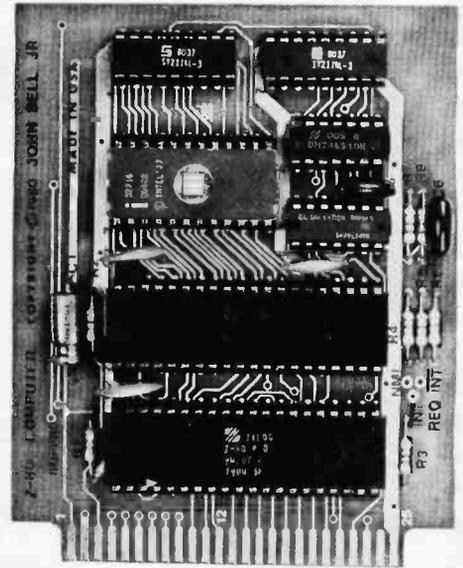
6502, Z80, 8080 AND 8085 USERS



**JOHN BELL
ENGINEERING'S
6502 AND Z80
MICROCOMPUTERS
ARE DEDICATED COM-
PUTERS DESIGNED FOR
CONTROL FUNCTIONS.**

THESE BOARDS FEATURE:

- 2048 BYTES EPROM
- 1024 BYTES RAM
- ALL BOARDS INCLUDE COMPLETE DOCUMENTATION
- 50 PIN CONNECTOR INCLUDED IN KITS AND ASSEMBLED UNITS
- 2716 AVAILABLE SEPARATELY



JOHN BELL ENGINEERING'S 6502 MICROCOMPUTER, 2716 EPROM PROGRAMMER AND APPLE II PARALLEL INTERFACE PLUS THE APPLE II MICROCOMPUTER — A COMPLETE DEVELOPMENT SYSTEM.

6502 MICROCOMPUTER FEATURES:

- 1024 BYTES RAM
- 2048 BYTES EPROM
- USES ONE 6522 VIA (DOC. INCL.)
- 2 8 BIT BIDIRECTIONAL I/O PORTS
- 2 16-BIT PROGRAMMABLE TIMER/COUNTERS
- SERIAL DATA PORT
- LATCHED I/O WITH HANDSHAKING LOGIC
- TTL AND CMOS COMPATIBLE

80-153 ASSEMBLED \$110.95
BARE BOARD \$24.95 KIT \$ 89.95

USE YOUR 6502 OR Z80 MICROCOMPUTER TO CONTROL EVERYTHING!

- YOUR HOME SECURITY SYSTEM
- HEAT CONTROL
- LIGHT CONTROL
- SOLAR HEATING AND POWER SYSTEMS
- AUTOMATIC CONTROL OF TAPE RECORDERS
- TRAFFIC LIGHT CONTROL
- IRRIGATION SYSTEMS
- AUTOMATIC CONTROL OF VIDEO RECORDERS
- ROBOT CONTROL
- AUTOMATIC DIALER
- AUTOMATED SLIDE SHOW CONTROL
- COMMUNICATION SYSTEMS FOR THE DISABLED
- THE WORLD

JOHN BELL ENGINEERING'S NEW Z80 MICROCOMPUTER FEATURES:

- Z80 CPU SOFTWARE COMPATIBLE WITH Z80, 8080 AND 8085 MICROPROCESSORS
- 2048 BYTES EPROM
- 1024 BYTES RAM
- SINGLE 5V POWER SUPPLY AT 300MA
- CLOCK FREQUENCY IS 2MHZ, RC CONTROLLED
- Z80 PIO (DOC. INCL.)
- 2 8 BIT BIDIRECTIONAL I/O PORTS
- LATCHED I/O WITH HANDSHAKING LOGIC
- TTL AND CMOS COMPATIBLE

80-280 ASSEMBLED \$129.95
BARE BOARD \$29.95 KIT \$119.95



JOHN BELL ENGINEERING

ALL PRODUCTS ARE AVAILABLE FROM: **JOHN BELL ENGINEERING**

P.O. BOX 338 • REDWOOD CITY, CA 94064 • (415) 367-1137

*SEND FOR OUR COMPLETE CATALOG! ADD 6% SALES TAX IN CALIFORNIA. ADD 5% FOR SHIPPING AND HANDLING.

VISA

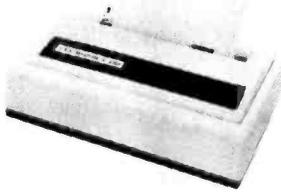
MASTER
CHARGE

ELECTRONICS CENTER

CALL TOLL FREE

1-800-228-4097

Call Toll Free For
"Unbelievable"
Low Low
Prices On These
Lines:



Tri-Quad 9" Desk Top Monitor



APPLE — ATARI — BASE 2
CENTRONICS
COMMODORE — DC HAYES
HAZELTINE — LEEDEX
MACROTRONICS — MAXELL
MOUNTAIN HARDWARE
NORTH STAR — PANASONIC
SANYO — SYNCOM

YOUR

ELECTRONICS PLAYGROUND

1840 "O" Street Lincoln, Nebraska 68508
In Nebraska Call (402) 476-7331



MICROCOMPEQUIP

DISCOUNTS & DEALER OVERSTOCKS

ALL ITEMS BELOW SOLD AS IS — NO RETURNS / NO REPAIRS
CALL FOR AVAILABILITY: LIMITED QUANTITIES

	Sell For	List Price
A.I. Cybernetics Speechboard	260.00	380.00
Anadex 40 Column Printer	641.00	855.00
Base 2 8K Memory Board Assembled	211.00	282.00
Commodore 2001-8 8K PET	550.00	795.00
Craig M-100 Translator	122.00	199.95
Dejen Cassette Interface	88.00	120.00
Dynabyte Naked Terminal	245.00	350.00
Digital Systems Dual 8" Single Density	2293.00	2732.00
Dutronics Poly Z-80 Upgrade Kit	123.00	169.95
Dutronics Imsai Z-80 Upgrade Kit	116.00	159.95
Eclectic Corp. Superchip for Apple II	75.00	95.00
Fidelity Electronics Ltd.		
Level 1 Chess Challenger	120.00	75.00
Level 4 Checker Challenger	100.00	115.00
Level 2 Checker Challenger	40.00	40.00
George Risk Inc. Pet Keyboard	176.00	250.00
Imsai CPU Board	125.00	175.00
Icom Micro Peripherals 5" Disk Drive	821.00	1095.00
Intertec Data Intertube Terminal	595.00	874.00
Kent Moore 8K RAM 450NS	148.00	197.50
Kent Moore Alpha Display Module	80.25	107.00
Mountain Hardware		
AC Control Apple	132.00	189.00
AC Remote	95.00	149.00
S-100 AC Control Kit	104.00	149.00
AC Remote Kit	67.00	99.00
AC Control-Apple Kit	104.00	145.00
Micromation Dual Memorex 8" disk drive	1467.00	1990.00
Micromation Dual Density disk controller Card	310.00	500.00
MS Corp. Apple PR-40 Interface	87.00	87.00
National Multiplex Digital Cassette Recorder	150.00	200.00
Novation 1200 Baud Modem (4202T)	274.00	375.00
Radio Shack TRS-80 Disk Drive	399.00	499.00
TRS-80 16K Computer	479.00	599.00
TRS-80 Expansion Interface	239.00	299.00

Polymorphic Systems		
8K Assembled	289.00	365.00
8K Memory Board	225.00	300.00
Poly KBD	169.00	225.00
8813	2880.00	3250.00
System 0	378.00	525.00
88-System 2	529.00	735.00
System 12 Kit	846.00	1128.00
System 6	1134.00	1575.00
Video Card	210.00	280.00
Processor Tech		
Cuts BD Assembled	139.00	199.00
8K Dynamic Ram	175.00	250.00
16K Dynamic Ram	300.00	429.00
64K Dynamic Ram	878.00	1350.00
Extended Basic Cassette	21.00	45.00
SOL 20 W/O Memory	1270.00	1895.00
System II Kit	1262.00	1905.00
Panasonic Monitor	143.00	210.00
SD Sales 32K Dynamic Ram Board Kit	332.00	475.00
Solid State Music 16K Static Ram Board Kit	300.00	325.00
Southwest Technical (SWTPC)		
MF-68 Dual 5" Floppy	796.00	995.00
Graphics Terminal	79.00	98.50
Technical Design Labs (TDL-Xitan)		
I/O board - SMB-II	257.00	395.00
32L Series K Memory Board	559.00	799.00
Fortran IV Ser.37	279.00	349.00
Fortran IV Ser.41	279.00	349.00
Xitan Alpha 1.5	823.00	1138.00
Xitan Alpha 1	576.00	769.00
Xitan Alpha 3	854.00	1181.00
Xitan Alpha 1.5	571.00	868.00
Video Board	277.00	369.00
Technico Super Starter Assembled	293.00	300.00
Technico Super Starter Kit	199.00	299.00
Trace Elec. 32K RAM Board Assem	599.00	999.00

NEW EQUIPMENT

CALL FOR
OUR LOW PRICES
FOR THE FOLLOWING
MANUFACTURERS:

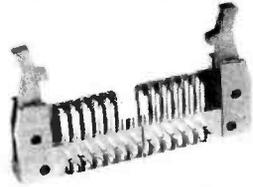
APPLE
ATARI
CROMEMCO
VECTOR GRAPHIC

MICROCOMPEQUIP
PO BOX 195
CROWNSVILLE, MD 21032

VISA / MC / CHECK
PHONE ORDERS:
(301) 261-1859

INSULATION DISPLACEMENT SOCKETS

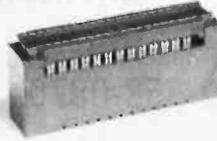
RIGHT ANGLE HEADERS



Pins	PC Mounting	Wire Wrap
10	IDH10SR .80	IDH10WR 1.75
20	IDH20SR 1.25	IDH20WR 2.75
26	IDH26SR 1.85	IDH26WR 3.60
34	IDS34SR 2.15	IDH34WR 4.15
40	IDH40SR 2.50	IDH40WR 4.90
50	IDH50SR 3.15	IDH50WR 6.15

EJECTOR EARS .25 EACH

CARD EDGE CONNECTORS



Pins	Part No.	Price
10	IDE10	3.25
20	IDE20	3.50
26	IDE26	4.05
34	IDE34	4.85
40	IDE40	5.65
50	IDE50	5.90

RIBBON CABLE



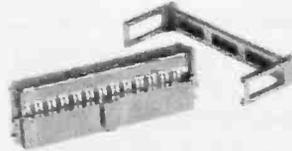
	Conductors: Solid Color		Color Coded	
	10 ft.	100 ft.	10 ft.	100 ft.
10	2.90	17.00	4.00	30.00
14	3.40	23.80	5.00	42.00
16	3.70	27.20	5.60	48.00
20	4.40	34.00	7.00	60.00
24	5.00	40.80	8.00	72.00
26	5.40	44.20	8.60	78.00
34	6.80	57.60	11.00	102.00
40	7.80	68.00	13.00	120.00
50	9.50	85.00	16.00	150.00

25 PIN "D" CONNECTORS



Style	Part #	Price
SOLDER STYLE		
Male	DB25P	2.25
Female	DB25S	3.00
Hood	DB25C	1.10
INSULATION DISPLACEMENT		
Male	IDC25P	4.95
Female	IDC25S	5.25
Hood	IDC25C	1.35

SOCKETS



Pins	Part No.	Price	Stain Relief
10	IDS10	1.25	.25
20	IDS20	2.02	.25
26	IDS26	2.65	.25
34	IDS34	3.50	.25
40	IDS40	4.05	.25
50	IDS50	5.06	.25

CABLE PLUGS



Pins	Part No.	Price
14	IDP14	1.25
16	IDP16	1.40
24	IDP24	2.25
40	IDP40	3.65

WIRE WRAP WIRE

Length	100/Bag	500/Bag	1K/Bag
2.5"	\$1.25	\$3.58	\$ 6.19
3.0"	1.30	3.86	6.78
3.5"	1.37	4.15	7.37
4.0"	1.42	4.44	7.94
4.5"	1.48	4.74	8.54
5.0"	1.54	5.04	9.13
5.5"	1.58	5.38	9.72
6.0"	1.65	5.66	10.31

Kynar precut wire. All lengths are overall, including 1" strip on each end. Colors and lengths cannot be mixed for quantity pricing. Choose from colors Red, Blue, Black, Yellow, White, Green, Orange, and Violet.

WIRE KITS

Kit No. 1	\$9.95	Kit No. 3	\$32.95
250 3" 100 4 1/2"		500 2 1/2" 500 4 1/2"	
250 3 1/2" 100 5"		500 3" 500 5"	
100 4" 100 6"		500 3 1/2" 500 5 1/2"	
		500 4" 500 6"	
Kit No. 2	\$24.95	Kit No. 4	\$59.95
250 2 1/2" 250 5"		1000 2 1/2" 1000 4 1/2"	
500 3" 100 5 1/2"		1000 3" 1000 5"	
500 3 1/2" 250 6"		1000 3 1/2" 1000 5"	
500 4" 100 6 1/2"		1000 4" 1000 6"	
250 4 1/2" 100 7"			

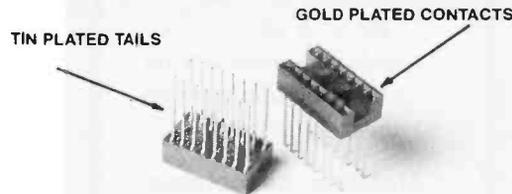
ORDERING INFORMATION:

- Orders under \$25 include \$2 handling
- All prepaid orders shipped UPS Ppd.
- Visa, MC & COD's charged shipping.
- All prices good through cover date.
- Most orders shipped same day.
- Byte must be mentioned to get sale price.

Write or call for 1981 catalog

- IC Sockets
- Vector Board & Pins
- Bishop Drafting Aids
- OK Tools
- RN IDC Crimp Connectors

"NEW" WIRE WRAP SOCKETS FEATURING A SELECTIVE PLATING METHOD THAT WILL SAVE YOU MONEY BY HAVING GOLD ONLY WHERE IT COUNTS.



3 Level closed entry.

RN Side Wipe contact design gives twice the contact area for high reliability.

Size	Quantity/Tube	Price ea.	Price/Tube
8	52	.41	21.32
14	30	.47	14.10
16	26	.51	13.26
18	23	.70	16.10
20	21	.87	18.27
22	19	.94	17.86
24	17	.96	16.32
28	15	1.25	18.75
40	10	1.70	17.00

*FOR REFERENCE. MUST BE ORDERED IN TUBE QUANTITIES.

Z-80 FORTH \$50.00

Fast, interactive, and flexible language well suited for real time applications. Full fig-FORTH and FORTH-79 vocabularies, plus extensions for access to all CP/M** functions. Uses standard CP/M compatible random access files for screen storage. Eight-inch soft-sectored single density diskette includes: Interpreter/compiler, line editor, screen editor, Z-80 assembler, decompiler, utilities, and demonstration programs. 60 page user manual supplied. Requires Digital Research CP/M 2.x or MP/M 1.x. Price includes tax and shipping by first class mail or UPS.

Laboratory Microsystems
4147 Beethoven Street
Los Angeles, CA 90066

- * FORTH Interest Group.
- ** CP/M is a trademark of Digital Research, Inc.

Circle 341 on inquiry card.

OHIO SCIENTIFIC

COMPUTERS

CIP SERIES II — \$479.00
OUR PRICE — \$399.00
other OSI discounts available

CALL NOW TOLL FREE
1-800-558-0870

COMPUTERS PLUS, INC.

2749 S. 108th St.
MILWAUKEE, WI 53227
(414) 321-1770
IN WISCONSIN

Circle 342 on inquiry card.

QUARTZ CRYSTALS

3218-B	5.2428	9.9336	20.000	36.2866	42.8518	46.8128-B
5300-A	5.610	9.98408	20.4984	36.3636	42.8768	47.3768-B
1.000-A	5.7143	9.98408	22.1184	37.9628	42.8256	47.8838-B
1.8432-A	5.955	10.000	22.6256	38.1768	42.9608	48.000-B
1.8437-A	5.955	10.000	23.1408	38.4448	43.0008	48.3008-B
2.000-A	6.000	10.000	23.5008	38.7528	43.0378	48.6668-B
2.0971-A	6.144	10.775	26.7608	38.2758	43.0748	48.7008-B
2.4576-A	6.15036	10.8255	27.000	39.2128	43.1858	48.7868-B
2.560-A	6.29786	10.8256	27.2008	39.3038	43.2608	49.7008-B
2.9657-A	6.400	11.1750	27.5256	39.9568	43.3338	49.1338-B
2.9650-A	6.5636	11.155	28.4008	39.7538	43.3708	49.8128-B
3.000-A	6.72530	11.2186	28.6276	39.8768	43.4078	50.2508-B
3.067-A	6.75840	11.2800	28.7538	39.9628	43.4378	51.0558-B
3.200-A	6.9000	11.4776	29.8758	40.4448	43.4488	51.3728-B
3.2718-A	7.0063	11.5566	29.8758	40.5298	43.5558	51.7718-B
3.500-B	7.0336	11.5816	30.0648	40.8128	43.6798	51.8508-B
3.579-B	7.0916	12.440	30.3608	40.8336	43.6668	52.8128-B
4.000-B	7.1836	14.3187	30.6758	40.8758	43.7178	56.7508-B
4.1943-B	7.2586	14.4008	30.8768	40.8888	43.8128	60.5008-B
4.3426-B	8.000	15.000	31.4776	40.9256	43.9148	60.7508-B
4.4803-B	8.0556	15.4008	31.7538	41.0008	43.8518	66.7508-B
4.6103-B	8.1416	15.5066	31.9008	41.1666	43.8888	70.4008-B
4.6603-B	8.1818	16.000	32.000	41.2508	43.9258	75.0008-B
4.8303-B	8.3303	16.3448	32.2008	41.3378	44.0008	90.8338-B
4.9152-B	8.4998	17.2248	32.5258	42.0008	44.3718	95.9568-B
5.000-B	8.5756	17.4277	34.5558	42.5836	44.3768	100.9568-B
5.0688-B	8.6956	18.000	34.7538	42.6268	44.7778	101.4668-B
5.1203-B	8.9608	18.4320	34.9776	42.7008	45.1256	103.0668-B
5.1850-B	9.9906	18.4960	35.9256	42.7538	46.3008	103.4668-B
5.1856-B	9.47208	19.7508	36.000	42.8148	45.7008	104.9168-B

ALL A — \$2.95 ALL B — \$1.95 10 OR MORE DEDUCT 5%
ADD \$1.00 SHIPPING
CAL. RES. ADD 6% SALES TAX
FREE OSCILLATOR SCHEMATICS
WITH ANY ORDER
QUALITY COMPUTER PARTS
P.O. BOX 743 / CHATSWORTH, CA 91311

Circle 343 on inquiry card.

COMPUTER COMPONENTS SLIDER

Q.T. AND GODBOUT COMPONENTS FROM SLIDER

Assembled & Tested	List	Price
Q.T. 28K 2MHz Static RAM	280	325
Q.T. 28K 2MHz Static RAM	310	375
16 - 18K 4MHz Static RAM	210	175
RAM - 60 18K 4MHz Static RAM Bank Select	280	230
Expandable - 8K Dynamic RAM Expanded Address	625	525
Expandable - 8K Dyn. Exp. Addr. No. 1/2 Size, Com.	875	545
Silence - Motherboards & Slot	50	45
18 Slot	70	60
12 Slot	88	75
18 Slot	140	120
Mainframe - with power supply	350	295
Mainframe - with 8 & Dual 5 1/4 Disk Cabinet	400	325
Mainframe - with 8 & Dual 8" Disk Cabinet	575	475
For Mainframe - 8 Motherboards & 8 Slot from above	150	125
CG - 2 Serial & Four 8 bit Parallel Ports	300	260
Clock Chipset - 5.000 Active Components	175	150
DDC - 2 Single & Dual Drive Cabinet w/ops	4995	4245
Q.T. 515 8" 1 sided dual floppy 8K System	5795	4825
Q.T. 515 8" 2 sided dual floppy 8K System	2495	1740
Q.T. Mini 515 3 1/2" 1 sided 2 floppy 8K System	2795	2375
Q.T. Mini 515 3 1/2" 2 sided 2 floppy 8K System	2795	2375
4148 200K Motorola Rom - 16K171 8 sec		12
GODBOUT COMPUPRO PRODUCTS ASSEMBLED & TESTED		
INTERACR 1 of 2 A&T	548	495
CRU 2 A&T 4MHz run at 5MHz w/200 280B	295	254
CRU 805 A&T 5MHz run RAM 200K addressable	375	325
CRU 805 8008 5MHz A&T The best of 8" 16 bit	425	361
COMPUPRO DISK CONTROL FOR 805 up to 5MHz	495	425
RAM 22 32K Static RAM A&T Will run to IDEMS	499	565
RAM 24 12K Static RAM C&C Serial atc	295	260
SYSTEM SUPPORT for A&T C&C Serial atc	395	335
COMPLETE WORD PROCESSING AND ACCOUNTING PACKAGE		
Q.T. System Complete with 280K, 8K RAM, 2 Serial ports, Dual 8" floppy		
CPM 2.3, Wordstar, BASIC 2, Accounting, GIGALPAK II (Payroll/Man-)		
aging, and MICR 510 printer. Includes 80K 4 Terminal 890	5095	5095
Same package w/3 1/2" Dual floppies	7345	6120
Postage & sales tax extra		
CALL OR WRITE FOR C&C AND ITEMS NOT LISTED		
Make Cashier's Checks, Certified Checks, or Postal Money Orders payable to SLIDER P.O. Box 951, Westminster, CA 92683 Call (714) 895-1748 9 to 5 Pacific Time M-Thurs-F. Postage Minimums \$2.00. Flippers & Mainframes add \$5.00 AND \$15.00 on Systems. California Residents add 6% Sales Tax. All Prices Subject to Change Without Notice.		
FREE ACCOUNTING PACKAGE TO END USERS ON Q.T. SYSTEMS		
P.O. BOX 951		
WESTMINSTER CA 92683		
714 895 1746		

Circle 344 on inquiry card.

CP/M 68XX CROSS-SOFTWARE including source code in "C"

- ASSEMBLER FEATURES:
- 2-pass absolute assembly
 - Full instruction set, Motorola-compatible
 - Free-format input
 - Unlimited length labels
 - Arithmetic expressions in operands
 - Sorted symbol table output
 - Intel format hex output

PACKAGE A6800... MC6800/MC6802/MC6808
PACKAGE A6801... MC6801/MC6803
PACKAGE A6809... MC6809

8" soft-sectored disk format, w/manual... \$100.00
5" North Star disk format, w/manual... \$100.00
Manual and listing alone... \$ 85.00
(Wisconsin residents please add 4% tax)

introl corp.
647 W. Virginia St. Visa and
Milwaukee, WI 53204 Master Charge
(414) 276-2937 Accepted

Circle 345 on inquiry card.

COMPUTER SURPLUS

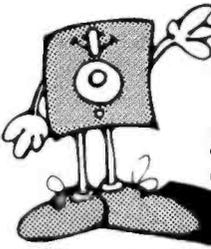
Used micro computer systems 100% functional, \$600 to \$1500. Video terminals & keyboards, \$50 to \$700. Stringy floppy units-brand new, \$300. All the above with documentation. Computer cabinets, 19" rack, \$50 to \$100. Power supplies, capacitors, ribbon cable, cooling fans, misc. components & hardware. Also deal in IBM & Univac.

CALL VIC CLOUGH at
(216) 473-0866
DATA HARDWARE
701 Beta Dr. #4
Cleveland Ohio 44143
DEALERS WELCOME

Circle 346 on inquiry card.

Dysan CORPORATION

Solve your disc problems, buy 100% surface tested Dysan diskettes. All orders shipped from stock, within 24 hours. Call toll FREE (800) 235-4137 for prices and information. Visa and Master Card accepted. All orders sent postage paid.



PACIFIC EXCHANGES
100 Foothill Blvd.
San Luis Obispo, CA
93401. (In Cal. call
(805) 543-1037.)

Circle 347 on inquiry card.

Pascal and C for hire

- Experience in:
- systems software
 - real time applications
 - business applications
 - scientific applications
 - data reduction

McHenry Associates
P.O. Box 2700
Huntington Beach, CA 92647
(714) 962-6019

Circle 348 on inquiry card.

CONVERT ANY TV TO A HIGH QUALITY MONITOR

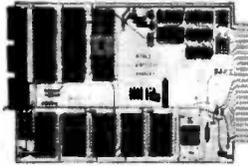


- Hot Chassis or Transformer sets*
 - 64-80 characters per line
 - By-passes tuner & I.F.
 - Normal viewing unaffected
 - Safe—Easy kit installation
 - ACVM Hi-resolution \$34.95 ppd.
 - * Referenced to neutral
- V. A. M. P. INC.
Box 29315, Los Angeles, CA 90029
Calif. Residents add 6% Sales Tax

Circle 349 on inquiry card.

\$94.20*

Single Board Computer



6800 MPU, serial I/O, parallel I/O, RAM, EROM, 44-pin 4 1/2" x 6 1/2" PCB

EXPANSION MODULES
RAM, ROM, CMOS RAM/battery, analog I/O, serial I/O, parallel I/O, counter/timer, 488 GPIB, EROM programmer, power fail detect/power on reset



Wintek Corp.
1801 South Street
Lafayette, IN 47904
317-742-8428

Circle 292 on Inquiry card.

SUPERLETTER

Is For
SuperBrain® People!

Now, owners and operators of Intertec SuperBrain computers around the world have a special newsletter to call their own! Superletter is packed each month with important technical news, accessory ideas, and CP/M software designs for the SuperBrain.

Regular monthly features include Technical Corner, Q & A Forum, Intertec Factory News, Guest Interview, and Super Classifieds.

For subscription info and ad rates, contact:

SUPERLETTER

Abrams Creative Services
P.O. Box 3121
Beverly Hills, CA 90212
(213) 277-2410

Circle 293 on Inquiry card.

MULTIPLE TERMINALS WITH CP/M®1

Irvine Computer's NEW Model 100 Transaction Multiplexer lets you construct CP/M®-based, multi-terminal, transaction-oriented applications without requiring additional system memory, serial interfaces, or a multi-user operating system!

The Model 100 connects to your computer in place of your existing RS-232 console terminal. Up to seven (7) RS-232 terminal devices can then be connected to the Model 100. When the computer is busy, the Model 100 buffers all terminal input data until the application program asks for it.

NO CP/M® mods, hardware mods, nor assembly-language code is required. Applications can be written in high-level languages. Loaded with features! \$1495, quantity one, F.O.B. Costa Mesa, CA. Limited manufacturer's warranty. For more information, call or write:

EASTERN U.S. AND FOREIGN:

Wright Marketing Company, Ltd.
19104 Rhodes Way
Gaithersburg, MD 20760 (301) 840-1928

WESTERN U.S.:

Irvine Computer Corporation (mfr.)
3001 Red Hill Avenue, 6-103
Costa Mesa, CA 92626 (714) 557-5292

CP/M® is a registered trademark of Digital Research.

Circle 294 on Inquiry card.

Keepers-Finders

NEW!

FILING SYSTEM FOR COMPUTER DISKETTES



Try one FREE!

A non-glare clearplac page having two pockets on one side to house one 8" diskette plus a top pocket to store an index card to record disk data. The pages are three-hole punched for convenient and economical storage in standard three-ring binders.

Write for FREE sample or send \$2.95 for a package of 10 holders plus \$.75 for shipping and handling.



BIS, INC., P.O. BOX 969, BRENTWOOD, TN 37027
(615) 373-2380

Circle 295 on Inquiry card.

ATARI OWNERS

SCREEN PRINT INTERFACE

Obtain hardcopy of any screen image (graphics and / or text) on either a TRENDCOM 200 or IDS 440 Paper Tiger printer. Simply attach the supplied parallel printer cable and load the software from cassette (may be transferred to Disk). Obtain a "picture" of the screen on your printer under direct (CTRL7) or program (XIO) control. Works in all graphics / text modes as well as LPRINT and LIST "P".

Only \$139

Parallel Printer interface for the ATARI 400 / 800

Connects to controller jacks 3&4 works with BASIC / DOS / ASSEMBLER Three printer connectors available:

ATARI 400 / 800		
TRENDCOM 100 / 200	A4P-1	A8P-1
CENTRONICS 730 / 737	A4P-2	A8P-2
CENTRONICS 36 PIN*	A4P-3	A8P-3

CA sales add 6% tax MC / VISA accepted.

\$69.95

* Fits all other parallel Centronics plus Anodex, Base 2, Epson, Comprint and Microtek. Order by part number. ATARI is a recognized trademark of ATARI, Inc.

MACROTRONICS, inc. ®

1125 N. Golden State Blvd. / Suite G
Turlock, CA 95380 (A) (209) 667-2888 / 634-8888

Circle 296 on Inquiry card.

<h3>HEADERS</h3> <p>PRINTED CIRCUIT RIGHT ANGLE MOUNT</p> <p>34 PIN HEADER 3M 3413-1003 \$1.25 EA</p> <p>40 PIN HEADER ALPHA \$1.50 EA</p> <p>50 PIN HEADER 3M 3433-1002 \$1.75 EA</p> <p>40 PIN CONNECTOR 3M 3417 \$1.50 EACH</p> <p>22/44 EDGE CONNECTOR TIN SOLDER TAIL .156" x .200"</p> <p>LARGE QUANTITIES AVAILABLE \$1.35 each 10 for \$12.50</p>	<h3>7-17vdc S.S. BUZZER</h3> <p>Fits dip socket CMOS Compatible Max Current 14mA Sound output 70dB @ 20 cm \$1.25 each</p> <p>FLAT LEVER HANDLE MINI TOGGLE SPDT RATED 6 AMPS @ 125 V 1/4" 40 BUSHING \$1.00 each 10 for \$8.50</p> <p>Litronix FRL-4403 FLASHER LED diffused red led with built in flashing unit T 1 1/2 package Pulse rate 3Hz @ 5v 20 ma. 2 for \$1.70</p>
--	--

ALL ELECTRONICS CORP.

905 S. Vermont Ave. Los Angeles, Calif. 90006
(213) 380-8000
Mon. - Fri. 9 AM - 5 PM Saturday 10 AM - 3 PM
TERMS: Quantities Limited, Min. Order \$10.00, Add \$2.00 Shipping USA, Calif. Res. Add 6%, Prompt Shipping

SEND FOR FREE CATALOG

Circle 297 on Inquiry card.

LISP

INTERPRETER FOR THE TRS-80®

SEE THE AUGUST, '79 ISSUE OF BYTE TO FIND HOW EASY IT IS TO USE LISP.

- INCLUDES MORE THAN 30 FUNCTIONS & PREDICATES.
- CODED FOR HIGH-SPEED OPERATION.
- FULL ARITHMETIC CAPABILITY.
- USER'S MANUAL.
- SUPPLIED ON CASSETTE FOR 16K-64K LEVEL II.

SEND \$50 IN CHECK OR MONEY ORDER TO:

CYBER INNOVATIONS
WORLD TRADE CENTER
P.O. Box 58657
DALLAS, TEXAS 75258

*TRADEMARK OF TANDY CORPORATION

Circle 298 on Inquiry card.

LOWEST COST

LIGHTNING, RFI, STATIC, AND TRANSIENT

VOLTAGE PROTECTION

SOLVES	USED FOR
disc drive errors	small computers
memory loss	medical equipment
intermittancies	stereos, tv's
short lifetimes	word processors

"CIRCUIT-SAFE"
2 INDIVIDUALLY FILTERED BANKS OF 3 SOCKETS (6 TOTAL 3-PRONG SOCKETS)

1875 WATT MAX LOAD \$26.95 ppd.

try one for 15 days!

HORIZON, INC.
COMPUTER PRODUCTS DIV.
BOX 454
PALATINE, IL. 60087

ENCLOSING CHECK _____ MONEY ORDER _____
VISA _____ MASTERCHARGE (BANK NO. _____)
EXPIRES _____ SIGNED _____

ACCT. NO. _____

NAME _____

ADDRESS _____

Circle 299 on Inquiry card.

ATARI®

COMPLETE LINE OF ATARI
COMPUTER PRODUCTS 20-25% OFF

Atari 800 with 16K.....	\$810	Atari 810 Disk Drive.....	\$460
Atari 400 with 8K.....	\$399	Atari 410 Cassette Player.....	\$69
Visicalc.....	\$170	Kurta Graphics Tablet.....	\$560
Ramcrum 32K Modules (upgrade 400 or 800).....	\$256		

ALL ATARI SOFTWARE 20% OFF
BIT BUCKET SOFTWARE FOR ATARI:

Utilities Disk with Disassembler, Basic Renumberer, Character Generator, Cruncher Utility (requires 24K)..... \$45
Games: Mastercode, Mr. Simon, City Bomber (each)..... \$12.95
Hex, Cryptogram,
Flying Saucers (each)..... \$14.95
Any 3 of above \$30.00. (specify disk or cassette)

ALSO: Commodore Pet at Similar Savings
PLUS: Centronics, NEC, Zenith, Intertec, and More!



The Bit Bucket

Hardware, Software, Consulting
168 North Beacon Street
P.O. Box 365
Newton Highlands, MA 02161
Phone: (617) 783-3144

Circle 300 on inquiry card.

DOWN-TO-EARTH PRICES ON OUT-OF-THIS-WORLD PERSONAL COMPUTERS AND COMPONENTS.

Look at this!



Ohio Scientific Superboard II \$299

- It's the first complete computer system on a board.
- Superboard II uses the ultra powerful 6502 Microprocessor
- 8K Microsoft BASIC-in-ROM
- 4K static RAM on board, expandable to 8K
- Full 53-key keyboard, with upper and lower case. Plus user expandability.
- Video interface and audio cassette interface.

The Ohio Scientific Superboard II at \$299 — in today's economy — has got to be the best buy by far. It will entertain you with spectacular graphics made possible by its ultra high resolution graphics and super fast BASIC. It will help you in school or industry, as an ultra powerful scientific calculator. Advanced scientific functions and a built-in "immediate" mode allow you to solve complex problems without programming.

The Superboard II can be expanded economically, for business uses, or to remotely control your home appliances and security. Even communicate with other computers.

Read what's been written about Superboard II:

"We heartily recommend Superboard II for the beginner who wants to get into microcomputers with a minimum cost. A real computer with full expandability."

—POPULAR ELECTRONICS, MARCH 1979

"The Superboard II is an excellent choice for the personal computer enthusiast on a budget."

—BYTE, MAY 1979

Look at these easy hardware prices:

610 Board For use with Superboard II and Challenger 1P. 8K static RAM. Expandable to 24K or 32K system total. Accepts up to two mini-floppy disk drives. Requires +5V @ 4.5 amps.	\$ 298
Mini-Floppy Disk Drive Includes Ohio Scientific's PICO DOS software and connector cable. Compatible with 610 expander board. Requires +12V @ 1.5 amps and +5V @ 0.7 amps. [Power supply & cabinet not included.]	299
630 Board Contact us for important details.	229
AC-3P 12" combination black and white TV/video monitor.	159
4KP 4K RAM chip set.	79
PS-005 5V 4.5 amp power supply for Superboard II.	45
PS-003 12V power supply for mini-floppies.	45
RF Modulator Battery powered UHF Unit.	35
CS-900B Metal case for single floppy disk drive and power supply. [While stock lasts.]	49
AC-12P Wireless remote control system. Includes control console, two lamp modules and two appliance modules, for use with 630 board.	175
AC-17P Home security system. Includes console, fire detector, window protection devices and door unit for use with 630 board.	249
C1P Sams C1P Service manual	8
C4P Sams C4P Service manual	16
C3 Sams Challenger III manual	40
Ohio Scientific and independent suppliers offer hundreds of programs for the Superboard II, in cassette and mini-floppy form.	

Freight Policies All orders of \$100 or more are shipped freight prepaid. Orders of less than \$100 please add \$4.00 to cover shipping costs. Ohio residents add 5.5% Sales Tax.



Hours: Call Monday thru Friday,
8:00 AM to 5:00 PM E.D.T.
TOLL FREE: 1-800-321-5805

Guaranteed Shipment

Cleveland Consumer Computers & Components guarantees shipment of computer systems within 48 hours upon receipt of your order. Our failure to ship within 48 hours entitles you to \$35 of software, FREE.

To Order: Or to get our free catalog **CALL 1-800-321-5805 TOLL FREE.** Charge your order to your **VISA** or **MASTER CHARGE** account. Ohio residents call: [216] 464-8047. Or write, including your check or money order, to the address listed below.



CLEVELAND CONSUMER COMPUTERS & COMPONENTS

P.O. Box 46627
Cleveland, Ohio 44146

Order Form: CLEVELAND CONSUMER COMPUTERS & COMPONENTS P.O. Box 46627 Cleveland, Ohio 44146

- | | |
|--|---|
| <input type="checkbox"/> Superboard II \$299. | <input type="checkbox"/> RF Modulator \$35. |
| <input type="checkbox"/> 610 Board \$298. | <input type="checkbox"/> AC-3P 12" B/W Monitor \$159. |
| <input type="checkbox"/> Mini-Floppy Disk Drive \$299. | <input type="checkbox"/> C1P Sams Manual \$8. |
- [Attach separate sheet for other items.]

NAME _____

ADDRESS: _____

CITY: _____ STATE: _____ ZIP: _____

PHONE: _____

Payment by: VISA _____ MASTER CHARGE _____ MONEY ORDER _____

Credit Card Account # _____

Expires _____ Interbank # [Master Charge] _____

TOTAL CHARGED OR ENCLOSED \$ _____ [Ohio Residents add 6.5% Sales Tax]

Orders of less than \$100, please add \$4.00 to cover shipping costs. Orders will be accepted from U.S. and Canada only. All prices quoted are U.S., date of publication, standard UPS shipping FOB the factory.

B

Close-Out!!



Desk Top Computer

This unit is a computerized Electronic Secretary. It keeps time, date, calendar, message, and meeting files. Originally sold thru a major mail order house for over \$450.

Technically, it's a 6507 MICRO, ROM, RAM, Panaplex Alpha Display, Ni-Cad battery, Power Supply, Keyboard, Wood and Aluminum Case with Schematic and operating instructions.

Most of these Computers are warranty returns. We are offering Refurbished, like new, units for \$99.95 and AS IS (most have minor problems) units for \$44.95. Add \$4.95 for shipping and handling. All units are complete as described. All sales are final. California Residents add 6.5% sales tax.

Send Payment with order or call our Order Line 408-272-2320 and use your MC or VISA card.

Solid State Surplus
P.O. Box 32418/San Jose, CA 95152

Circle 302 on Inquiry card.

**SOFTWARE
DESIGN ENGINEER**

BSEE/BSCS, minimum 3 years programming experience. Real-time systems programming and software development for electronic switches is a plus. Experience with PASCAL or C or Assembly language required. Call collect or send resume to Kenneth W. Cooper, Harris Corporation, RF Communications Division, 1680 University Avenue, Rochester, NY 14610, (716) 244-5830, EXT 3356.



HARRIS
COMMUNICATION AND
INFORMATION PROCESSING

An Equal Opportunity Employer M/F

8035 SYSTEMS

A compact modular set of PC Boards for implementing test Instruments, measurement and control systems, badge readers, data communications, data entry, games or home security systems.

KIT A&T	
CPU Board, 8035, 2716	
1K RAM, 40 I/O Lines	\$99 \$125
SIO Board, 3 8251A, RS 232	
Dr/Rec, 6 LEDs	99 125
PIO Board, 2 8255 PIOs.	
Line Drivers	99 125
2 or 3 Slot Mother Boards	50
Power Supply, 5V, 12V & 12V	55 65
Diagnostic EPROM and Listing	40

Bare Boards, Schematics and Parts Lists, each \$19.95

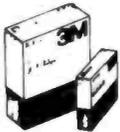
Boards are 4" by 7", 80 pins, 156 centers edge connector. Development Tools available on CPM.

Make check payable to:

SKP Electronics
2211 Caper Tree Dr. Tustin, CA 92680
(714)832-1732

California residents add 6% sales tax.
Please add \$3.00 for shipping and handling.

Circle 304 on Inquiry card.



Scotch
DISKETTES

SAVE 40% Write for our complete list.

5 1/4" Sgl. Dens. 26.70/10
Specify soft, 10 or 16 hard sectors

8" Sgl. Dens. 27.30/10
8" Dbl. Dens. 35.80/10
Specify soft or 32 hole hard

Add \$2.00 shipping - Michigan add 4% tax

LYBEN COMPUTER SYSTEMS
27204 Harper Ave.
St. Clair Shores, MI 48081

Authorized Distributor
Information Processing Products



Circle 305 on Inquiry card.

**FLOPPY DISKS
8" & 5 1/4"**

OPUS - \$26.00/Box of 10

3M - \$32.00/Box of 10

MCS PO Box 5059
Milford, Ct.
06460
(203) 877-3610

We carry a full line
of computer supplies

Send for free catalog.

VISA - MASTERCHARGE - CHECK

Circle 306 on Inquiry card.



**SAVE
20 to 30%**

BUY WHOLESALE!

Sale thru 4/30/81 on Zenith/Heath
Z-89 64K system, listing for \$3045

Anyone may buy 1 for \$2375
or 2 for \$2284 each
or 3 for \$2193 each

Call or write for prices on other Zenith, North Star, and other Z-80 based computer systems, modules, peripherals, and supplies at New England's oldest independent computer store.

Computer Mart, Inc.
1395 Main Street
Waltham, MA 02154
(617) 899-4540

Circle 307 on Inquiry card.

**OKIDATA
MICROLINE 80
PRINTERS**

479.00

80 CPS • Up to 3 part copy • 9x7 dot matrix • 80,132 columns - 64 shapes for graphs or charts • 6 or 8 lines per inch • Friction feed standard - Tractor feed optional • Quantity discounts available. Charge card orders add 3%.

American Business Computers
118 South Mill Street
Pryor, OK 74361
918-825-4844



Circle 308 on Inquiry card.

TRADE-A-COMPUTER

A classified ad magazine
run by a computer...

With AD-LINE®, a menu-driven computer program, one phone call will immediately compose and expertly index your ad. Prompts will insure inclusion of all pertinent details. AD-LINE® will answer all questions and take all subscription information.

Use your terminal and any 300 baud coupler for instant communication with our computer.

If you don't have a terminal to access AD-LINE® mail your ads to:

PO Box 15842
Philadelphia, PA 19103



1-215-462-4415

6 PM TO MIDNIGHT 7 DAYS A WEEK

Circle 309 on Inquiry card.

**MICRO
DESIGN CONSULTANTS**

1 Bit through
32-Bit Machines

We handle concept
through production
prototypes with
complete documentation.

HARDWARE - 916/723-1050

David Jenkins
7214 Springleaf Court
Citrus Heights, CA 95610

SOFTWARE - 916/381-1717

Richard Lerseth - LEAPAC
8245 Mediterranean Way
Sacramento, CA 95826

Circle 310 on Inquiry card.



THE STAR MODEM

From Livermore Data Systems

RS232 MODEM	SALE \$135
IEEE 488 MODEM	SALE \$245
RS232 CCITT	\$170
IEEE 488 CCITT	\$280

STAR Modem is the price performance leader with a full 2 YEAR FACTORY WARRANTY.

MIPLLOT Intelligent Plotter

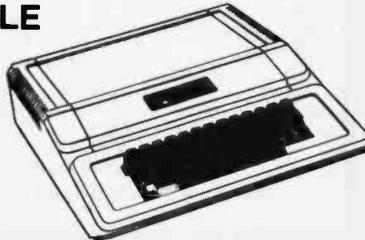
by Watanabe Instruments (Digiplot)

SPECIAL
\$1145



Has all intelligent functions for producing graphs and drawings including 8 vector and 4 character commands. Solid and broken lines can be specified. Character generator for alpha, numeric, and symbols. Characters can be rotated in 4 orientations, and can be 16 sizes. Coordinate axes drawn by specifying graduation interval and number of repetitions. Parallel ASCII interface, 11 x 17 paper.

WE CARRY THE BLACK APPLE



EBS Business System for PET/CBM

Extremely comprehensive package for small business. Fully integrated inventory and accounts receivable system including invoices, packing slips, mail labels, statements, bank deposit slips, and 17 reports.

Paper-Mate Word Processor \$29.95

PET/CBM full featured 60 command system by Michael Riley. Uses either tape or disk and any printer. Includes in-text commands, floating cursor, scrolling, etc.

FLEX-FILE Data Base for CBM/PET \$60

Random file handling system with Report Writer and Mail Label Handler. By Michael Riley

KMMM Pascal for PET \$75

Subset of standard Pascal with true machine language translator for faster execution. 16K with tape or disk.

EARL for PET (disk file based) \$65

Editor, Assembler, Relocater, Linker to generate relocatable object code.

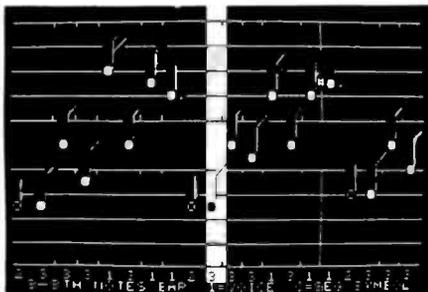
fullFORTH+ for PET/CBM \$65

A full-featured FORTH with extensions conforming to Forth Interest Group standards. Includes assembler, string processing capabilities, disk virtual memory multiple dimensioned arrays, floating point and integer processing.

6502	7.45	10/6.95	50/6.55	100/6.15
6502A	8.40	10/7.95	50/7.35	100/6.90
6520 PIA	5.15	10/4.90	50/4.45	100/4.15
6522 VIA	6.45	10/6.10	50/5.75	100/5.45
6532	7.90	10/7.40	50/7.00	100/6.60
2114-L200 ns RAM		3.75	20/3.50	100/3.25
2716 EPROM (5 volt)		9.90	5/9.45	10/8.90
TMS 2532 EPROM				23.50
4118-200 ns RAM				8 for 29.00
S-100 Wire Wrap				2.65

CASSETTES - AGFA PE-611 PREMIUM

High output, low noise, 5 screw housing, labels.
C-10 10/5.65 50/25.00 100/48.00
C-30 10/7.30 50/34.00 100/66.00
All other lengths available. Write for price list.



4 PART HARMONY MUSIC SYSTEM for PET

Allows you to easily enter, display, edit, and play 4 part harmony music. Includes whole notes thru 64ths (with dotted and triplets), tempo change, key signature, transpose, etc. The KL-4M unit includes D to A converter and amplifier (add your own speaker).

KL-4M Music Board with VMM Program \$59.90



CBM-PET SPECIALS

FREE Up to \$235 FREE merchandise with purchase of one of following CBM-PET items!

8032 32K - 80 column CRT	\$1795	235
8050 Dual Disk Drive - 1 megabyte	1795	235
8N Full size graphics keyboard	795	75
16K Business or Graphic Keyboard	995	150
32K Business or Graphic Keyboard	1295	205
2040/4040 Dual Disk Drive - 340K	1295	205
2022 Tractor Feed Printer	795	100
C2N External Cassette Deck	95	12
CBM Voice Synthesizer	395	50
Used CBM/PET Computers		CALL

WRITE FOR SYSTEM PRICES

EDUCATIONAL DISCOUNTS

Buy 2 PET/CBM Computers, receive 1 FREE

WordPro 3+	32K, disk, printer	250
WordPro 4+	8032, disk, printer	385
OZZ Data Base System for CBM 8032		335
VISICALC for PET, ATARI		170
BPI General Ledger, A/P, A/R for PET/CBM		270

EPROM Programmer for PET	72.00
Programmers Toolkit - PET ROM Utilities	34.90
2 Meter IEEE to IEEE Cable	43.00
PET Spacemaker Switch	24.90
Dust Cover for PET	6.90
IEEE-Parallel Printer Interface for PET	110.00
IEEE-RS232 Printer Interface for PET	120.00
The PET Revealed	17.00
Library of PET Subroutines	17.00

Source Hookup over 1000 programs/services 88

DISK SPECIALS



SCOTCH (3M) 5 1/4"	10/2.90	50/2.80	100/2.70
SCOTCH (3M) 8"	10/2.95	50/2.85	100/2.75
Verbatim 5 1/4"	10/2.45	50/2.40	100/2.35
(add 1.00 for 5 1/4" Verbatim plastic storage box)			
Verbatim 8" Dbl. Dens.	10/3.45	50/3.35	100/3.25
BASF 5 1/4" soft	10/2.60	20/2.50	100/2.40
BASF 8" soft	10/2.65	20/2.55	100/2.45

Maxell Disks In stock - write for prices

Diskette Storage Pages	10 for 3.95
Disk Library Cases	8" - 2.85 5" - 2.15

ATARI 800 \$777

All Atari Modules 20% OFF

ATARI EDUCATIONAL PLAN Write for details.

A P Products 15% OFF
A P Hobby-Blox 15% OFF



ALL BOOK and SOFTWARE PRICES DISCOUNTED

The 8086 Book (Osborne)	14.00
Z8000 Assembly Language Programming	16.90
PET Personal Computer Guide (Osborne)	12.75
PET and the IEEE-488 Bus (Osborne)	13.60
6502 Assembly Language (Osborne)	14.45
Programming the 6502 (Zaks)	10.45
6502 Applications Book (Zaks)	10.45
6502 Software Cookbook (Scelbi)	9.45
CP/M Handbook (w/ MP/M) Zaks	11.85
Practical BASIC Programs (Osborne)	13.60
Some Common BASIC Programs (Osborne)	12.75

WRITE FOR CATALOG.

Add \$1.25 per order for shipping. We pay balance of UPS surface charges on all prepaid orders. Prices listed are on cash discount basis. Regular prices slightly higher.

115 E. Stump Road
Montgomeryville, PA 18936 **215-699-5826 A B Computers**

H-89

I/O EXPANSION KITS

1. Decoder interface (H-89-1): This board plugs into the CPU board of the H-89 and gives an additional 64 I/O ports (0 to 77Q) plus a socket for another 64 ports defined by the user.....\$39.95
2. Parallel I/O board (H-89-2): This board contains 2 of 8255A chips plus a circuit for an optional 2716 EPROM and 74S470 decoder burner. It will be compatible with the expansion box to be announced later.....\$59.95
3. PROM burner kit (H-89-3): This kit contains all the parts and software to complete the (H-89-2) into a 2716 EPROM and 74S470 PROM burner....\$49.95

The price includes shipping and handling within U.S.A. 6% tax for Illinois residents. 10% off before May 31, 81.

MICROFLASH CO.
4916 B CAROL
SKOKIE, ILL. 60077
(312) 677-4928

Circle 312 on inquiry card.

COMPUTER INTERFACE

for the IBM Electronic Typewriter

The MEDIAMIX ETI™ will allow you to connect an IBM ET Model 50, 60 or 75 to any computer that has a Centronics type parallel port. Features include a Z 80 Microprocessor, 2000 bytes RAM, user definable codes & characters, right justification and access to all of the tricks these typewriters are capable of.

MEDIAMIX
PO Box 67B57 dept. B
Los Angeles, CA. 90067

213-475-9949

Circle 313 on inquiry card.

MAGIC WAND™ \$325

This powerful word processor is in stock for most CP/M compatible systems, including Radio Shack, North Star, Vector Graphics, Cromemco and APPLE (with Z-80 card @ \$295 and Videx 80 column board @ \$295). We will custom configure your diskette if you will specify: CPU, terminal, printer.

Our fully interactive

MAIL MAGIC™

mail management software, with 14 user defined fields and full merge and sort capability is available for \$149.

We will also quote on all specific hardware and software for APPLE, PET and Vector Graphics.

Computer City
P.O. Box 60284 B
Houston TX 77205
(713) 821-2702



Magic Wand is a registered trademark of Small Business Applications
Mail Magic is a registered trademark of Computer City

Circle 314 on inquiry card.

Tired of BASIC? Try S/S PASCAL!

for CP/M* users

- Powerful subset of Standard PASCAL.
- Integers, Reals, Strings, Text Files, etc...
- INTERACTIVE COMPILER !!
- Correct your errors during compilation!
- Your source on disc is compiled in fast efficient Poode directly stored on disc.
- Complete and detailed manual.
- No knowledge of PASCAL required.

SCOTIA SOFTWARE

\$65 on cassette
or 5.25" disc
\$10 manual only

1964, Beech st., Halifax N.S.
R3H 4B8, CANADA

Requirement: 24K with CP/M*

* CP/M is a trademark of Digital Research

Circle 315 on inquiry card.

**Cancer
dies with the patient
Heart Disease
dies with the patient
Huntington's
Disease
kills on and on and on.**



Suite 501, 1441 Broadway
New York, N.Y. 10018
212-966-4320

79-3

THIS SPACE CONTRIBUTED BY THE PUBLISHER

HARDWARE SPECIALS

PRINTERS	
CENTRONICS 730-1	\$ 575
CENTRONICS 737-1	\$ 720
DIABLO 630	\$2075
TERMINALS	
TELEVIDEO 920C	\$ 835
TELEVIDEO 912C	\$ 775

NORTH STAR HORIZON MICROPROCESSORS

Fully Tested Liberal Return Policy

NS HORIZON II	
QUAD DENSITY, 32K	\$2938
DOUBLE DENSITY, 32K	\$2524
UPGRADE TO 64K	\$ 520
CP/M* FOR NORTHSTAR	\$ 150

GREAT DEALS ON SOFTWARE

MICROPRO	
WORDSTAR™	\$ 325
MAILMERGE™	\$ 100
DATASORT™	\$ 230
SUPERSORT I™	\$ 165
SUPERSORT II™	\$ 130

SMALL BUSINESS APPLICATIONS, INC.
MAGIC WAND™ \$ 275

20% OFF CP/M* WITH NS HORIZON II
10% OFF ALL OTHER SOFTWARE WITH NS HORIZON II

DWP Inc. (703) 241-2910

123 Roswell Court, Falls Church, Virginia 22046

CP/M is a registered trademark of Digital Research Corp.

Circle 317 on inquiry card.

INVENTORY CLEARANCE

* UP TO 50% OFF *

*** 16K RAM MEMORY KIT ***
UPGRADE YOUR COMPUTER
IN 5 MINUTES
4116 chips -- Guaranteed PRIME
ADD 200ns 16K (1 SET OF 8) \$32.95
10 SETS OR MORE ONLY \$ 29.95

** CENTRONICS 101A PRINTER - ONLY \$895.

TRS -80
SAVE HUNDREDS OF DOLLARS OFF MODEL II
AND MODEL III

*** TAP THE SOURCE OR MICRNET *****
HUGE DATABASE
WITH HAZELTINE 1000 terminal
AND MODEM ONLY ----- \$499.00

-COMPUTER SYSTEM-
STANDARD AND CUSTOMIZED, WORD-
PROCESSING, DISTRIBUTED AND
MANY MORE... DATAPOINT, ALPHA/PRINT

--- REPAIRS ---

OUR IN-HOUSE EXTENSIVE ELECTRONIC
REPAIR SERVICE REPAIRS DISK DRIVES
TERMINALS -- PRINTERS AND MUCH MORE.
GENERAL PERIPHERALS 41 GRASSY PLAIN
BETHEL CT. 06801 PHONE (203) 743-5583

**We're the
MAGNOLIA people
you've been
looking for...**

Add the CP/M* disk operating system to your Zenith/Heath '89 All-in-One Computer. Easily installed hardware and software proven by reliable service for more than a year. Supports 8-inch, double-sided 5-inch, and hard disk drives.

Only \$195.
Ask your local dealer, or

MAGNOLIA
MICROSYSTEMS
2812 THORNOYKE AVE. WEST
SEATTLE, WASHINGTON 98199

(206) 285-7266

CP/M* is a registered trademark of Digital Research, Inc.

Circle 319 on inquiry card.

?? APPLE*-ITIS ??

Hardware or Software Problems?
Save time and money by having your own diagnostic disk. Determine immediately if you have a hardware problem.

XPS's APPLE*-CILLIN can help you cure your problems fast and easily.

Order APPLE*-CILLIN for
\$29.95**

XPS inc.

323 York Road
Carlisle, PA 17013

* trademark of Apple Computer Inc.
**PA Residents add 6% sales tax
Requires 48K and one Disk II*

Circle 320 on inquiry card.

WE WILL NOT BE UNDERSOLD

DISK DRIVES



FOR TRS-80* Model I
 CCI-100 TEAC 5 1/4", 40 Track (102K) \$314
 CCI-100 MPI 5 1/4", 40 Track (102K) \$319
 CCI-280 5 1/4", 80 Track (204K) \$429

ADD-ON DRIVES FOR ZENITH Z-89
 CCI-189 5 1/4", 40 Track (102K) \$394
 CCI-289 5 1/4", 80 Track (204K) \$499
 Z-87 Dual 5 1/4" system \$995

External card edge and power supply included. 90 day warranty/one year on power supply.

RAW DRIVES 8" SHUGART 801R \$425
 5 1/4" MPI, TEAC or TANDOM \$ CALL

MORROW DESIGNS/THINKER TOYSTTM
 DISCUS 2D 1 DRIVE \$ 938 2 DRIVE \$1635
 DISCUS 2 + 2 1 DRIVE \$1259 2 DRIVE \$2245
 DISCUS Hard Disk M26 \$3990 M10 \$2999

DEI CARTRIDGE TAPE BACK-UP
 For your hard disk. With either S-100 control card or piggy back board for single board Z-80 computers. ~~\$3500~~ \$2995

DISK OPERATING SYSTEMS
 PATCHPAK #4 by Percom Data \$8.95
 CP/M[®] for Model I, Zenith \$145 for Model II, Altos \$ 169
 NEWDOS Plus 40track \$ 79 NEWDOS 80 \$ 135

DISKETTES — Box of 10 with plastic library case
 5 1/4" Scotch \$35 Maxell \$40 BASF/Verbatim \$24
 8" Scotch \$50 Maxell \$55 BASF/Verbatim \$36
 CLEAR PLASTIC CASE—Holds 50 5 1/4" diskettes \$19

COMPLETE SYSTEMS
 ARCHIVES \$ CALL
 ALTOS ACS8000 Series \$ CALL
 APPLE II-16K \$1075 III-96K \$3749
 Call for other Apple products
 TRS-80* II-64K \$3499 III-16K \$ 899
 ZENITH 48K, all-in-one computer \$2395
 ZENITH Z-19 \$ 795
 TELEVIDEO 920C \$ 748 950 \$1049
 IBM 3101 Display Terminal \$1195
 ATARI 400 \$ 479 800 \$ 795
 APF Game Only \$ 95 System \$ 489
 MATTEL INTELLIVISION \$ 229
 Used TRS-80* Model I Computers, tested and guaranteed \$ CALL

MONITORS
 APF 9" B & W TVM-10 \$120
 BELL & HOWELL 9" B & W BHD911 \$220
 LEEDEX 12" B & W \$129 13" Color \$389
 SANYO 9" B & W VM4509 \$155
 SANYO 12" B & W DM5012 \$226
 SANYO 12" Green Screen DM5112 \$238
 SANYO 13" Color DMC6013 \$416
 ZENITH 13" Color \$350

TELECOMMUNICATIONS
 LIVERMORE STAR MODEM 2-year guarantee \$129
 UNIVERSAL DATA SYSTEMS UDS-103 \$179
 D-CAT HARD WIRED DIRECT MODEM \$189
 AUTO-CAT Auto Answer, Direct Connect Modem \$249

For fast delivery, send certified checks, money orders or call to arrange direct bank wire transfers. Personal or company checks require two to three weeks to clear. All prices are mail order only and are subject to change without notice. Call for shipping charges.

PRINTERS

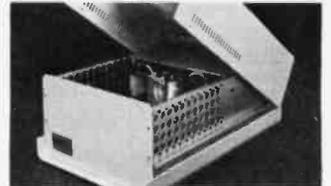
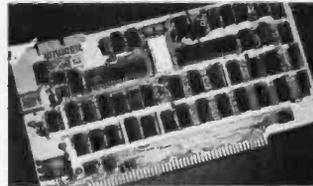


NEC Spinwriter
 Letter Quality High Speed Printer
 R.O. \$2395
 R.O. with tractor feed \$2595
 KSR with tractor feed \$2895

C.ITOH Starwriter \$1795 Starwriter II \$1995
 EPSON MX-80 \$ CALL
 PAPER TIGER
 IDS 445 Graphics & 2K buffer \$ 699
 IDS 460 Graphics & 2k buffer \$1050
 IDS 560 Graphics \$1599
 ANADEX DP-8000 \$849 DP-9500/01 \$1345
 OKIDATA
 Microline 80 Friction & pin feed \$ 499
 Microline 80 Friction, and pin & tractor feed \$ 599
 Microline 82 Friction & pin feed feed \$ 719
 Microline 83 120 cps, uses up to 15" paper \$ 995
 CENTRONICS 730 \$ 595 737 \$ 780 779 \$ 969
 EATON LRC 7000⁺ \$ 269
 TI-810
 TRS-80* software, compressed print & vert. form control \$1865

16K RAM KITS 2 for \$56 \$30
 200 ns for TRS-80*, Apple II, (specify): Jumpers \$2.50

S-100 CALIFORNIA COMPUTER SYSTEMS



MAINFRAME Model 2200A \$349
 Z80 CPU Model 2810 \$269
 MOTHER BOARD Model 2501 \$ CALL
 16K STATIC RAM, 200ns Model 2016BC \$309
 32K STATIC RAM, 200ns Model 2032C \$619
 64K DYNAMIC RAM Model 2065A \$599
 FLOPPY DISC CONTROLLER Model 2422A \$359
 EXTENDER BOARD Model 2520 \$ CALL
 2P + 2S I/O Model 2718 \$ CALL

ACCESSORIES
 Z-80 SOFTCARD \$299.00
 SCOTCH HEAD CLEANING DISKETTE: Cleans drive
 Read/Write head in 30 seconds; specify 5 1/4" or 8". \$ 25.00
 FLOPPY SAVER: Protection for center holes of 5 1/4"
 floppy disks. Installation tools and rings for 25 diskettes. \$ 11.95
 Re-orders of rings only \$ 6.95
 VIDEX BOARD 80 Column, U/L case conversion card \$279.00
 CRT FILM: Helps eliminate external glare, 9" \$ 29.00
 RF MODULATOR: Adapts video to TV \$ 29.00
 TRS-80 & OTHER MYSTERIES \$ 18.95
 NEC SPINWRITER THIMBLE \$11.95 RIBBON \$ 6.00
 CCS CARDS: Parallel or serial printer interface cards \$115.00
 RS232: For Radio Shack Interface. \$ 89.00
 DISK-DRIVE EXTENDER CABLES: Fits all mini-disk drives. \$ 16.95
 SIX (6) PRONG ISOLATOR: ISO-2 \$ 54.00
 AC FILTER/6 PRONG POWER STRIP \$ 39.00
 DISK DRIVE CABLES: 2 drive \$29.00 4 drive \$ 35.00

DEALER (NATIONAL/INTERNATIONAL) INQUIRIES INVITED Send for FREE Catalogue

The CPU SHOP

TO ORDER CALL TOLL FREE 1-800-343-6522
 TWX: 710-348-1796 Massachusetts Residents call 617/242-3361

5 Dexter Row, Dept. B04M
 Charlestown, Massachusetts 02129
 Hours 10AM-6PM (EST) Mon.-Fri. (Sat. till 5)

Technical Information call 617/242-3361
 Massachusetts Residents add 5% Sales Tax
 Tandy Corporation Trademark/ Digital Research



COMPUTER EQUIPMENT & SOFTWARE BARGAINS



EVERY MONTH

BUY, SELL OR TRADE ALL TYPES OF COMPUTER EQUIPMENT AND SOFTWARE (pre-owned and new) among 20,000 readers nationwide in BIG (11x14") pages. Classified ads are only 10¢ per word and are indexed for easy and fast location. Subscription: \$10 a year / 12 issues. Money back guarantee. Sample copy, \$1.50.

COMPUTER SHOPPER

P.O. Box F-14
Titusville, FL 32780
(305) 269-3211

MasterCard or VISA subscription orders only, call **TOLL FREE 1-800-528-6050 Ex. 184**.

Circle 322 on inquiry card.

BELOW DEALERS COST!



NorthStar Horizon
4860B - TESTED AND ASSEMBLED

32K DD	— 2265.00
32K QUAD	— 2600.00

Immediate Delivery
Application Software

NorthStar Pascal \$160.00	NorthWord \$335.00	General Ledger \$825.00
Info Manager \$395.00	NorthStar BASIC FREE	Mail Manager \$245.00
Accounts Receivable \$475.00		Accounts Payable \$475.00

COD - CASH IN ADVANCE - VISA / MASTER CHARGE*
*ADD 4 PERCENT ON CHARGE ORDERS



CUSTOM BUSINESS COMPUTERS

103 ATLANTIC AVENUE, LYNBROOK, NEW YORK 11563-(516)887-3340

Circle 323 on inquiry card.

Fine Software Tools in C



The Toolbox

list prints that missing source listing.
xref cross reference C programs
sort alphabetize by all or part of text line.
col arrange text in columns on page.
print paginates text for hard copy.
and more

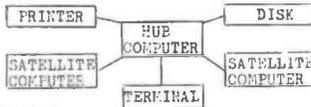
All programs are in portable Whitesmith C xref and list are compatible with the compiler's error listing. Title lines on list and print output includes the date on RT-11 systems. Source code on 8" floppy and manual available immediately for \$45 (tax and shipping included) Specify RT-11 or CP/M format.

The Toolsmith
Dept. BYTE
P. O. Box 22511
San Francisco, CA 94122

RT-11 is a trademark of Digital Equipment Corp.
CP/M is a trademark of Digital Research.

Circle 324 on inquiry card.

SMARTNET



FEATURES

- Automatic spooling and despooling.
- Levels 1-15 of the hub computer are password protected.
- No modifications needed to the BIOS or XIOS.
- Block data transfer with checksum.
- Low memory requirements.
- Complete source code provided.

REQUIREMENTS

- Hub computer must be running MP/II*.
- Smartnet requires CP/II* 2.2, 20k of memory and at least one disk drive.
- Dumbnet requires at least 16k of memory. Disk drives not needed.

PRICE

SMARTNET \$150.00 DUMBNET \$175.00
PURCHASE TOGETHER \$300.00

LINMAR

541 Ingraham Ave.
Calumet City, IL 60409
312-868-4866 Ask for Mark

* Trademark of Digital Research.

Circle 325 on inquiry card.

SURPLUS ELECTRONICS

ASCII ASCII



TRS-80* COMPATIBLE, IBM SELECTRIC® -BASED I/O TERMINAL with ASCII conversion installed: \$645.00

Many Other Items Available: Tape Drives; Cable; Cassette Drives; Wire; Power Supplies (5 volt 35 amp, others); Displays; Cabinets; Transformers; Heat Sinks; Printers; Components.

Send for Free Catalog
WORLDWIDE ELECTRONICS, INC.
130 Northeastern Blvd.
Nashua, N.H. 03062

Phone orders accepted using VISA or MC
Toll Free 1-800-258-1036
in NH 603-889-7661

*TRS-80 is a trademark of the Radio Shack Division of Tandy Corporation.

Circle 326 on inquiry card.

MEMOREX Floppy Discs

Lowest prices. WE WILL NOT BE UNDERSOLD!! Buy any quantity 1-1000. Visa Mastercharge accepted. Call free (800)235-4137 for prices and information. All orders sent postage paid.



PACIFIC EXCHANGES
100 Foothill Blvd.
San Luis Obispo, CA
93401. (In Cal. call
(805) 543-1037.)

Circle 327 on inquiry card.

No TRS-80™ Word processor

is complete without

PROOFREADER

Let your TRS-80 proofread your SCRIPTSIT, Electric Pencil or other documents. Proofreader uses a 38,000 word dictionary and lists misspelled words on a file, screen, or printer. (Requires 32K, 1 disk, MODEL-I) \$34.00

RATFOR

Rational Fortran preprocessor allows structured programming using Fortran. One of the best versions available, with full manual. (Requires Fortran, 48K, 2 disks, MODEL-I) \$49.00

SOFT-TOOLS are professional quality software tools developed for the TRS-80 by a PhD in Computer Science. Versions for MODEL-III available soon.

Order Postpaid: SOFT-TOOLS
MHE Box 14
Tijeras, NM 87059

Circle 328 on inquiry card.

Know The Reasons Why The FORCE-80 is your "Best Buy."

- FORCE-80** The computer protector
- Power dropout protection
 - Suppresses transient voltages
 - Suppresses RFI
 - Disc protection
 - Factory warranty
 - Satisfaction guaranteed
 - Direct from factory

FORCE-80

Only \$121.50 plus \$5.00 shipping & handling
Check, Mastercharge, Visa accepted



(5% discount for cash)
No C.O.D.'s please



P&S Electronics, Inc.

P.O. Box 23014 Dept. B
Nashville, TN 37202

Allow 6-8 weeks for delivery.
Add 14 days for personal checks.

Circle 329 on inquiry card.

Double Side Disk Drives



Disk Drive Subsystem with Dual Double Side Drives, Power Supply and Cable. Total Capacity 2.4 M-Byte. Fully Assembled and Tested.

- Only !!
1. Table Top Version \$1,695.00
 2. Rack Mount Version 1,695.00
 3. Pair of Slides with Attachment for Rackmount 35.00
 4. 5100 Disk Controller (handles single & double density in 256, 512 & 1024 byte sectors, single & double side) 350.00
 5. Double Side Disk Drives (1.2 mb) 535.00 (Qume DT/8)

Call Now (408)496-6910

OSM Computer Corporation
2364 Walsh Avenue
Santa Clara, CA 95051

Circle 330 on inquiry card.

This is a partial listing of over 500 items available from 500 authorized Jim-pak Distributors:

TTL			
7400	2/.85	7490	.85
7402	2/.85	7493	.85
7404	2/.85	74100	2.25
7406	2/1.19	74109	2/1.19
7407	2/1.19	74121	.69
7408	2/.89	74123	.99
7410	2/.85	74150	1.95
7414	.99	74154	1.95
7417	2/1.10	74157	.99
7420	2/.85	74161	1.19
7447	1.19	74164	1.59
7474	.69	74174	1.59
7475	.79	74175	1.49
7476	.69	74192	1.19
7485	1.19	74193	1.19
7486	2/1.19	74367	.99
7489	2.99	74393	1.95



GRAB BAGS

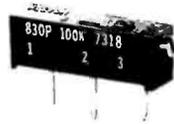
GB100	Cer. Caps. (100)	2.95	GB123	Heat Sinks (30)	3.95
GB101	Mylar Caps. (60)	4.95	GB127	Transistors (100)	3.95
GB102	Electrolytics (60)	4.95	GB137	Chokes (50)	3.95
GB103	Tantalums (40)	4.95	GB139	Term. Strips (40)	3.95
GB108	TTL IC's (50)	4.95	GB140	Spcr/Stndrff (150)	2.95
GB110	Asst. LEDs (100)	5.95	GB141	Washers (200)	2.95
GB113	Trimmers (30)	4.95	GB145	Lugs (100)	2.95
GB116	1/4W Resist. (200)	2.95	GB154	1&2w Resist. (100)	2.95
GB117	1/2W Resist. (200)	2.95	GB162	7-Seg. Dsplys. (50)	5.95
GB120	Slide Switch (25)	3.95	GB173	3/8" Pots. (100)	5.95

LS Schottky			
74LS00	.55	74LS109	.79
74LS02	.55	74LS123	1.95
74LS04	.69	74LS138	1.49
74LS08	.55	74LS139	1.49
74LS10	.55	74LS154	2.49
74LS14	1.09	74LS157	1.49
74LS30	.55	74LS161	1.79
74LS32	.69	74LS174	1.79
74LS38	.69	74LS175	1.79
74LS42	1.49	74LS192	1.89
74LS47	1.49	74LS193	1.89
74LS48	1.79	74LS221	1.95
74LS73	.79	74LS244	2.49
74LS74	.79	74LS245	3.49
74LS75	.99	74LS367	1.29
74LS85	1.95	74LS374	2.49
74LS90	1.09	81LS97	2.49

POTENTIOMETERS



2 Watt @ 70°C
7/8" Slotted Shaft
Linear Taper



3/4 Watt @ 70°C
15 Turn Pot.
Linear Taper

1K	5K	10K	100Ω	500Ω	1K
25K	50K	100K	5K	10K	50K
1 Meg			100K	500K	1Meg

CMU .. \$2.95 830P .. \$1.79

REGULATED POWER SUPPLY KIT



Uses LM309K. Heat Sink provided. PC board construction. Provides a solid 1 amp @ 5 volts. Can supply up to ±5V, ±9V and ±12V with JE205 Adapter. Includes components, hardware and instructions. 3 1/2"x5"x2"H

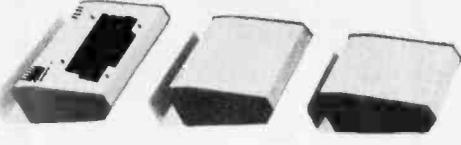
JE200 \$14.95

SOCKETS




Low Profile	Wire Wrap		
8 pin LP	2/.59	14 pin WW tin	.75
14 pin LP	2/.69	14 pin WW gold	1.09
16 pin LP	2/.79	16 pin WW tin	.79
18 pin LP	2/.89	16 pin WW gold	1.19
20 pin LP	2/.99	24 pin WW gold	1.69
22 pin LP	2/1.09	40 pin WW gold	2.75
24 pin LP	.79	14 p. plug/cover	1.29
28 pin LP	.82	16 p. plug/cover	1.39
36 pin LP	.99	24 p. plug/cover	1.95
40 pin LP	1.19	Also, The Molex Line	

DESK TOP ENCLOSURES



DTE-8 (Pictured)	\$31.95
DTE-11 (Pictured)	34.95
DTE-14	36.95
DTE-HK (Case for JE600)	47.95
DTE-AK (Case for JE610) (Pictured)	52.95

DIODES & TRANSISTORS

1N751	2/.59	2N2219A	2/1.19
1N757	2/.59	2N2222A	2/.89
1N188	2.69	2N2907A	2/.89
1N3600	5/.99	2N3055	.99
1N4001	4/.59	2N3772	2.25
1N4004	4/.69	2N3904	2/.69
1N4007	4/.79	2N3906	2/.69
1N4148	10/.99	2N4401	2/.79
1N4733	2/.69	2N4403	2/.79
1N4734	2/.69	2N5129	2/.69
1N4735	2/.69	2N5139	2/.69
1N4742	2/.69	2N5210	2/.79
1N4744	2/.69	2N5951	2/1.29

CMOS

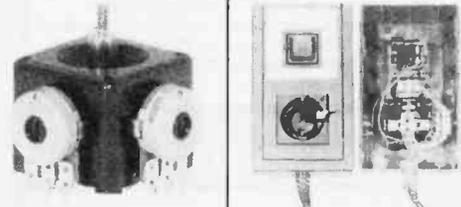
4000	.69	4030	.79
4001	.69	4040	1.95
4002	.69	4044	1.39
4006	1.95	4046	2.49
4009	.89	4047	2.75
4010	.85	4049	.89
4011	.69	4050	.89
4013	.85	4051	1.95
4016	.85	4066	1.19
4017	1.49	4069	.79
4018	1.49	4070	.79
4020	2.19	4071	.79
4023	.49	4081	.69
4024	1.29	4093	1.19
4027	.89	4511	1.95

CAPACITORS

Dipped Tantalum	ELECTROLYTIC		
.1mfd @ 35V	2/.89	1mfd @ 50V	3/.69
.47mfd @ 35V	2/.89	4.7mfd @ 50V	2/.69
1mfd @ 35V	2/.89	10mfd @ 50V	2/.69
2.2mfd @ 25V	2/1.09	22mfd @ 50V	2/.79
3.3mfd @ 25V	2/1.19	47mfd @ 50V	2/.89
4.7mfd @ 25V	2/1.39	100mfd @ 50V	.59
10mfd @ 25V	1.19	220mfd @ 50V	.69
33mfd @ 25V	3.95	1000mfd @ 25V	1.19
		2200mfd @ 16V	1.39

100V MYLAR	50V CERAMIC		
.001-.01mfd	4/.79	.022mfd	4/.89
.022mfd	4/.89	10pf-.022mfd	4/.59
.047mfd	4/.99	.047mfd	4/.69
.1mfd	4/1.19	.1mfd	4/.79
.22mfd	4/1.29		

JOYSTICKS



JS-100K	100K Linear Taper Pots	\$5.49
JVC-40	40K (2) Video Controller	5.95

CONNECTORS



DB25P	D-Subminiature Plug	3.95
DB25S	D-Subminiature Socket	4.95
DB51226	Cover for DB25P/S	2.25
22/44SE	P.C. Edge	2.95
UG88/U	BNC Plug	2.19
UG89/U	BNC Jack	3.95
UG175/U	UHF Adapter	.59
SO239	UHF Panel Recp.	1.49
PL258	UHF Adapter	1.95
PL259	UHF Plug	1.95
UG260/U	BNC Plug	2.39
UG1094/U	BNC Bulkhead Recp.	1.49

MICROPROCESSORS

Z80A	CPU (4MHz)	14.95
MC6800	8 Bit MPU	14.95
8080A	CPU	7.95
8212	8 Bit I/O Port	3.95
8216	BI-Directional Bus Driver	4.49
2513/2140	Character Generator	12.95
8T97	Tri-State Hex Buffer	2.25
AY-5-1013	30K Baud UART	6.95
AY-5-2376	88-Key Keyboard Encoder	13.95
2114-3	4K Static RAM (300ns)	9.49
MK4116	16K Dynamic RAM (250ns)	9.95
2708	8K EPROM	10.95
2716	16K EPROM (+5V)	19.95

TOOLS

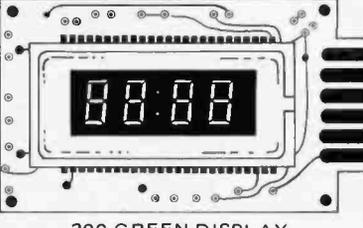


PCB-3	P.C. Board Vise	\$12.49
WS-150	5" Wire Strip./Cut. (12-24AWG)	3.99
SG-30	10" 110-120V 30W Solder Iron	7.50
SG-TIP	Replacement Tip for SG-30 S. Iron	1.25

LINEAR

LM301N	.59	LM7805T	1.75
LM305H	1.39	LM7812T	1.75
LM307N	.75	LM7815T	1.75
LM308N	1.19	LM380N	1.49
LM309K	2.25	LM384N	2.49
LM310N	2.69	LM555N	.69
LM311N	1.49	LM556N	1.49
LM317T	2.29	LM565N	1.95
LM318N	2.95	LM566N	1.95
LM319N	2.95	LM567N	1.79
LM320K-5	2.25	LM723N	.79
LM7905T	1.75	LM741N	.65
LM7912T	1.75	LM1310N	2.95
LM7915T	1.75	LM1458N	.99
LM323K	5.95	LM1488N	1.59
LM324N	1.29	LM1489N	4.49
LM337T	2.29	LM1800N	4.49
LM339N	1.29	76477N	3.95

12VDC AUTOMOTIVE/ INSTRUMENT CLOCK MODULE



.300 GREEN DISPLAY

MA 1003 \$19.95

!! REAL TIME !!

The TIME MACHINE from ALPHA OMEGA COMPUTER SYSTEMS isn't just another digital clock chip surrounded by interface circuitry. It's an intelligent microcomputer based peripheral device.

The TIME MACHINE communicates with your computer via a serial I/O port at a user selectable data rate between 300 and 2400 bauds. RS-232, RS-422, or current loop communication may be used.

Battery protection against power loss is included. The TIME MACHINE automatically computes day of the week and leap year. Buffered output pulses at one second, one minute, and one hour intervals are provided.

Dimensions are 2.5 x 4.75 x 7.5 inches. Batteries, power supply, and communication cable are included.

Price is only \$450 single lot and quantity discounts are available. Dealer Inquiries Invited. Off the shelf delivery.

ALPHA OMEGA COMPUTER SYSTEMS, INC.
P.O. Box 727 / Corvallis, Oregon 97330
15031754-1917



Circle 332 on inquiry card.

**ZAS
Z-8000**

SOFTWARE DEVELOPMENT PACKAGE

A professional Z-8000 assembly language package now available for 8080 & Z-80 based microcomputers which use the CP/M® or ISIS-III® operating system. The package includes:

ZAS Full featured relocatable cross assembler. Uses Zilog syntax, supports segmented and non-segmented code, symbol names to 64 characters. 26 directives, including nested conditional assembly, "Include" files, and named program, data and absolute sections. Outputs: object and listing files.

ZLK Task Builder. The most powerful linker you've ever used! Sections can be combined in any order and optionally "located" at fixed addresses. ZLK can also handle complicated overlay arrangements.

ZLD Object Loader. Loads an absolute object file for execution by a Z-8000 CPU on the bus. Includes host OS interface.



Box 48 Placerville, CO 81430

ZAS, ZLK, ZLD CP/M® .. \$395
ISIS-III® .. \$495

Manual Only.....\$25

Supplied on Single Density 8" Disk
CP/M® Digital Research, Inc. ISIS-III® Intel Corp.

Circle 333 on inquiry card.

**North Star
BASIC UTILITY SET**

- EDITOR — Create & edit a Basic program using 26 commands, including GLOBAL locate & change.
- BPRT — Print & cross reference a Basic program.
- BPAK — Pack a Basic program.
- RE — Rename a disk file.

\$69 plus \$1.50 shipping,
Calif. Res. add 6%.
Check, VISA, M/C

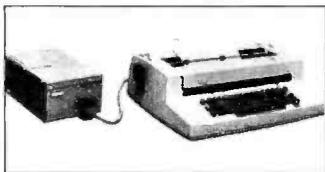
SZ Software Systems

1269 Rubio Vista Road, Altadena, Calif. 91001
(213) 791-3202

Circle 334 on inquiry card.

IPEX NEW!

**Interface Converts
Your Typewriter
Into Printer**



- Finest print quality
- Easy installation
- Fits IBM SELECTRIC® typewriter with no modification.
- For TRS-80®, Apple®, or any parallel or RS232 port.
- Write or phone for more information, today!
- Low cost
- Quick delivery

— U.S. and worldwide sales —

IPEX INTERNATIONAL INC.
16140 Valerio St.
Van Nuys, CA 91406 USA
TEL: 213/781-0020 TLX/TWX: 910-495-1767

Circle 335 on inquiry card.



New Sensibly-Priced Paper Tape Reader

A new, smaller, less expensive Stand-Alone Paper Tape Reader Model 605 reads at 150 CPS, has a parallel TTL output and is bi-directional. It stops on character, is completely self-contained and has automatic taut-tape sensing.

The new reader has 5 volt DC and 24 volt DC output power available and an optional internal clock. The desk-top model is priced at \$495 for one unit, a saving of about 25% of the price of the larger Model 612.

Contact Louis Doshay, Addmaster Corporation, 416 Junipero Serra Drive, San Gabriel 91776; telephone (213) 285-1121

Circle 336 on inquiry card.

A NEW WIRELESS AC REMOTE CONTROL INTERFACE for the Sears and BSR X-10 home control system. Use your present TRS-80 Level II, Apple II or S100 computer to provide complete home security through control of lights, appliances and motors with a few simple BASIC commands.

As featured in:
"COMPUTERIZE A HOME" BYTE, January 1980

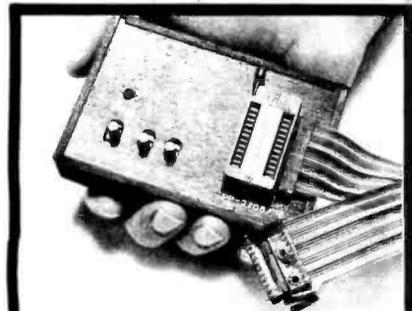
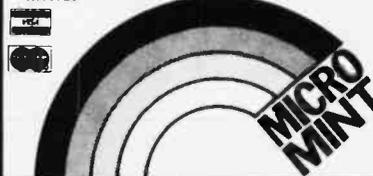
Busy Box - Assembled & tested
For TRS-80 .. \$109.95
For S100 119.95
For Apple II... 114.95

Realtime control software - TRS-80 19.95
To order call (516) 374-6793
or write: The MicroMint Inc.
917 Midway,
Woodmere, NY 11598



DEALER INQUIRIES INVITED

BUSY BOX



OAE's PP-Series EPROM Programmers plug directly into any vacant EPROM socket and allow you to transfer data directly from RAM to EPROMs. No additional power supplies are required. All timing & control sequences are handled by the programmer. Each unit includes internal DC to DC switching regulator, ZIF socket and 4 ft. ribbon cable terminated with a 24 pin plug. Programmers are available for all EPROMs from 2708's thru 2532's.

Oliver Advanced Engineering, Inc.
676 W. Wilson Ave., Glendale, CA 91203
(213) 240-0080 or Telex 194773.
PP SERIES PROGRAMMERS
See us at NCC, booth 770

Circle 338 on inquiry card.

**DISK DRIVES
REMEX**

Compatible with IBM and Shugart.
Double sided, Double Density
RFD 4000 1600 K Bytes. \$595
Double Sided, Double Density
RFD 2000 800K Bytes \$395

For fast delivery, send certified checks, money orders or call to arrange direct bank wire transfers. Personal or company checks require two weeks to clear. California Res. add 6% sales tax. Minimum shipping charge \$10.00. No C.O.D.

Electronic Equipment Unlimited
3845 Birch Street
Newport Beach, CA 92660
PH: (714) 540-5231

Pricing and availability subject to change without notice.

Circle 339 on inquiry card.

**MEDICAL
BILLING**

for
APPLE II

- 7000 ACCOUNTS
 - 2000 TRANSACTIONS
- \$995**

PROSOFT

3604 Foothill, LaCrescenta, CA
(213) 248-2884

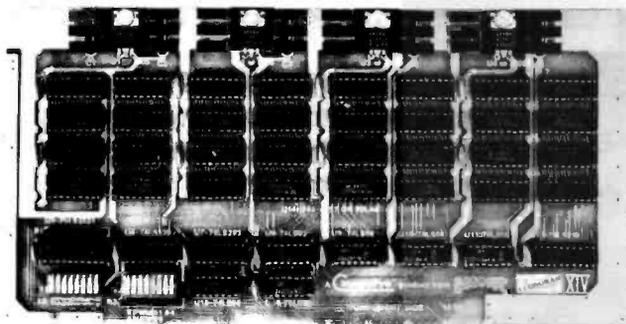
Circle 340 on inquiry card.

**ANOTHER FAMOUS PRIORITY 1 ELECTRONICS
TRUCK LOAD PURCHASE
10 MHZ 16K A&T STATIC S-100 RAM
FROM**

CompuPro™

division of

**GODBOUT
ELECTRONICS**



LIST
\$349⁰⁰

SAVE
\$150⁰⁰

The RAM 14 provides 16K X 8 of reliable, totally static RAM storage. Conforming fully to the IEEE 696/S-100 bus standard, RAM 14 not only provides 24 address lines for 16 megabyte extended addressing capability, but also includes a number of features you would only expect to find in memory boards costing considerably more. Here's a partial listing of what makes RAM 14 your best choice!

- Operates up to 10 MHZ (70 ns Ram Chips)
- Assembled & Tested
- Meets or exceeds all IEEE 696/S-100 specifications (including timing).
- Fully static design eliminates the timing problems associated with dynamic memories.
- Switch selectable choice of 24 address lines conforming to the IEEE 696/S-100 extended addressing specifications, or 16 address lines as used in older S-100 systems.
- Ideal for multi-user installations.
- Board is addressable as one 16K x 8 block on any 4K boundary.
- Switch selectable PHANTOM disable and write protect.
- + 5 Volt operation (requires no other supply voltages).
- Low power operation (900 mA typical, 1200 mA maximum).
- 1 year Factory Warranty

GBT-143A **\$199.00**

Quantities are limited so hurry!



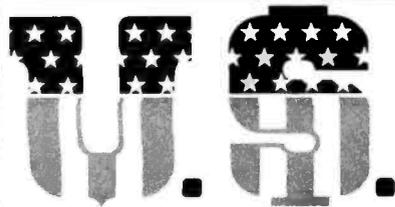
ORDER TOLL FREE
1-800-423-5633
except CA., AK., HI., CALL
(213) 894-8171

PRIORITY ONE ELECTRONICS

16723 B ROSCOE BLVD. • SEPULVEDA, CA 91343

Terms: Visa, MC, BAC, Check, Money Order, U.S. Funds Only. CA residents add 6% sales tax.
*Sales Prices are for prepaid orders only. Credit card orders will be charged appropriate freight.

Circle 290 on inquiry card.



MICRO SALES

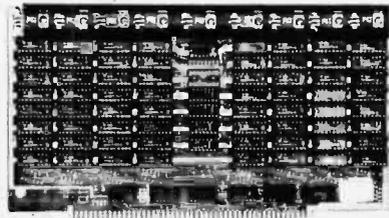
DEALS □ DEALS □ DEALS

SHOP HERE AND
SAVE!

(MINIMUM ORDER \$10.00)

This is **ABSOLUTELY** the **LOWEST PRICE EVER**
for a Hi Speed (300 NS) LO-LO Power 32K RAM.
4K by 1 Chips are organized in Selectable Banks.

\$299



★ Extended Address Lines A16 - A17

★ Phantom Line

★ 9 Regulators

(KIT)

SCHOOLS

DIP SWITCHES	POS.	PRC.
	4	.88
	5	.92
	6	.95
	7	.99
	8	1.05
	9	1.15
	10	1.19



AMP - Need we say more? There is a difference in sockets! These aren't the lowest prices you can find. But, if you've been "burned" before by bad connections in your computer, a few pennies for the best is worth it!

PINS	PC	WW
8	.10	.26
14	.13	.29
16	.16	.32
18	.18	.34
20	.22	.38
24	.32	.48
28	.34	.50
40	.45	.61

RESISTORS .02 ea!

(100 PACK) ¼W

1.0	75	2.7K	22K	220K
4.7	100	3.3K	24K	330K
6.8	150	3.9K	27K	470K
10	220	4.7K	33K	680K
15	330	6.8K	39K	1M
22	470	10K	47K	1.5M
27	680	12K	68K	2.2M
33	1K	15K	100K	4.7M
47	1.5K	18K	150K	10M
68	2.2K	20K		

WIRE WRAP WIRE

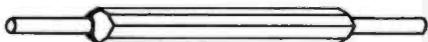
Packed in 500 Lot Bundles
(Length includes 2" x 1" Strip)

Color - R, Bu, G, Y, Bk, W

50 ft. \$1.65 - 100 ft. \$3.00 - 500 ft. \$9.50

2.5-3.25	4.0-3.75	6.0-4.75
3.0-3.35	4.5-4.00	7.0-5.00
3.5-3.50	5.0-4.50	8.0-5.50
		10.0-6.50

OK WIRE WRAP TOOL \$5.95



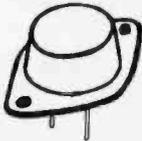
6 Amps 125 VAC
7 Amps 30 VDC

\$1.25 ea.

DPDT STANDARD TOGGLE

- ST21 (ON-NONE-ON)
- ST22 (ON-OFF-ON)
- ST23 (MOM ON-OFF-MOM ON)
- ST24 (ON-OFF-MOM ON)
- ST25 (ON-NONE-MOM-ON)
- ST26 (ON-ON-ON)

HOBBIEST

LM323K 5V. 3A.

REGULATOR
\$5.50



TAB MOUNT

7805	+5V	1A
7905	-5V	1A
7812	+12V	1A
7912	-12V	1A



HEAT SINKS
49¢ **\$1.25**

◆ GOLD ◆

S-100-CONNECTOR TI or Better



SOLDER TAIL WIRE WRAP

\$2.50 \$3.25

DIP PLUGS

PART#	PINS	PRICE
08DP	8	.40
14DP	14	.55
16DP	16	.58
24DP	24	.95
40DP	40	1.50

Socket and Dip Plug priced based on gold not exceeding \$700 per ounce.

CONNECTORS

DUAL ROW .100		CARD EDGE	
PINS	PRICE	PINS	PRICE
20	2.35	20	3.35
26	3.00	26	3.80
34	3.85	34	4.65
40	4.50	40	5.50
50	5.50	50	5.90

RIBBON - 20 to 34 @ 1.00 ft.
40 & 50 @ 1.30 ft.

CRIMPING 2.00 / CONNECTOR

OEM'S

Z-80-A \$6.95

4MHZ Beastie with extra instructions!

Z-80 SUPPORT

CTC - \$6.55

SIO - \$25.50

PIO - \$6.50

DMA - \$18.75

All 4MHZ (who wants 2MHZ?)

74LSXX

74LS00 .33	74LS107 .59	74LS221 2.95
74LS01 .33	74LS109 .59	74LS240 2.95
74LS02 .33	74LS112 .59	74LS241 2.49
74LS03 .33	74LS113 .59	74LS242 1.95
74LS04 .59	74LS114 .49	74LS243 1.95
74LS05 .39	74LS122 .59	74LS244 2.95
74LS06 .39	74LS123 1.19	74LS245 8.95
74LS07 .39	74LS124 1.49	74LS247 1.19
74LS08 .59	74LS125 .89	74LS248 1.19
74LS09 .39	74LS126 .89	74LS249 1.69
74LS10 .29	74LS132 .79	74LS251 1.79
74LS11 .39	74LS133 1.19	74LS253 .95
74LS12 .39	74LS136 .69	74LS257 1.95
74LS13 .69	74LS138 .99	74LS258 1.95
74LS14 1.25	74LS139 .99	74LS259 2.95
74LS15 .49	74LS145 1.25	74LS260 .75
74LS20 1.95	74LS148 1.49	74LS266 1.15
74LS21 3.7	74LS151 .79	74LS273 1.75
74LS22 .29	74LS154 2.49	74LS275 4.39
74LS26 .39	74LS155 1.49	74LS279 .79
74LS27 .49	74LS156 1.49	74LS283 1.49
74LS28 .39	74LS157 1.49	74LS289 5.75
74LS30 .49	74LS158 1.49	74LS290 1.29
74LS32 .95	74LS160 .75	74LS293 1.95
74LS33 1.95	74LS161 1.99	74LS295 1.95
74LS37 .75	74LS162 1.25	74LS298 1.29
74LS38 .39	74LS163 1.25	74LS324 1.75
74LS40 .25	74LS164 2.15	74LS352 1.65
74LS42 1.39	74LS165 1.49	74LS353 1.65
74LS47 .79	74LS166 2.49	74LS365 .95
74LS48 .79	74LS168 2.95	74LS366 .79
74LS35 .25	74LS169 1.95	74LS367 .99
74LS54 .25	74LS170 1.95	74LS368 .99
74LS55 .70	74LS173 1.25	74LS373 2.95
74LS73 .79	74LS174 1.49	74LS374 3.95
74LS74 .59	74LS175 1.49	74LS377 1.95
74LS75 .79	74LS181 2.15	74LS378 1.95
74LS76 .79	74LS189 6.95	74LS379 1.95
74LS78 .49	74LS190 .99	74LS386 .59
74LS83 .95	74LS191 1.95	74LS390 1.95
74LS85 1.49	74LS192 1.95	74LS393 1.95
74LS86 .95	74LS193 1.95	74LS395 1.95
74LS90 .75	74LS194 1.49	74LS490 4.95
74LS92 .75	74LS195 .95	74LS668 1.69
74LS93 .95	74LS196 .95	74LS669 1.89
74LS95 1.29	74LS197 1.95	74LS670 3.55
74LS96 1.29		

DEALS □ DEALS □ DEALS

OUR BUYERS ARE IN
CONTACT WITH EVERY MAJOR
SUPPLIER AND O.E.M.
BUY HERE AT 1000 PIECE



MICRO SALES

QUANTITY PRICES

ALL MERCHANDISE 100%
GUARANTEED! 15 DAY FULL
CASH REFUND!

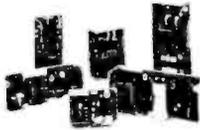
664 N. MICHIGAN AVE. ★ SUITE 1010 ★ CHICAGO, ILLINOIS 60611
CALL TOLL FREE: 1-800-435-9357 ★ MONDAY thru SATURDAY
(ILLINOIS RESIDENTS CALL: 815-485-4002) ★ 8:00 a.m. to 6:30 p.m.

TERMS: Prepayment - C.O.D. up to \$100.00 - M/C Visa
\$5.00 Processing and Handling added to each order PLUS
Shipping Charges. Please allow personal check
to clear before shipment.

JUST HOT STUFF

POWER SUPPLIES

If you can beat these prices we will be truly amazed. OEM's at 500 lot pay more than this. Call or write for full spec. sheets.



DISK POWER SUPPLIES				
PRIAM-SHUGART-CENTURY-MICROPOLIS				
+5V @ 9A	-5V @ 8A	+24V @ 7A	US-384	89.00
SHUGART - SIEMANS - MPI 5 1/4"				
+5V @ .5A	+12V @ .9A		US-340	33.50
+5V @ 2A	+12V @ 4A		US-323	56.25
SHUGART - SIEMANS - CDC 8"				
+5V @ 1A	-5V @ .5A	+24V @ 1.5A	US-205	52.50
+5V @ 2A	-5V @ .5A	+24V @ 3A	US-206	69.00
+5V @ 3A	-5V @ .6A	+24V @ 5A	US-162	89.00
+5V @ 1.7A	-5V @ 1.5A	+24V @ 2A	US-272	69.00
+5V @ 2A	+12V @ .4A	-12V @ .4A	US-HTAA	37.50

TELEVIDEO 912C

SOROC IQ120- \$675.00
Televideo 912C- 665.00
Televideo 920C- 720.00
AddS R-25 - 710.00

Also have 920C, SOROC, HAZELTINE, etc. What we don't have is room on this page. Call Toll Free 800 number for prices.



C-ITOH PRINTER

\$499.00

Look closely at the photo and see other adds in this rag at \$995.00. Perfect units, warranteed. Only 500 pcs. Same story, manufacturer had too many.



S-100 CARD EXTENDER

\$12.50

(Gold Contacts)

As long as there is a price war, we will fight your battle. Compare at your local Dept. store and buy US MICRO.



MEMOREX - VERBATUM - WABASH

BASF FLOPPIES

BOX OF 10 ONLY:

5 1/4"	SOFT	\$2.65 ea.
5 1/4"	HARD 10	2.65 ea.
5 1/4"	HARD 16	2.65 ea.
8"	SOFT 1D	3.25 ea.
8"	SOFT 2D	3.85 ea.
8"	SOFT 2DDS	5.00 ea.



SPECIAL OF THE QUARTER

S1-MOD (KIT)

\$189.00



Complete S-100 12 Slot Computer. Ample system power with regulated power for drives. Excellent for Subsystem or Hobby use. 4 hours to build. (6 conn. incl., less fans)

DUAL DRIVE SUBSYSTEM

\$995.00

\$195.00 w/no Drives

If this looks like a Lobo Drive System, don't be fooled. Just because it looks like one, works like one, smells like one, and tastes like one (?) doesn't mean it has to cost like one!



2 SHUGART 801R POWER SUPPLY

TWIN VERTICAL DRIVES

5" \$550.00 - 8" \$980.00

Attractive, convenient and compact Two Drive Mass Storage includes Power Supply, Drives, Cabinets and Cables. Double Sided, Double Track available too!



Z-80 CPU (KIT)

The first time this world popular CPU offered in Kit, 2 serial, 3 parallel, CTC, EProm Z-80 at 4 mhz. Software buad rate, etc. (less Prom & cable) **\$212.00**



EXPANDABLE RAM

★SPECIAL★SPECIAL★SPECIAL★

This is the best all around 64K board you can buy. If after you see it, you don't agree return for full refund, Bank Select by extended address lines or I.O. 40H.



★\$389.00 A&T★

US - D&K \$255.00

Double Density 8" and 5" Disk Controller designed for S-100 IEEE standards. Uses Western Digital 1795, 1691 2143 Chip Set.



FANS \$14.95

These are brand new, in the box fans. Not noisy bearing pullouts. Never again at these low prices!



3-1/8"

4-5/8"

SPECIALS OF THE MONTH

4116s

\$2.95

Expansion 16K Dynamic RAMs for Apple, TRS-80 S-100 systems. T.I., Mostek Intel, Call for manufacturer.

200 NS

DIP-80 \$399.00

Don't be misled by this LOW price. This is a rugged 100% Duty Cycle 7 by 7 Dot Matrix Printer. Brand new, factory warr.



• RS-232 ADD \$65.00
• TRACTOR FEED ADD \$70.00

2114s

\$3.45

One of the world's two most popular STATIC RAMs. Factory prime tested units. Sold in lots of 8 only. FUJITSU, HITACHI, etc.



200 NS

TMS-4044

MM-5257

INTEL 2147

\$4.25

250 NS

The other of the world's most popular STATIC RAMs. This one is 4K by 1 organization. Don't buy Gold, buy these, the price won't last!

2716s

\$9.50 (450 NS)

2708s

\$6.95 (450 NS)

Remember when 2716s were \$50.00 and hard to get? These units are so beautiful it's hard to part with them. But we will, for a small price. Guaranteed!

SHUGART DRIVE



8" 801R

\$395.00

Manufacturer had too many, buys at 1000 piece rate, sales dropped, so we got'em. Fantastic buy, get them while they last! Full warranty.

8" 851R \$585.00

SIEMANS DRIVE

8" 120-8

\$375.00

Very Special Price on these BRAND NEW current production units Add \$10.00 for Extended 1 Year Warrantee!

SALE

SALE

SALE

Disk Drives



JADE's new dual disk sub-assemblies include: Handsome metal cabinet with proportionally balanced air flow system, rugged dual drive power supply, cooling fan, cable kit, lighted power switch, approved fuse assembly, line cord, Never-Mar rubber feet, and all necessary hardware to mount 2-8" disk drives - it's all American made, guaranteed for six months, and it's in stock!

Dual 8" Sub-Assembly Cabinet

END-000421 Cabinet kit \$225.00
END-000420 Bare cabinet \$59.95

Single sided, double density disk drive sub-system
END-000423 Kit w/2 8" drives \$975.00
END-000424 A & T w/2 8" drives \$1195.00

Double sided, double density disk drive sub-system
END-000426 kit w/2 8" drives \$1495.00
END-000427 A & T w/2 8" drives \$1695.00

JADE DISK PACKAGE

Double density controller, two 8" double density floppy disk drives, CP/M 2.2 (configured for controller), hardware and software manuals, boot PROM, cabinet, power supply, fan, & cables

Special package price \$1395.00

8" Disk Drive Sale

Highly reliable double density floppy disk drives

Shugart 801R single sided, double density

MSF-10801R SA-801R \$425.00
Special Sale Price 2 for \$790.00

Siemens FDD100-802 single sided, double density

MSF-201120 6 mo warranty \$385.00
Special sale price 2 for \$750.00

Real Double-Sided Drives 8" Double-Sided Double-Density Sale

* Shugart SA-851R double-sided, double-density *
* only \$625.00 ea 2 for \$1190.00 *

MFE M701 8" double-sided, double-density drives
only \$525 ea 2 for \$1040.00

Qume Data Track 8 double-sided, double-density drives
only \$575.00 2 for \$1100.00

Printers

CENTRONICS 737-1

9 x N dot matrix, letter quality, proportional spacing
PRM-15737 Parallel \$795.00
With interface for Apple \$895.00

MX-80 - Epson

132 column, 9 x 9 dot matrix, multiple fonts
PRM-27080 Save \$100.00 \$545.00
Interface for Apple \$110.00



SPINWRITER - NEC

65 cps, bi-directional, letter quality printer with deluxe tractor mechanism, both parallel and serial interfaces on-board, 16K buffer, ribbon, print thimble, graphics, micro space justification, data cable, and self test/diagnostic ROM.

PRD-55511 without 16K buffer ... \$2795.00
PRD-55512 with 16K buffer \$2895.00

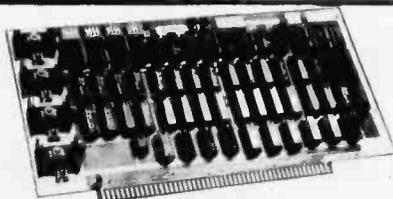
S-100 Systems

S-100 SYSTEM - Calif Computer Sys

Complete S-100 system including 12 slot mainframe, 4 MHz Z-80 CPU, 64K RAM memory, double density disk controller, RS-232 cable, 8" & 5 1/4" disk drive cables, CP/M 2.2, manuals, auto boot ROM, completely assembled & tested.

2210A Integrated & tested \$1995.00
2210B Not integrated \$1795.00

S-100 Memory



64K RAM - Calif Computer Sys

4 MHz bank port / bank byte selectable, extended addressing, 16K bank selectable. PHANTOM line allows memory overlay. 8080 / Z-80 / front panel compatible.

MEM-64565A A & T \$449.95

MEMORY BANK - Jade

4 MHz, IEEE S-100, bank selectable, 8 or 16 bit

MEM-99730B Bare board \$55.00
MEM-99730K Kit, no RAM \$219.95
MEM-16730K 16K kit \$249.95
MEM-32731K 32K kit \$289.95
MEM-48732K 48K kit \$324.95
MEM-64733K 64K kit \$359.95
Assembled & tested add \$50.00

EXPANDORAM II - S D Systems

4 MHz RAM board expandable from 16K to 256K

MEM-16630K 16K kit \$275.95
MEM-32631K 32K kit \$295.95
MEM-48632K 48K kit \$315.95
MEM-64633K 64K kit \$335.95
Assembled & tested add \$50.00

32K STATIC RAM - Jade

2 or 4 MHz expandable static RAM board uses 2114L's
MEM-16151K 16K 4 MHz kit \$169.95
MEM-32151K 32K 4 MHz kit \$299.95
Assembled & tested add \$50.00

16K STATIC RAM - Cal Comp Sys

2 or 4 MHz 16K static RAM board, IEEE S-100, bank selectable, Phantom capability, addressable in 4K blocks
MEM-16160A 16K 2 MHz A & T ... \$286.95
MEM-16162A 16K 4 MHz A & T ... \$289.95
MEM-16160B Bare board \$50.00

PB-1 - S.S.M.

2708, 2716, 2732, 2758, & 2516 EPROM programmer
MEM-99510K Kit \$154.95
MEM-99510A A & T \$229.95

PROM-100 - SD Systems

2708, 2716, 2732, 2758, & 2516 EPROM programmer
MEM-99520K Kit \$219.95
MEM-99520A Jade A & T \$269.95

S-100 Video

VB-3 - S.S.M.

80 characters x 24 lines expandable to 80 x 48 for a full page of text, upper & lower case, 256 user defined symbols, 160 x 192 graphics matrix, memory mapped, has key board input.

IOV-1095K 4 MHz kit \$375.00
IOV-1095A 4 MHz A & T \$450.00
IOV-1096K 80 x 48 upgrade \$39.95

VIDEO BOARD - Jade

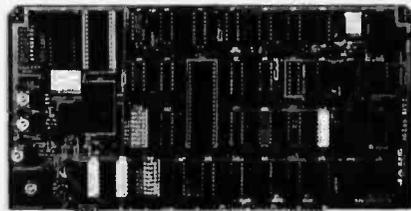
64 characters x 16 lines, 7 x 9 dot matrix, full upper/lower case ASCII character set, numbers, symbols, and Greek letters, normal/reverse/blinking video, S-100.

IOV-1050K Kit \$99.95
IOV-1050A A & T \$125.00
IOV-1050B Bare board \$19.95

S-100 CPU

2810 Z-80* CPU - Cal Comp Sys

2/4 MHz Z-80A* CPU with RS-232C serial I/O port and on-board MOSS 2.2 monitor PROM, front panel compatible.
CPU-30400A A & T \$269.95



THE BIG Z* - Jade

2 or 4 MHz switchable Z-80* CPU with serial I/O, accomodates 2708, 2716, or 2732 EPROM, baud rates from 75 to 9600

CPU-30201K Kit \$145.00
CPU-30201A A & T \$199.00
CPU-30200B Bare board \$35.00

CB-2 Z-80 CPU - S.S.M.

2 or 4 MHz Z-80 CPU board with provision for up to 8K of ROM or 4K of RAM on board, extended addressing, IEEE S-100, front panel compatible.

CPU-30300A A & T \$229.95

SBC-200 - SD Systems

4 MHz Z-80* CPU with serial & parallel I/O ports, up to 8K of on-board PROM, software programmable baud rate generator, 1K of on-board RAM, Z-80 CTC.

CPC-30200K Kit \$339.95
CPC-30200A Jade A & T \$399.95

S-100 Disk Controller

DOUBLE DENSITY - Cal Comp Sys

5 1/4" and 8" disk controller, single or double density, with on-board boot loader ROM, and free CP/M 2.2* and manual set.

IOD-1300A A & T \$369.95

DOUBLE-D - Jade

Double density controller with the inside track, on-board Z-80A*, printer port, IEEE S-100, can function on an interrupt driven buss

IOD-1200K Kit \$299.95
IOD-1200A 8" A & T \$389.95
IOD-1205A 5 1/4" A & T \$389.95
IOD-1200B Bare board \$65.00

VERSAFLOPPY II - SD Systems

New double density controller for both 8" & 5 1/4"

IOD-1160K Kit \$379.95
IOD-1160A Jade A & T \$439.95

Motherboards

ISO-BUS - Jade

Silent, simple, and on sale - a better motherboard

6 Slot (5 1/4" x 8 3/4")
MBS-061B Bare board \$19.95
MBS-061K Kit \$39.95
MBS-061A A & T \$49.95

12 Slot (9 1/4" x 8 3/4")
MBS-121B Bare board \$29.95
MBS-121K Kit \$69.95
MBS-121A A & T \$89.95

18 Slot (14 1/2" x 8 3/4")
MBS-181B Bare board \$49.95
MBS-181K Kit \$99.95
MBS-181A A & T \$139.95

Card Cages

S-100 CARD CAGE - Jade

Metal cage with card guides & fan mounting
ENX-106001 Six slot \$29.95

S-100 CARD CAGE - Vector

19" rack mountable, adjustable, holds 21 cards
VCT-CCK100 Anodized Al \$49.95

SALE

SALE

SALE

S-100 I/O

S.P.I.C. - Jade

Our new I/O card with 2 SIO's, 4 CTC's, and 1 PIO

- IOI-1045K 2 CTC's, 1 SIO, 1 PIO .. \$199.00
- IOI-1045A A & T .. \$259.00
- IOI-1046K 4 CTC's, 2 SIO's, 1 PIO .. \$259.00
- IOI-1046A A & T .. \$319.00
- IOI-1045B Bare board w/ manual .. \$59.95
- IOI-1045D Manual only .. \$20.00

I/O-4 - S.S.M.

2 serial I/O ports plus 2 parallel I/O ports

- IOI-1010K Kit .. \$179.95
- IOI-1010A A & T .. \$249.95
- IOI-1010B Bare board .. \$35.00

TERMINATOR - S.S.M.

Active terminator for S-100 bus

- TSX-195K Kit .. \$29.95
- TSX-195A A & T .. \$54.95
- TSX-195B Bare board .. \$22.95

S-100 EXTENDER - Cal Comp Sys

Put those problem boards (the ones you probably bought from one of our competitors) within easy reach.

- TSX-160A A & T .. \$37.95

S-100 PROTO BOARD - Jade

Universal design, plated thru holes, gold fingers

- TSX-140B Bare board .. \$24.95

TERMINATOR & EXTENDER - C.C.S.

Can be used as both an S-100 extender and terminator

- TSX-150K Kit .. \$43.95

Diskettes

DISKETTES - Jade

Bargain prices on magnificent magnetic media

5 1/4" single sided, single density, box of 10

- MMD-5110103 Soft sector .. \$27.95
- MMD-5111003 10 sector .. \$27.95
- MMD-5111603 16 sector .. \$27.95

5 1/4" double sided, double density, box of 10

- MMD-5220103 Soft sector .. \$39.95

8" single sided, single density, box of 10

- MMD-8110103 Soft sector .. \$33.95

8" single sided, double density, box of 10

- MMD-8120103 Soft sector .. \$39.95

8" double sided, double density, box of 10

- MMD-8220103 Soft sector .. \$49.95

Video Monitors

9" B & W MONITOR - A.P.F.

High quality, high resolution video monitor

- VDM-750900 9" monitor .. \$159.95

13" COLOR MONITOR - Zenith

The hi res color you've been promising yourself

- VDC-201301 .. \$449.00

12" GREEN SCREEN - NEC

20 MHz, P31 phosphor video monitor with audio, exceptionally high resolution - A fantastic monitor at a very reasonable price

- VDM-651200 12" monitor .. \$259.95

Mainframes

MAINFRAME - Cal Comp Sys

12 slot S-100 mainframe with 20 amp power supply

- ENC-112105 Kit .. \$359.95
- ENC-112106 A & T .. \$419.95

DISK MAINFRAME - NNC

Holds 2 8" drives and an 8 slot S-100 system. Attractive metal cabinet with 8 slot motherboard, power supply, fan, key switch, and other professional features

- ENS-112320 with 30 amp p.s. \$699.95

Accessories-Apple/TRS-80



16K MEMORY UPGRADE

Add 16K of RAM to your TRS-80, Apple, or Exidy in just minutes. We've sold thousands of these 16K RAM upgrades which include the appropriate memory chips (as specified by the manufacturer), all necessary jumper blocks, fool-proof instructions, and our 1 year guarantee.

- MEX-16100K TRS-80 kit .. \$29.00
- MEX-16101K Apple kit .. \$29.00
- MEX-16102K Exidy kit .. \$29.00

DISK DRIVE for APPLE

5 1/4" disk drive with controller for your Apple

- MSM-12310C with controller .. \$499.95
- MSM-123101 w/out controller .. \$375.00

DISK DRIVES for TRS-80

23% more storage, 8 times faster, 40 track with free patch, 120 day warranty, includes case, power supply, and cable

- MSM-12410C Save \$125.00 !!! .. \$299.95

DOS 3.3 UPGRADE - Apple

Upgrade your old DOS to the improved 3.3

- IOD-2233A Complete kit .. \$64.95

APPLE STICK - Micromate

Joy stick with pots for Apple II

- SYA-1510A A & T .. \$35.95

Z-80* CARD for APPLE

Z-80* CPU card with CP/M 2.2 for your Apple

- CPX-30800A A & T .. \$279.95

AIO - S.S.M.

Parallel & serial interface for your Apple

- IOI-2050K Kit .. \$155.95
- IOI-2050A A & T .. \$194.95

PRINTER INTERFACE - C.C.S.

Centronics type I/O card w/ firmware

- IOI-2041A A & T .. \$99.95

APPLE CLOCK - Cal Comp Sys

Real time clock w/battery back-up

- IOK-2100A A & T .. \$109.95

Modems

LEX-11 MODEM - Lexicon

A real star! 300 baud, answer/originate, RS 232C

- IOM-5511A Best buy !!! .. \$128.00

NOVATION CAT

300 baud, answer/originate acoustic modem

- IOM-5200A 1 year warranty .. \$179.00

D-CAT 300 baud, direct connect modem

- IOM-5201A Special sale price .. \$189.00

AUTO-CAT Auto answer/originate, direct connect

- IOM-5230A Special sale price .. \$239.95

MICROMODEM - D.C. Hayes

Auto answer/dial modem card for Apple or S-100

- IOM-2010A Apple modem .. \$349.95
- IOM-1100A S-100 modem .. \$375.00

MICRONET MODEM - Micromate

Direct connect with extra features - a best buy

- IOM-2020A Best Apple modem .. \$275.00

* Z-80, Z-80A, and the letter Z are recognized trademarks of Zilog, Inc. *CP/M is a registered trademark of Digital Research Corp. *CBASIC is a trademark of Compiler Systems, Inc.

Single Board Computers



AIM-65 - Rockwell

6502 computer with alphanumeric display, printer, & keyboard, and complete instructional manuals

- CPK-50165 1K AIM .. \$374.95
- CPK-50465 4K AIM .. \$449.95
- SFK-74600008E 8K BASIC ROM .. \$99.95
- SFK-64600004E 4K assembler ROM .. \$84.95
- PSX-030A Power supply .. \$64.95
- ENX-000002 Enclosure .. \$49.95

4K AIM, 8K BASIC, power supply, & enclosure
Special package price .. \$625.00

Z-80* STARTER KIT - SD Systems

Complete Z-80* computer with RAM, ROM, I/O, display, keyboard, manual, and kluge area.

- CPS-30010K Kit .. \$369.95
- CPS-30010A Jade A & T .. \$459.95

MICROPROCESSORS		PROMS	
Z-80	10.95	2708 450ns	6.25
Z-80A	12.95	10 for \$4.90 ea	
6502	11.50	2716 12.5v	11.95
6800	11.95	2716 5v	11.95
6802	17.95	10 for \$8.90 ea	
6809	39.95	2532 5v	39.95
8035	24.00	2732 5v	39.95
8080A	6.59	2758 5v	9.95
8085	15.95		
8748	59.95		
RAMS			
Z-80 SUPPORT		21102 2 MHz	1.25
3881 PIO	9.50	21102A 4 MHz	1.50
3881-4 PIO 4 MHz	14.50	2114L 2 MHz	3.75
3882 CTC	9.50	2114LA 4 MHz	3.95
3882-4 CTC 4 MHz	14.95	4116	4.25
3883 SIO	29.50	4164 64K x1	59.95
3884 SIO	49.50	5257 2 MHz	6.75
		5257A 4 MHz	7.25
		MK4118	18.95

BAUD RATE GENERATORS		SUPPORT DEVICES	
MC14411	10.00	8212	3.25
1.843 MHz xtal	4.95	8214	4.65
UARTS			
AY5-1013A	5.25	8216	2.95
AY3-1014A	8.25	8224	3.25
TR1602B	5.25	8224-4	5.75
TMS6011	5.95	8226	3.85
IM6402	9.00	8228	4.95
		8238	4.95
		8243	8.00
6800 SUPPORT			
6821P	5.95	8250	14.95
6824P	11.95	8251	6.50
6834P	22.50	8253	17.95
6840P	18.75	8255	6.50
6850P	4.80	8257	19.95
6852P	5.79	8259	17.95
68751	7.40	8275	49.95
68488P	25.00	8279	15.95

PLACE ORDERS TOLL FREE

Continental U.S. Inside California
800-421-5500 800-262-1710

For Technical Inquiries or Customer Service call

213-973-7707

JADE Computer Products

4901 W. Rosecrans, Hawthorne, Ca 90250

TERMS OF SALE: Cash, checks, credit cards, or Purchase Orders from qualified firms and institutions. Minimum order \$15.00. California residents add 6% tax. Minimum shipping and handling charge \$3.00. Pricing and availability subject to change without notice.

LITRONIX DISPLAY SALE

DL-4500 DL-4507 DL-3000 DL-3000 DLG-2535 DL-4509 DL-6500 DL-6530 DL-3130

MULTI-DIGIT REFLECTOR ARRAYS FOR CLOCKS

PART NUMBER	CHAR. I/O	POLARITY	DESCRIPTION	TYPE	HT	PRICE
DL-4500 (Hole)	50	C.C. MPX	4 Digit 7 Segment with Canon. Lead Numbers Indicated	8	1.0	1.7
DL-4507 (Hole)	50	C.C. MPX	4 Digit 7 Segment with Canon. Lead Numbers Indicated	8	1.0	1.7
DL-3000 (Hole)	50	C.C. MPX	4 Digit 7 Segment with Canon. Lead Numbers Indicated	8	1.0	1.7
DL-3130 (Hole)	1.0	C.C. MPX	7 Segment 3 Digit D.P. Right	1.8	1.0	3.4

MULTI-DIGIT REFLECTOR ARRAYS

PART NUMBER	CHAR. I/O	POLARITY	DESCRIPTION	TYPE	HT	PRICE
DL-2200 (Hole)	30	C.C. MPX	1 Seg 2 Digit D.P. Right	2.8	1.1	2.0
DLG-2535 (Hole)	30	C.C. MPX	8 Seg 2 Digit	2.8	2.0	3.8
DL-4509 (Hole)	50	C.C. MPX	8 Seg 4 Digit D.P. Right	8	1.0	1.7
DL-6500 (Hole)	50	C.C. MPX	8 Seg 4 Digit D.P. Right	8	1.0	1.7
DL-6530 (Hole)	50	C.C. MPX	8 Seg 4 Digit D.P. Right	8	1.0	1.7
DL-3130 (Hole)	1.0	C.C. MPX	7 Segment 3 Digit D.P. Right	1.8	1.0	3.4

DISCRETE LEADS

Part No.	Color	Value	Part No.	Color	Value
XCS56R	200Ω	red	5/31	MV50	0.05Ω
XCS56G	200Ω	green	4/31	XC209R	125Ω
XCS56Y	200Ω	yellow	4/31	XC209G	125Ω
XCS56C	200Ω	clear	4/31	XC209Y	125Ω
XCC22R	200Ω	red	5/31	XCS56R	185Ω
XCC22G	200Ω	green	4/31	XCS56G	185Ω
XCC22Y	200Ω	yellow	4/31	XCS56Y	185Ω
MV10B	170Ω	red	4/31	XCS56C	185Ω

RESISTOR LEAD METAL
RL-2 . . \$3.99 ea. or 3/\$1.00

DISPLAY LEADS

Type	Polarity	Ht	Type	Polarity	Ht
MAN 1	C.A.-red	270	DLG507	C.A.-green	500
MAN 2	5x7 D.M.-red	300	DL704	C.C.-red	300
MAN 3	C.C.-red	125	DL707	C.C.-red	300
MAN 52	C.A.-green	300	DL728	C.C.-red	500
MAN 54	C.C.-green	300	DL741	C.A.-red	600
MAN 71	C.C.-red	300	DL746	C.A.-red ± 1	630
MAN 72	C.A.-red	300	DL747	C.A.-red	600
MAN 74	C.C.-red	300	DL770	C.C.-red	600
MAN 82	C.A.-yellow	300	DL087	C.A.-orange	800
MAN 84	C.C.-yellow	300	DL088	C.C.-orange	800
MAN 3620	C.A.-orange	300	DL335	C.C.-red	110
MAN 3630	C.C.-orange ± 1	300	FND350	C.C. ± 1	357
MAN 3640	C.C.-orange	300	FND503	C.C. (FND503)	500
MAN 4610	C.A.-orange	400	FND507	C.A. (FND510)	500
MAN 6610	C.A.-orange-DD	560	HDSF-3401	C.C.-red	800
MAN 6630	C.A.-orange ± 1	560	HDSF-3403	C.C.-red	800
MAN 6640	C.C.-orange-DD	560	5082-7751	C.A., R.H.D.-red	430
MAN 6650	C.C.-orange	1	5082-7760	C.C., R.H.D.-red	430
MAN 6660	C.A.-orange	560	5082-7302	4x7 sig. dig. RHD	600
MAN 6710	C.A.-red-DD	560	5082-7304	Overrange, char. ± 1	600
MAN 6760	C.C.-red ± 1	560	4N28	Photo Xistor Opto-Isol.	99
DL0304	C.C.-orange	300	LI-1	Photo Xistor Opto-Isol.	69
DLG500	C.C.-green	500	MOC3010	Optically Isol. Triac Driver	1.25

POTENTIOMETERS

\$2.95 each
2 Watt @ 70°C ± 10%
7/8" Slotted Shaft
Linear Taper
Vents Printed Circ.

\$1.35 each
3/4 Watt @ 70°C
15 turn pot. Linear taper
Printed Circ.

Part No.	RV4NAY SD - 102A	1K	Part No.	RV4NAY SD - 102A	5K	Part No.	RV4NAY SD - 102A	10K
CMU 1021	RV4NAY SD - 102A	1K	830P-500hm	830P-5K	830P-100K	830P-100hm	830P-10K	830P-200K
CMU 5021	RV4NAY SD - 102A	5K	830P-100hm	830P-20K	830P-500K	830P-1K	830P-1Meg	
CMU 1031	RV4NAY SD - 103A	10K	830P-1K	830P-50K	830P-1Meg	830P-2K	830P-10K	
CMU 5031	RV4NAY SD - 103A	50K	830P-10K	830P-100K	830P-1Meg	830P-100K	830P-100K	
CMU 1041	RV4NAY SD - 104A	100K	830P-100K	830P-100K	830P-100K	830P-100K	830P-100K	
CMU 1052	RV4NAY SD - 105A	1Meg	830P-100K	830P-100K	830P-100K	830P-100K	830P-100K	

LOW PROFILE (TIN) SOCKETS

Pin Count	1-24	25-49	50-100
8 pin LP	.17	.16	.15
14 pin LP	.20	.19	.18
16 pin LP	.22	.21	.20
18 pin LP	.29	.28	.27
20 pin LP	.34	.32	.30
22 pin LP	.37	.36	.35
24 pin LP	.38	.37	.36
28 pin LP	.45	.44	.43
36 pin LP	.60	.59	.58
40 pin LP	.63	.62	.61

SOLDERTAIL (GOLD) STANDARD

Pin Count	1-24	25-49	50-100
8 pin SG	.39	.38	.37
14 pin SG	.49	.48	.47
16 pin SG	.54	.53	.52
18 pin SG	.59	.57	.56
20 pin SG	.71	.70	.69
24 pin SG	1.10	1.00	.90
36 pin SG	1.65	1.40	1.26
40 pin SG	1.75	1.59	1.45

WIRE WRAP SOCKETS (GOLD) LEVEL #3

Pin Count	1-24	25-49	50-100
8 pin WW	.59	.54	.49
10 pin WW	.69	.63	.58
14 pin WW	.79	.73	.67
16 pin WW	.85	.77	.70
18 pin WW	.99	.90	.81
20 pin WW	1.19	1.08	.99
24 pin WW	1.39	1.25	1.23
28 pin WW	1.49	1.36	1.14
36 pin WW	2.19	1.89	1.38
40 pin WW	2.29	2.09	1.79

1/4 WATT RESISTOR ASSORTMENTS - 5%

ASST. 1	5 ea.	10 Ohm	12 Ohm	15 Ohm	18 Ohm	22 Ohm	27 Ohm	33 Ohm	39 Ohm	47 Ohm	56 Ohm	68 Ohm	82 Ohm	100 Ohm	150 Ohm	200 Ohm	250 Ohm	300 Ohm	350 Ohm	50 pcs.	\$1.95	
ASST. 2	5 ea.	68 Ohm	82 Ohm	100 Ohm	120 Ohm	150 Ohm	180 Ohm	220 Ohm	270 Ohm	330 Ohm	390 Ohm	470 Ohm	560 Ohm	680 Ohm	820 Ohm	1K	1.2K	1.5K	1.8K	50 pcs. <th>\$1.95</th>	\$1.95	
ASST. 3	5 ea.	470 Ohm	560 Ohm	680 Ohm	820 Ohm	1K	1.2K	1.5K	1.8K	2.2K	2.7K	3.3K	3.9K	4.7K	5.6K	6.8K	8.2K	10K	12K	15K	80 pcs. <th>\$1.95</th>	\$1.95
ASST. 4	5 ea.	22K	27K	33K	39K	47K	56K	68K	82K	100K	120K	150K	180K	220K	270K	330K	390K	470K	560K	680K	820K	\$1.95
ASST. 5	5 ea.	150K	180K	220K	270K	330K	390K	470K	560K	680K	820K	100K	120K	150K	180K	220K	270K	330K	390K	470K	560K	\$1.95
ASST. 7	5 ea.	2.7M	3.3M	3.9M	4.7M	5.6M	6.8M	8.2M	10M	12M	15M	18M	22M	27M	33M	39M	47M	56M	68M	82M	100M	\$1.95

ASST. 8R Includes Resistor Asssts. 1-7 (350 pcs.) \$10.95 ea.

Jameco ELECTRONICS

MAIL ORDER ELECTRONICS - WORLDWIDE
1355 SHOREWAY ROAD, BELMONT, CA 94002
PRICES SUBJECT TO CHANGE

PHONE ORDERS WELCOME (415) 592-8097

INTERISIL

Part No.	Function	Price
70451PI	CMOS Precision Timer	14.95
70456V/Kit*	3 1/2 Digit Stowch Chip, XTL	22.95
7106CP	3 1/2 Digit A/D (LCD Drive)	16.95
7106EV/Kit*	IC, Circuit Board, Display	34.95
7107CPL	3 1/2 Digit A/D (LED Drive)	15.95
7107EV/Kit*	IC, Circuit Board, Display	28.95
7113CPL	3 1/2 Digit A/D LCD Dri. H.L.D.	18.95
7113EV/Kit*	IC, Circuit Board, Display	17.95
7201DIR	Battery Volt Indicator	2.65
7205IPG	CMOS LED Stowch/Timer	12.95
7205EV/Kit*	Stowch Chip, XTL	19.95
7206JPE	Tone Generator	5.15
7207AIPD	Tone Generator Chip, XTL	5.15
7207AIEV/Kit*	Oscillator Controller	6.50
7207AIEV/Kit*	Freq. Counter Chip, XTL	11.10
7208IPD	Seven Decade Counter	3.95
7209IPD	4 Func. CMOS Stowch Ckt	13.95
7215EV/Kit*	4 Func. Stowch Chip, XTL	19.95
7216AICJ	8-Digit Univ. Counter C.A.	32.00
7216ICJ	8-Digit Univ. Counter C.A.	26.95
7217DIPI	8-Digit Univ. Counter C.A.	21.95
7217IPI	4-Digit LED Up/Down Counter	12.95
7218ICJ	8-Digit Univ. LED Drive	10.95
7224IPL	LCD 4 1/2 Digit Up Counter DRI	11.25
7224IPL	8-Digit Univ. Counter	31.95
7240ICJ/Kit*	LCD 4 1/2 Digit Counter, XTL	11.25
7240IJA	CMOS Bin Prog. Timer/Counter	4.95
7242AICJ	CMOS Divide-by-256 RC Timer	2.05
7250IJE	CMOS BCD Prog. Timer/Counter	6.00
7250IJE	CMOS BCD Prog. Timer/Counter	6.00
75551PI	CMOS 555 Timer (8 pin)	1.45
75551PI	CMOS 555 Timer (14 pin)	2.20
7611BCPA	CMOS Op Amp Comparator	5MV 2.25
7612BCPA	CMOS Op Amp Ext. Cmvr.	5MV 2.25
7613BCPA	CMOS Dual Op Amp Comp.	5MV 3.95
7613ICPE	CMOS Tri Op Amp Comp.	10MV 5.35
7641CCPD	CMOS Quad Op Amp Comp.	10MV 7.50
7642CCPD	CMOS Quad Op Amp Comp.	10MV 7.50
8099CCP	500mBamp-GAP Volt Ref. Diode	2.50
8121CPA	Volt Ref./Indicator	2.50
8121CPA	Volt Ref./Indicator	2.50

* INTERISIL'S EVALUATION KITS

74C

Part No.	Price	Part No.	Price
74C00	.39	74C195	1.59
74C01	.39	74C221	2.25
74C02	.39	74C240	2.25
74C03	.39	74C244	2.25
74C04	.39	74C245	2.25
74C05	.39	74C246	2.25
74C06	.39	74C247	2.25
74C07	.39	74C248	2.25
74C08	.39	74C249	2.25
74C09	.39	74C250	2.25
74C10	.39	74C251	2.25
74C11	.39	74C252	2.25
74C12	.39	74C253	2.25
74C13	.39	74C254	2.25
74C14	.39	74C255	2.25
74C15	.39	74C256	2.25
74C16	.39	74C257	2.25
74C17	.39	74C258	2.25
74C18	.39	74C259	2.25
74C19	.39	74C260	2.25
74C20	.39	74C261	2.25
74C21	.39	74C262	2.25
74C22	.39	74C263	2.25
74C23	.39	74C264	2.25
74C24	.39	74C265	2.25
74C25	.39	74C266	2.25
74C26	.39	74C267	2.25
74C27	.39	74C268	2.25
74C28	.39	74C269	2.25
74C29	.39	74C270	2.25
74C30	.39	74C271	2.25
74C31	.39	74C272	2.25
74C32	.39	74C273	2.25
74C33	.39	74C274	2.25
74C34	.39	74C275	2.25
74C35	.39	74C276	2.25
74C36	.39	74C277	2.25
74C37	.39	74C278	2.25
74C38	.39	74C279	2.25
74C39	.39	74C280	2.25
74C40	.39	74C281	2.25
74C41	.39	74C282	2.25
74C42	.39	74C283	2.25
74C43	.39	74C284	2.25
74C44	.39	74C285	2.25
74C45	.39	74C286	2.25
74C46	.39	74C287	2.25
74C47	.39	74C288	2.25
74C48	.39	74C289	2.25
74C49	.39	74C290	2.25
74C50	.39	74C291	2.25
74C51	.39	74C292	2.25
74C52	.39	74C293	2.25
74C53	.39	74C294	2.25
74C54	.39	74C295	2.25
74C55	.39	74C296	2.25
74C56	.39	74C297	2.25
74C57			

National Semiconductor Clock Modules

12VDC AUTOMOTIVE/INSTRUMENT CLOCK

APPLICATIONS:

- In dash auto clocks
- After-market auto/rv clocks
- Aircraft-marine clocks
- 12VDC oper. instr.
- Portable/rv powered instr.

Features: Bright 0.3" green display. Internal crystal time base. ±0.5 sec./day accur. Auto. display brightness control logic. Display color filterable to blue, blue-green, green & yellow. Complete—just add switches and lens.

MA1003 Module \$16.95

MA1023 .7" Low Cost Digital LED Clock Module 8.95
 MA1026 .7" Dig. LED Alarm Clock/Thermometer 18.95
 MA5036 .3" Low Cost Digital LED Clock/Timer 6.95
 MA1002 .5" LED Display Dig. Clock & X'timer 9.95

MICROPROCESSOR COMPONENTS

—8080A/8080A SUPPORT DEVICES—

IN5800A	CPU	4.50
DP214	8-Bit Input/Output	3.25
DP214	Priority Interrupt Control	5.95
DP216	Bi-Directional Bus Driver	3.49
DP221	Clock Generator/Driver	3.95
DP224	Bus Driver	3.49
DP228	System Controller/Bus Driver	9.95
DP231	System Controller	4.95
IN5431	I/O Expander for 4 Serial	6.25
IN5450	Asynchronous Comm. Element	16.95
DP251	Prog. Comm. I/O (USART)	16.95
DP253	Prog. Interrupt Timer	16.95
DP255	Prog. Peripheral I/O (PPI)	16.95
DP257	Prog. DMA Control	16.95
DP259	Prog. Interrupt Control	16.95
DP274	Prog. CRT Controller	16.95
DP275	Prog. Keyboard/Display Interface	16.95
DP300	Octal Bus Receiver	4.95
DP302	System Timing Element	4.95
DP304	8-Bit Bi-Directional Receiver	3.95
DP307	8-Bit Bi-Directional Receiver	3.95
DP308	8-Bit Bi-Directional Receiver	3.95

—8080A/8080A SUPPORT DEVICES—

MC8000	MPU	18.95
MC8002CP	MPU with Clock and RAM	19.95
MC8010AP	128-Kbit Static RAM	4.95
MC8011	Peripheral Interf. Adapt. (MC8020)	7.49
MC8012	Priority Interrupt Controller	10.95
MC8013L	1024-Kbit ROM (MC8013)	14.95
MC8014	Asynchronous Serial Data Adapter	6.95
MC8015	Synchronous Serial Data Adapter	6.95
MC8016	40000s Digital MODEM	10.95
MC8017	24000s Modem	10.95
MC8018A	Dual 8-Static Bus Trans. (MC8017)	22.95

—MICROPROCESSOR CHIPS—

Z80 (Z80C)	CPU (MK3800N) (12MHZ)	13.95
Z80A (Z80-1)	CPU (MK3800N-1) (4MHZ)	18.95
CDP1802	256K EPROM	15.95
IN5400A	MPU—8-Bit (80H)	12.95
IN5401A	CPU—4-Bit Static (Com. Temp. Grade)	18.95
MC5600	MPU w/Clock (65K Bytes Memory)	11.95
IN5403A-4	MPU—8-Bit (80H)	12.95
IN5403A-4	CPU—56K Chio 8-Bit (128 Bytes RAM)	15.95
IN5404A-4	CPU (256 Bytes RAM)	24.95
IN5405A-4	CPU—64-Bit (128 Bytes RAM)	24.95
IN5407A	CPU w/Basic Micro Interpreter	20.95
PM05	CPU—16-Bit	49.95
IN5400	CPU—16-Bit	49.95
TMS9901L	8-BIT REGISTER	2.95

—SHIFT REGISTERS—

MM5201-4	Dual 25-Bit Dynamic	.50
MM5201-4	Dual 50-Bit Dynamic	.50
MM5201-4	Dual 100-Bit Dynamic	.50
MM5101-4	Dual 64-Bit Accumulator	.50
MM1102	256-Bit Dynamic	1.95
MM5013	128-Bit Dynamic/Accumulator	1.95
MM5015H	500/128-Bit Dynamic	3.95
MM5014H	Octal 80-Bit	9.95
MM5015H	Octal 80-Bit	9.95
MM5016H	128-Bit Dynamic	3.95
7418N	Hex 32-Bit Static	4.95
7421V	Dual 128-Bit Static	9.95
7422V	512-Bit Dynamic	9.95
7423V	1024-Bit Dynamic	2.95
7424V	Dual 256-Bit Static	2.95
7425V	Dual 256-Bit Static	2.95
7426V	Dual 2048-Bit Static	4.00
7427N	Quad 80-Bit Static	2.95
7428N	File (Dual 80)	3.95

—DATA ACQUISITION—

AF12B-1CJ	Universal Active Filter 25%	5.95
AF12B-1CJ	Touch Tone Low Pass Filter	18.95
LM2824A	Super Gain Op Amp	1.00
LM2824	Constant Current Source	1.00
LM135Z	Temperature Transducer	1.40
LF73AN	JFET Input Op Amp	1.10
LF73AN	Sample & Hold Amplifier	2.95
LM7911	Temp. Comp. Pres. Ref. (500mV/C)	4.95
AOC0801CN	8-Bit A/D Converter (1LSB)	4.95
OAC0801CN	8-Bit D/A Converter (0.1% Lin.)	7.25

—DATA ACQUISITION (CONTINUED)—

ADC0801CN	8-Bit A/D Converter (8-Ch. Multil.)	5.25
ADC1001CN	10-Bit A/D Converter (16-Ch. Multil.)	10.95
DAC1001CN	10-Bit D/A Conv. Micro Comp. (0.25% Lin.)	12.95
DAC1001L	10-Bit D/A Conv. Micro Comp. (0.25% Lin.)	8.95
DAC1001L	10-Bit D/A Converter (0.05% Lin.)	8.49
DAC1021L	10-Bit D/A Converter (0.25% Lin.)	5.95
DAC1201L	12-Bit D/A Converter (0.25% Lin.)	9.95
OC0451N	4-Channel Multiplexer	1.19
AV-5-103	30K 8-Bit UART	3.95

—RAM'S—

1101	256-Kbit Static	1.49
1102	1024-Kbit Dynamic	.99
201 (1101)	256-Kbit Static	2.95
2102	1024-Kbit Static	1.95
211 (1101)	256-Kbit Static	2.95
2114	256-Kbit Static MOS	3.95
2114	1024-Kbit Static CMOS	5.95
2114L	1024-Kbit CMOS Low Power	6.95
2114L	1024-Kbit Static 300ns	7.49
2114L-1	1024-Kbit Static 300ns Low Power	7.95
2117	16.384-Kbit Dynamic 500ns (house market)	4.95
2117	32K EPROM (256K)	49.95
MM2112	4096-Kbit 30ns	3.95
3101	1024-Kbit Dynamic Fully Decoded	1.95
MM2181	2048-Kbit Dynamic	.99
MM2182	4096-Kbit Dynamic	.99
MM2183	8192-Kbit Dynamic	.99
MM2184	16384-Kbit Dynamic	.99
MM2185	32768-Kbit Dynamic	.99
MM2186	65536-Kbit Dynamic	.99
MM2187	131072-Kbit Dynamic	.99
MM2188	262144-Kbit Dynamic	.99
MM2189	524288-Kbit Dynamic	.99
MM2190	1048576-Kbit Dynamic	.99
MM2191	2097152-Kbit Dynamic	.99
MM2192	4194304-Kbit Dynamic	.99
MM2193	8388608-Kbit Dynamic	.99
MM2194	16777216-Kbit Dynamic	.99
MM2195	33554432-Kbit Dynamic	.99
MM2196	67108864-Kbit Dynamic	.99
MM2197	134217728-Kbit Dynamic	.99
MM2198	268435456-Kbit Dynamic	.99
MM2199	536870912-Kbit Dynamic	.99
MM2200	1073741824-Kbit Dynamic	.99

—PROMS/EPROMS—

1701A	2K 8-Kbit EPROM	5.95
2701	8K EPROM	9.95
TM52176	8K EPROM (+5V, +5V, +5V)	15.95
271616 (1251617)	8K EPROM (Single +5V)	17.95
271616 (1251617)	32K EPROM (Single +5V)	49.95
2751	16K EPROM	15.95
2751	8K EPROM (450ns) (Simple +5V)	7.95
2764	32K EPROM	14.95
2764	16K EPROM (Open Collector)	4.95
2764	4096-Bit/8-Prot. (Simple +5V)	19.95
2764	32-Kbit 7-Static Bidir. Prom	4.95
2764	8K PROM	29.95

—ROM'S—

25112(140)	Character Generator (Upper Case)	5.95
25113(121)	Character Generator (Lower Case)	5.95
25114	Character Generator	10.95
25115	2048-Static Only Memory	4.95
MM2182	4096-Bit/8-Prot. (Simple +5V)	19.95
MM2183	8192-Bit/16-Prot. (Simple +5V)	19.95
MM2184	16384-Bit/32-Prot. (Simple +5V)	19.95
MM2185	32768-Bit/64-Prot. (Simple +5V)	19.95
MM2186	65536-Bit/128-Prot. (Simple +5V)	19.95
MM2187	131072-Bit/256-Prot. (Simple +5V)	19.95
MM2188	262144-Bit/512-Prot. (Simple +5V)	19.95
MM2189	524288-Bit/1024-Prot. (Simple +5V)	19.95
MM2190	1048576-Bit/2048-Prot. (Simple +5V)	19.95
MM2191	2097152-Bit/4096-Prot. (Simple +5V)	19.95
MM2192	4194304-Bit/8192-Prot. (Simple +5V)	19.95
MM2193	8388608-Bit/16384-Prot. (Simple +5V)	19.95
MM2194	16777216-Bit/32768-Prot. (Simple +5V)	19.95
MM2195	33554432-Bit/65536-Prot. (Simple +5V)	19.95
MM2196	67108864-Bit/131072-Prot. (Simple +5V)	19.95
MM2197	134217728-Bit/262144-Prot. (Simple +5V)	19.95
MM2198	268435456-Bit/524288-Prot. (Simple +5V)	19.95
MM2199	536870912-Bit/1048576-Prot. (Simple +5V)	19.95
MM2200	1073741824-Bit/2097152-Prot. (Simple +5V)	19.95

—NMOS READ ONLY MEMORIES—

MC16421P	128-Kbit ASCII Shifted w/Grak	13.95
MC16422P	128-Kbit ASCII Shifted w/Grak	13.95
MC16423P	128-Kbit ASCII Shifted w/Grak	13.95
MC16424P	128-Kbit ASCII Shifted w/Grak	13.95

—MICROPROCESSOR MANUALS—

M-280	User Manual	7.50
M-CDP1802	User Manual	7.50
M-7950	User Manual	5.00

—SPECIAL FUNCTION—

DS2002CN	Dual MOS Clock Driver (5Kx2)	3.50
DS2002CN	Dual MOS Clock Driver (5Kx2)	1.95
IN5171N-1	Floppy Disc Controller	24.95
IN5201N	Communication Chip	19.95
MC16421P	Microprocessor Real Time Clock	11.95
MC16422P	Microprocessor Compatible Clock	11.95
MC16423P	Microcontroller with 8-Bit RAM	6.95
MC16424P	Microcontroller with 8-Bit RAM	6.95
CP4042M	Microcontroller with 8-Bit RAM	3.49
CP4042M	Direct LED Drive w/In Bus In	3.25
CP4042M	35-50V VAC Fluor. Driver (50-pin pkg.)	3.25

—TELEPHONE/KEYBOARD CHIPS—

AV-5-100	Push Button Telephone Dialer	14.95
AY-5-100	Rotary Dialer	14.95
AY-5-100	CMOS Clock Generator	4.95
AV-5-101	Hexadecimal Encoder (16 keys)	11.95
HD01655	Keyboard Encoder (16 keys)	2.95
74C22	Keyboard Encoder (16 keys)	5.49
74C22	Keyboard Encoder (20 keys)	5.78
KM153100N	Push Button Pulse Driver	7.95
MM5709N	16/14-Key Serial Keyboard Encoder	8.95

JOYSTICKS

JS-5K

JS-5K 5K Linear Taper Pots \$5.25
 JS-100K 100K Linear Taper Pots \$8.95
 JVC-40 40K (2) Video Controller in case \$5.95

JS-5K 5K Linear Taper Pots \$5.25
 JS-100K 100K Linear Taper Pots \$8.95
 JVC-40 40K (2) Video Controller in case \$5.95

AC and DC Wall Transformers

Part No. Input Output Price
 AC 250 117V/60Hz 12 VAC 250mA \$3.95
 AC 500 117V/60Hz 12 VAC 500mA \$4.95
 AC 1000 117V/60Hz 12 VAC 1 amp \$6.95
 AC 1700 117V/60Hz 9 VAC 1.7 amp \$6.95
 DC 9200 117V/60Hz 9 VDC 200mA \$3.25
 DC 9000 120V/60Hz 9 VDC 500mA \$3.95

CONNECTIONS

DB25P D-Subminiature Plug \$2.95
 DB15226 D-Subminiature Socket \$3.50
 DB9C Edge (22/44 Pin) \$1.75
 UG88/U BNC Plug \$1.79
 UG89/U BNC Jack \$3.79
 UG175/U UHF Adapter \$.49
 SO239 UHF Panel Recp. \$1.29
 PL258 UHF Adapter \$1.60
 PL259 UHF Plug \$1.60
 UG260/U BNC Plug \$1.79
 UG1094/U BNC Bulkhead Recp. \$1.29

TRS-80 16K Conversion Kit

Expand your 4K TRS-80 System to 16K.
 Kit comes complete with:
 * 8 ea. MM5290 (UPD416/4116) 16K Dyn. Rams (1*NSI)
 * Documentation for Conversion

TRS-16K2 *150NS \$49.95
 TRS-16K4 *250NS \$39.95

JE610 ASCII Encoded Keyboard Kit

The JE610 ASCII Keyboard Kit can be interfaced into most any computer system. The kit comes complete with an industrial grade keyboard switch assembly with 62-key IC's, sockets, connectors, electronic components and a double-sided printed wiring board. The keyboard assembly requires +5V @ 150mA and -12V @ 10 mA for operation. Features: 60 keys generate the 256 characters, upper and lower case ASCII set. Fully buffered. Two user-definable keys provided for custom applications. Caps lock for upper-case only alpha characters. Utilizes a 2376 (40-pin) encoder read-only memory chip. Outputs directly compatible with TTL/DTL or MOS logic arrays. Easy interfacing with a 16-pin dip or 18-pin edge connector. Size: 3 1/2" x 14 1/2" x 8 3/4" D

JE610/DTE-AK (as pictured above) . . . \$124.95
 JE610 Kit 62-Key Keyboard, PC Board, & Components (no case) . . . \$ 79.95
 K62 62-Key Keyboard (Keyboard only) . . . \$ 34.95
 DTE-AK (case only — 3 1/2" x 14 1/2" x 8 3/4" D) \$ 49.95

JE600 Hexadecimal Encoder Kit

FULL 8-BIT LATCHED OUTPUT 19-KEY BOARD

The JE600 Encoder Keyboard Kit provides two separate hexadecimal digits produced from sequential key entries to allow direct programming for 8-bit microprocessor or 8-bit memory circuits. Three additional keys are provided for user operations with one having a bistable output available. The outputs are latched and monitored with 9 LED readouts. Also included is a key entry feedback feature. Full 8-bit latched output for microprocessor use. Three user-definable keys with one being bistable operation. Debounce circuit provided for all 19 keys. 9 LED readouts to verify entries. Easy interfacing with standard 16-pin IC connector. Only +5VDC required for operation. Size: 3 1/2" x 8 3/4" x 8 3/4" D

JE600/DTE-HK (as pictured above) . . . \$99.95
 JE600 Kit 19-Key Hexadec. Keyboard, PC Board & Components (no case) . . . \$59.95
 K19 19-Key Keyboard (Keyboard only) . . . \$14.95
 DTE-HK (case only — 3 1/2" x 8 3/4" x 8 3/4" D) \$44.95

National Semiconductor RAM SALE

MM5290N-4 (MK4116/UPD416) . . . \$4.95 each
 16K DYNAMIC RAM (250NS)
 (8 EACH \$39.95) (100 EACH \$450.00/lot)

MM5290J-2 (MK4116/UPD416) . . . \$6.95 each
 8K DYNAMIC RAM (150NS)
 (8 EACH \$49.95) (100 EACH \$550.00/lot)

MM5298J-3A . . . \$3.25 each
 8K DYNAMIC RAM (LOW HALF OF MM5290J) 200NS
 (8 EACH \$23.95) (100 EACH \$250.00/lot)

MM2114-3 . . . \$5.95 each
 4K STATIC RAM (300NS)
 (8 EACH \$43.95) (100 EACH \$450.00/lot)

MM2114L-3 . . . \$6.25 each
 4K STATIC RAM (LOW POWER 300NS)
 (8 EACH \$44.95) (100 EACH \$475.00/lot)

EPROM Erasing Lamp

• Erases 2708, 2716, 1702A, 52030, 52040, etc.
 • Erases up to 4 chips within 20 minutes.
 • Maintains constant erasure distance of one inch.
 • Special conductive foam liner eliminates static build-up.
 • Built-in safety lock to prevent UV exposure.
 • Compact — only 7.5/8" x 2.7/8" x 2".
 • Complete with holding tray for 4 chips.

UVS-11E \$79.95

DESIGNER'S SERIES

Blank Desk-Top Electronic Enclosures

• High strength epoxy molded pieces in mocha brown finish.
 • Sliding rear/bottom panel for service and component accessibility.
 • Top / bottom panels .080 thk alum. Aldine type 1200 finish (gold tint color) for best paint adhesion after modification.
 • Vented top and bottom panels for cooling efficiency.
 • Rigid construction provides unlimited applications.

CONSTRUCTION:

The "DTE" Blank Desk Top Electronic Enclosures are designed to blend and complement today's modern computer equipment and can be used in both industrial and home. The end pieces are precision molded with an internal slot (all around) to accept both top and bottom panels. The panels are then fastened to 3/4" thick tabs inside the end pieces to provide maximum rigidity to the enclosure. For ease of equipment servicing, the rear/bottom panel slides back on slotted tracks while the rest of the enclosure remains intact. Different panel widths may be used while maintaining a common profile outline. The molded end pieces can also be painted to match any panel color scheme.

Enclosure Model No.	Panel Width	PRICE
DTE-8	8.00"	\$29.95
DTE-11	10.65"	\$32.95
DTE-14	14.00"	\$34.95

\$10.00 Min. Order — U.S. Funds Only
 Calif. Residents Add 6% Sales Tax
 Postage — Add 5% plus \$1 Insurance

Spec Sheets — 25¢
 Send 41¢ Postage for your
 FREE 1981 JAMECO CATALOG

PHONE ORDERS WELCOME
 (415) 592-8097

MAIL ORDER ELECTRONICS — WORLDWIDE
 1355 SHOREWAY ROAD, BELMONT, CA 94002
 PRICES SUBJECT TO CHANGE

Jumbo 6-Digit Clock Kit

• Four .630" ht. and two .300" ht. common anode displays
 • Uses MM5314 clock chip
 • Switches for hours, minutes and hold functions
 • Hours easily viewable to 30 feet
 • Simulated walnut case
 • 115VAC operation
 • 12 or 24 hour operation
 • Includes all components, case and wall transformer
 • Size: 6 1/2" x 3 1/8" x 1 3/4"

JE747 \$29.95

6-Digit Clock Kit

• Bright .300 ht. comm. cath. edge display
 • Uses MM5314 clock chip
 • Switches for hours, minutes and hold modes
 • Hours easily viewable to 20 ft.
 • Simulated walnut case
 • 12 or 24 hr. operation
 • Includes all components, case & wall transformer
 • Size: 6 1/2" x 3 1/8" x 1 3/4"

JE701 \$19.95

NEW! JE215 Adjustable Dual Power Supply

General Description: The JE215 is a Dual Power Supply with independent adjustable positive and negative output voltages. A separate adjustment for each of the supplies provides the user unlimited applications for IC current voltage requirements. The supply can also be used as a general all-purpose variable power supply.

FEATURES:

- Adjustable regulated power supplies, pos. and neg. 1.2VDC to 15VDC.
- Power Output (each supply): 5VDC @ 500mA, 10VDC @ 750mA, 12VDC @ 500mA, and 15VDC @ 175mA.
- Two, 3-terminal adj. IC regulators with thermal overload protection.
- Heat sink regulator cooling.
- LED "on" indicator.
- Printed Board Construction
- 120VAC input
- Size: 3-1/2" x 5-1/16" L x 2" H

JE215 Adj. Dual Power Supply Kit (as shown) . . . \$24.95
 (Picture not shown but similar in construction to above)
 JE200 Reg. Power Supply Kit (5VDC, 1 amp) . . . \$14.95
 JE205 Adapter Brd. (to JE200) 5, -9 & -12V . . \$12.95
 JE210 Var. Pwr. Sply. Kit, 5-15VDC, to 1.5amp. \$19.95

Jameco ELECTRONICS

MAIL ORDER ELECTRONICS — WORLDWIDE
 1355 SHOREWAY ROAD, BELMONT, CA 94002
 PRICES SUBJECT TO CHANGE

Circle 352 on Inquiry card.

BYTE April 1981 399

California Digital

Post Office Box 3097 B • Torrance, California 90503



DISKETTES

FREE PLASTIC LIBRARY CASE INCLUDED WITH THE PURCHASE OF EVERY BOX OF DISKETTES

Private labeled for California Digital by one of the most respected producers of magnetic media. Each diskette is certified double density at 40 tracks. To insure extended media life each diskette is manufactured with a reinforced hub-hole. And of course, a plastic library case is included with every box of diskettes. **MINI-DISK(111)** Please specify computer or required sectors.

\$24.95
BOX

Ten boxes \$22.75 One hundred boxes \$21.50

MINIDISKETTES	Box	10 boxes	Box	10 boxes
Mehorex 3401	\$27.00	\$25.00		\$29.00
Verbatim 52501(111)	29.00	27.00		
Scotch 7440X(10X16)	\$31.00		\$30.00	\$3.00
Ilysan	45.00		45.00	13.00

EIGHT INCH	Scotch	box 10 bx.	Ilysan	box 10 bx.	319X	box 10 bx.
Single side/single den.	740-0	\$35. \$32	3740/1	\$48. \$47	3060 5.5	\$4.31
Single side/double den.	741-0	45. 43	3740/d	75. 73	3090 37	35.
Single side/32 sector	740-32	35. 33	na.	na.	na.	na.
Double side/double fl.	743-0	65. 52	na.	na.	3115 49.	45.

SCOTCH II head head cleaning kit. \$24.95 MIA-CK(5X8) please specify 5 1/4" 8" Prices available on request for: tape, cartridges, diskpacs, volume diskettes.

MEMORY

TRS-80 \$29
APPLE II

16k memory (8) 4116's



Installation is simple. Anyone who has ever changed a spark plug should be able to up-grade his microcomputer. How can California Digital offer these memory up-grade sets at 25% below our competition? Simple, we buy in volume, wholesale to dealers and sell the balance directly to owners of personal micro-systems. These 16K dynamic memory circuits are factory prime and unconditionally guaranteed for one full year. NOW, before you change your mind, pick up the telephone and order your up-grade memory from California Digital. Add \$3 for TRS80 jumpers.

STATIC	1-31	32-99	100-5C	-999	1K+
21L02 450nS.	1.19	.99			
21L02 250nS.	1.49	1.39		*	*
2114 1Kx4 450	5.95	5.50	5.25	4.75	4.50
2114 1Kx4 300	8.95	8.50	8.00	*	*
4044 4Kx1 450	5.95	5.50	5.25	*	*
4044 4Kx1 250	9.95	9.50	9.00	*	*
4045 1Kx4 450	8.95	8.50	8.00	*	*
4045 1Kx4 250	9.95	9.50	9.00	*	*
5257 low pow.	5.95	5.50	5.00	4.80	4.60

2716 EPROM SALE \$9.95

We have slashed price in an effort to reduce our over stocked inventory. These are single five volt EPROMs manufactured by one of the Worlds largest producers of semiconductor. All are first quality prime devices. Ceramic 450 nS.

FREE Ultra-Violet Products UVS 11-E UV EPROM ERASER

With purchase of FORTY 2716 EPROM's \$79 value



NEW from Shugart Technology

5 Megabyte Hard Disk Drive



Packaged in the same physical size as the industry standard 5 1/4" minifloppy disk drive. The micro-Wincheser stores thirty times as much data (6.38 megabytes unformatted), accesses data twice as fast (170 milliseconds) and transfers data twenty times faster (5.0 megabits per second.)

The ST506 is factory sealed to protect the media from environmental contaminants. Requires only DC voltage. Dual California Digital 5 1/4" enclosure. **\$1500**

Shugart Associates SA400 removable media disk drive for above package, add: **\$300** S-100 & Apple controller scheduled for spring release.

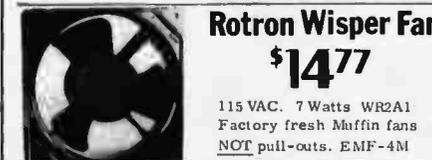


801/R Disk Drive 15 lbs.

Shugart 801/R with CP-206 power supply, muffin exhaust fan, complete in dual enclosure with all the necessary harnessing cables. Documentation included. 36 pounds. MSD-1801 Same as above but with two Shugart 801II disk drives. 50 pounds. MSD-2801 Disk drive cables, 8 feet 50 conductor with edge card connector at both ends. WCA-5505 \$25.00. Export disk drives. 220V. 50MHz add \$50.00 per disk drive.



The new BSR timer runs your home just like clockwork. Turns on lamps and appliances while your away from home. Completely compatible with your existing System X-10 decoder. BSR Timer eight channel \$65.00 Appliance Module 500 W. \$13.95 Master control console 34.95 Lamp Module 300 Watts 13.95 Ultrasonic Controller 19.95 NEW full control wall switch 14.50

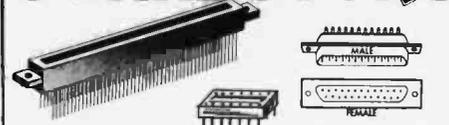


Rotron Wisper Fan

\$14.77

115 VAC. 7 Watts WR2A1 Factory fresh Muffin fans NOT pull-outs. EMF-4M

CONNECTORS

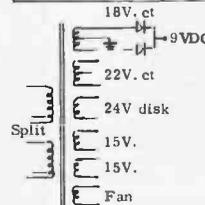


GOLD EDGE CONNECTORS		"D" Type	
S-100 .125" centers	each 10-	each	10-24 25*
Imal solder .230" row	\$2.95 \$2.50	DB9P male	\$1.00 \$1.40 \$1.30
Imal wire wrap (7H)	3.85 3.50	DA15P male	2.35 2.15 2.00
Sullins III-Rel. .250"	4.50 4.00	DA15F female	3.25 3.10 2.90
Sullins III-Rel. W/W	5.35 4.90	DA hood 2/P	1.60 1.35 1.30
Sullins /Altr. .140"	4.95 4.30	DB 25P male	2.50 2.35 2.25
.156" Centers (standard)		DB 25F female	3.25 3.15 3.05
22/44 Kim Eyelet	2.50 2.15	DB hood 2/P	1.35 1.15 1.05
36/72 Digital Group S/T	5.95 5.50	DC37P male	4.20 4.00 3.70
36/72 Digital Group W/W	6.50 6.15	DC27S female	6.00 5.75 5.50
43/86 Motorola 6800 S/T	6.40 6.15	DC hood 2/P	2.25 2.00 1.75
43/86 Moto. 5800 W/W	7.00 6.85	DD50P male	5.50 5.10 4.75
		DD50S female	9.40 8.60 8.00
		DD50 hood 2/P	2.50 2.40 2.10
INTEGRATED CIRCUIT SOCKETS		CENTRONICS	
Low Profile Wire Wrap		57-30300	7.95 8.75 9.75
each 100*	each 100*		
8 pin \$1.0 \$0.9 \$4.46 1.41			
14 pin .10 .09 .45 .41			
16 pin .12 .11 .50 .45			
18 pin .15 .13 .68 .61			
24 pin .08 .24 .94 .87			
40 pin .42 .40 1.60 1.47			
		RIBBON CABLE CONNECTORS	
		17/34 5" disk	4.85 4.15 3.95
		20/40 TRS-80	5.55 5.05 4.70
		25/50 8" disk	5.90 5.15 4.90

SURPLUS



S-100 POWER SUPPLY KIT \$59



Kit contains five high current bridge rectifiers, five computer grade electrolytic capacitors and a 700+ watt split primary transformer (410/220V). The supply is capable of supporting a full 30 Amp S-100 system, along with 125,000uF/100V and two 12,000/20V. All components are new surplus acquired from excess inventory of the National Cash Register Company. Please place your order early, as this low price is expected to see a quick sell out. SPC-PW100. . . . Shipping: East of Mississippi add \$15.00 California add \$8.00 all other states please add \$11.00 Foreign \$21.00

DATA INPUT TERMINAL

This Keystation terminal was recently acquired from the CMC division of the Perce Corporation. The unit was originally designed for inputing data directly onto magnetic tape.

The system is comprised of a premium cast aluminum and fibreglass enclosure, along with a Honeywell/Selectric II effect keyboard. This display lamp advise the operator of the systems status. Four inch loud speaker acknowledges acceptance of data and alerts the operator of pending problems. But most of all this "USED" terminal, with a little imagination, can be engineered to make the perfect home for an S-100 computer and video display; or with slight modification will accept the Rockwell AIM-85 micro-computer. Five volt regulated power supply is available for an additional \$20. (See June list) All units are in excellent condition. Original acquisition over \$700. 22 lbs.



These used data terminals were originally designed for retail store order entry systems. The operator enters the inventory control number, merchandise on hand and the unit price. After all pertinent data has been entered, the main warehouse is telephoned, the handset is placed in the acoustic coupler an all the recorded information is transmitted back the master computer. Each system includes: Cassette drive unit; Removable key keyboard with LED display; Five Gould "D" NICads with charger; Acoustical coupler and DB25 cable. All units removed from service in working condition. Original cost over \$2,500.

Regulated Power Supply 5 VOLT 5AMP \$11.95

This USED surplus power supply was removed from working equipment. Pass transistor regulation outputs five volts at a conservative five amps. Suitable for TTY, hobby applications. SPC-PS1 8 pounds.

\$59 Sankyo Magnetic Card Transport

This Sankyo card transport is capable of storing and retrieving over 400 characters of data from a single 2 x 2 1/2" HP style magnetic data card. Ideally suited for an S-100 motherboard head in under two seconds. Ideal for any data processing application where small amounts of information must be randomly retrieved. Original cost over \$200.00 Documentation and sample card included. New surplus. SPC-SC1

WESTERN UNION ENCLOSURE

These enclosures were manufactured for Western Union by Universal Technology. The exact purpose of the product is still a mystery but the enclosure is ideally suited for an S-100 motherboard with shielded power supply. Removable hood and pleights from make this enclosure an attractive bonus for any hobby product. New surplus in factory boxes supplied with three 22/44 edge connectors; DB25 communications connector; six foot grounded power cord and more. Inside dimensional 10" x 10" x 6". Shipping weight 8 lbs. **\$24.95**

TOLL FREE ORDER LINE
(800) 421-5041
TECHNICAL & CALIFORNIA
(213) 679-9001

All merchandise sold by California Digital is premium grade. Shipping: First five pounds \$2.00; each additional add \$.40 Foreign orders 10% shipping. Excess will be refunded. California residents add 6% sales tax. COD's discouraged. Open accounts extended to state supported educational institutions and companies with a "Strong Dun & Bradstreet." Warehouse: 15608 Inglewood Blvd. Visitors by appointment.

California Digital

Post Office Box 3097 B • Torrance, California 90503



MEMOREX 8" DISKETTES

\$25 WITH FREE LIBR'NY CASE

Recently the Memorex Corporation had a cancellation on a contract for a truck load of eight inch diskettes. California Digital was fortunate to be offered this load of prime magnetic media.

These diskettes are "UNBRANDED" but are guaranteed first quality Memorex Brand. (3050 single den.) Like all diskettes sold by California Digital, a library case is supplied free with the purchase of every box. This offer is subject to remaining inventory on hand.

IBM 3101 DISPLAY TERMINAL

The new 3101 display terminal is the IBM entry into the plug compatible micro computer industry.

This modularly constructed CRT terminal has been engineered with the user in mind. The video display module accepts and fits to provide the operator with a comfortable viewing posture.

Twelve inch P-39 green phosphor screen boasts a crisp 7 by 14 character matrix.

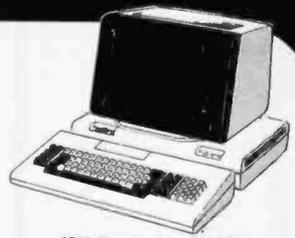
Standard 80 by 24 line screen format with a 25th line to display machine status and aid in the diagnostics in the event of a system malfunction.

87 key Selectric style keyboard arrangement along with numeric entry pad. Eight user definable function keys.

The 3101 video terminal is RS232 compatible and displays all 128 ASCII characters including control codes.

Accessible customer setup switches aid in choosing such options as line speed, parity scroll, and reverse video.

But most of all, built into every 3101 terminal is the quality that you have learned to expect from the IBM Corporation. VDT-3101



IBM direct price \$1295
CALIFORNIA DIGITAL
discount price
\$1195 immediate deliver



SUPER BUY



NEW from INTEGRAL DATA
Paper Tiger with GRAPHICS
\$1150

The 460 Paper Tiger uses a dot matrix character formation technique in which the placement of the dots overlap both horizontally and vertically to achieve a correspondence quality printing.

The printer's nine-wire print head uses staggered needle rows to create the vertically overlapping dots. The head is driven bi-directionally under microprocessor control by a stepper motor driven mechanism.

Two K buffer allows the printer to accept the entire content of a 1,020 character CRT screen. With graphics suggested retail price \$1,395 27 lbs. PRG-460G

NEC Spinwriter
5510P/S
\$2795



The most processing quality Spinwriter prints at speeds up to 55 characters per second. The Model 5510P/S is supplied with both parallel and RS-232C serial interfaces. Also included is the tractor feed mechanism, along with print film and ribbon. PHS-5510P/S 70 lbs. keyboard (MSL Model 5520P/S available \$2995. PHS-5520P/S 75 lbs.



TEC V-300
Word Processing
Daisy Wheel Printer
\$1595

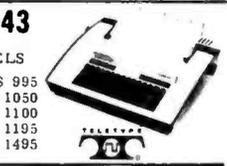
Finally a reasonably priced letter quality printer... Bi-directional printing at 25 characters per second. Full 136 print positions wide. Proportional spacing 1/120" horizontal, 1/48" vertical.

Uses standard Diablo brand interchangeable daisy print wheels.

Intel 8085 CPU microprocessor controlled. Interfaces via Centronics parallel connector. Shipping 5 lbs. PIV-300.

TELETYPE MODEL 43
4320 KEYBOARD MODELS

TTL serial output AAA \$ 995
RS232C serial AAK 1050
Friction 80 column AAE 1100
Friction 80 RS232C AAL 1195
Bell 103 Modem AAB 1495



EPSON
MX-80 \$495

The MX-80 is a 9x9 80 character per second dot matrix printer. Tractor feed mechanism. Adjusts to accept ten inch wide continuous paper. Reverses "Right to Left" Centronics type parallel interface. PHS-MX80 17 lbs.

CENTRONICS
730 \$595
737 \$750



Both the Centronics 730 and the 737 are capable of accepting standard office letter size dot pin face continuous forms.

For higher resolution the 737 implements a nine wire dot matrix print head. Parallel interface. Add \$65 for RS232C. PHS-730 65 lbs. PHS-737 65 lbs.

HEWLETT PACKARD \$2650



The Hewlett Packard HP-85 is a complete, low cost portable computer system. This self contained package includes CPU, keyboard, printer, CRT display and cassette tape drive. SYS-HP85 30 lbs.



26 Megabyte Hard Disk Drive from GEORGE MORROW'S Thinker Toys \$3950

Other Morrow Products:		Disk Jockey 31 Controller	\$345
Additional hard disk:	\$3650	Disk Jockey 1 Controller	195
Discos 3D 1 drive	930	32K hard disk Controller	625
Discos 3D 2 drives	1627	Switchboard interface	219
Discos 212 1 drive	1230	"New" Mailboard	275
Discos 212 2 drives	2237	M-16 Ten Megabyte hard	2550



AMPEX DIALOGUE 80 CRT TERMINAL \$995

New from the Amplex Corporation. The Dialogue 80 features removable keyboard, displayable two pages (four optional) dual program keys, half intensity protected "fields and status line". Transmits data either block, line or character mode. Excellent value. VDT-D80 shipping 47 lbs.



BMC VIDEO MONITOR \$259

Green phosphor with 18 MHz bandwidth, composite video input make the BMC VG-12C an ideal monitor for anyone requiring a high resolution 12" display.

High impact plastic enclosure assures that the BMC monitor is a rugged take anywhere instrument. For added protection the unit is equipped with a removable smoked non-flare Plexiglas screen. VMS-BMC 18 lbs.



direct connect MODEM Your Choice \$169

Direct connect modems eliminate loss of information due to the compression associated with acoustic modems. Choose either of these two great units.

The Universal Data Systems 1031P is switch selectable between answer and originate modes. Fully Bell 103 compatible. Directly connects to the new modular telephone jack. 100% powered from the telephone line. No need to locate modems in proximity to A.C. power receptacle. MD10-1031P 2 pounds.

Novation D'Cat connects to most of the new "Bell" modular handsets. Ideal for multiple line office telephones. Requires external A.C. power. MDU-DCAF 2 Lbs.

ACCESSORIES FOR THE APPLE COMPUTER

CALIFORNIA COMPUTER SYSTEMS		MOUNTAIN COMPUTER PRODUCTS	
Arithmetic processor 7811 B/C	\$319	Micro N-10 system for BSR	\$239
Asynchronous serial interface 7710	129	Micro N-10 card only	165
Centronics interface card 7728	95	15 channel AD/DA 8 bit	319
12K PROM Module 7114	69	Apple Clock battery back-up	225
Calendar/Clock, Bat. back-up 7424	99	Supersaver SD300	245
Parallel Interface 7704A	89	ROM Plus with filter	165
Programmable Timer 7740A	99	ROM Writer/Programmer	119
Analog/Digital converter 7470A	99	APPLE BRAND PRODUCTS	
MICROSOFT PRODUCTS		Apple Language card	450
Apple to Z-80 CPU card	379	Floppy disk with controller	560
D. C. HAYES PRODUCTS		Floppy disk without controller	485
Micromodem for Apple	319	Apple parallel interface	175
COMPUTER STOP PRODUCTS		SSM MICROCOMPUTER	
Double Vision/80 Column Video	250	Dual serial parallel interface AIO	550
INTERACTIVE STRUCTURES		SORRENTO VALLEY ASSOCIATES	
16 Channel A/D card AIO/2	275	8" floppy controller (Pascal)	360

S-100 BOARDS

Assembled • Tested • Burned-in

MEASUREMENT SYSTEMS		MORROW / THINKER TOYS	
Dynamic memory DMB-6400	\$770	Mailboard "NEW" Daisy wheel port, real time clock, power on bump, program interrupt control 3P/35	\$275
Dynamic memory DMB-3200	700	Switchboard interface 4P/25	219
GODBOUT/COMPURO		Disk Jockey II disk controller	195
Dual 8088/8085 16 bit CPU	375	Disk Jockey II double density	375
Z-80 CPU 21 bit address 4 MHz	239	SD SALLES	
Static RAM 32K (Alpha Micro)	575	PROM-100 programmer	
Spectrum color graphics board	329	Video display board 8024	
Interface II I/O board	189	Versafloppy 3740 controller	
SEATTLE COMPUTER PRODUCTS		MULLEN PRODUCTS	
8086 16 bit CPU 2 card set/86 dos 595	595	Sector board/Locate probe (kit) 49	49
CALIFORNIA COMPUTER SYSTEMS		Relay Cpio/control board	145
S-100 Mainframe 2200A	329	D. C. HAYES PRODUCTS	
Disk controller/2, 2 CPM 2422	329	Micromodem S-100 FCC register 375	375
Z-80 CPU 4 MHz DMA 2810A	250	AI/TEC ELECTRONICS	
DIGITAL RESEARCH		Wire Wrap port board WW/100	22
32K 2716 EPROM board	89	General Purpose proto GP/100	22
EPROMs for above 2716 16 req. 13	13	CALIFORNIA DIGITAL	
CALIFORNIA DATA CORPORATION		8086 CPU 4K on board static RAM 450	450
A/D board 16 channel 12 bit			
QT COMPUTER SYSTEMS			
Real time clock/calendar	135		

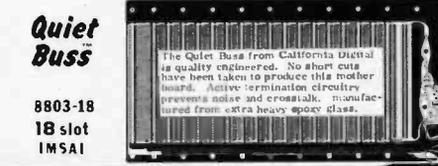
TELETEK SINGLE BOARD COMPUTER FLOPPY DISK CONTROLLER

The FIC-1 features the Z-80 CPU along with the NEC 765 floppy disk controller. The board supports both single or double density 5 1/4 or 5 1/8 disk drives. Two serial (45-9600 bps) and two parallel ports add to the flexibility of this single board computer.

Other standard features are real-time clock, reset jump to monitor, vectored interrupts and potential for controlling a Winchester hard disk drive.

With the addition of an external 5v power supply the Teletak board becomes capable of programming 2716 EPROMS, 10K-10C1 \$695

S-100 Mother Board \$35



Quiet Buss
8803-18
18 slot
IMSAI

The Quiet Buss from California Digital is quality engineered. No short cuts have been taken to produce this mother board. Active termination circuitry prevents noise and crosstalk. Manufactured from extra heavy epoxy glass.

TOLL FREE ORDER LINE
(800) 421-5041
TECHNICAL & CALIFORNIA
213 679-9001



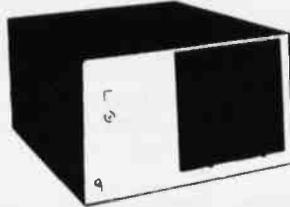
All merchandise sold by California Digital is premium grade. Shipping: First five pounds \$2.00; each additional add \$.40 Foreign orders 10% shipping. Excess will be refunded. California residents add 6% sales tax. COD's discouraged. Open accounts extended to state supported educational institutions and companies with a "Strong Dun & Bradstreet." Warehouse: 15608 Inglewood Blvd. Visitors by appointment.

Circle 353 on inquiry card.

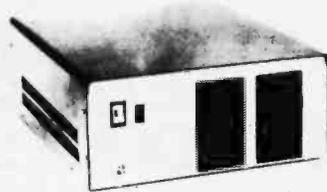


COMPUTER SYSTEMS INC.

15620 South Inglewood Avenue
Lawndale, California 90260
(213) 970-0952



**SYSTEM+
(8")**



**MINI-SYSTEM+
(5 1/4")**

QT SYSTEM +

The QT System+ is designed for both businessmen and engineers in accordance with the latest IEEE standards. Among other functions, it can be used for accounting and word processing, as well as a variety of scientific applications. The system will soon be available with MP/M® to allow multiuser, multi-tasking operations. This means, for example, that an engineer could be working on scientific applications in the lab while an accountant is writing payroll checks in the office. QT also offers a full line of business

and applications software, ranging from a business package to word processing.

Technical specifications: 4MHz Z-80A CPU • Dbl-sided, dbl-den. 5 1/4" & 8" floppy disk controller (handles both drives simultaneously) • Two 8" dbl-den., sgl. or dual sided disk drives, expandable to 4 floppy drives • CP/M® 2.2 included • 64K RAM • Comes complete in single mainframe • EPROM/ROM in any combination to 8K •

Two RS232C serial I/O ports • Two parallel I/O ports • Hard disk compatible • Real time clock • Std. 2K monitor program & disk routines included on ROM • Power-on/Reset jump to monitor program • 2716 (5V) EPROM programmer (software incl. on monitor ROM)(ext. 25.5V @ 50ma req.) • Uses Z-80A CPU vectored interrupts • Assembled, tested & burned • Documentation included.

With Terminal 920C Add \$900.00

SYSTEM + I (1MB+)

SYS+SS Computer System with 8" Single Sided Drives (801R) without Terminal

A&T (6 slot)	\$3595.00
A&T (8 slot)	\$3695.00
A&T (12 slot)	\$3795.00

SYSTEM + II (2MB+)

SYS+DS Computer System with 8" Dual-Sided Drives (Qume DT-8) without Terminal

A&T (6 slot)	\$4495.00
A&T (8 slot)	\$4595.00
A&T (12 slot)	\$4695.00

MINI-SYSTEM + I (1/2MB+)

Computer System with 5 1/4" Single Sided Drives (uses B-51 Disk Drives) No Terminal

A&T (6 slot)	\$2495.00
A&T (8 slot)	\$2595.00
A&T (12 slot)	\$2695.00

MINI-SYSTEM + II (1MB+)

Computer System with 5 1/4" Double Sided Drives (uses B-52 Disk Drives) No Terminal

A&T (6 slot)	\$2795.00
A&T (8 slot)	\$2895.00
A&T (12 slot)	\$2995.00

DISK DRIVE PRODUCTS



QT DISK PACKAGES

DDC-88-1 Dbl Den Controller, A&T, two 8" dbl den drives (801R) CP/M® 2.2, cabinet, power supply & cables	SPECIAL \$1495.00
DDC-88-2 Two 801R disk drives with cabinet, power supply, fan & cables	\$1200.00
DDC-88-22 Two DT-8 Qume drives with cabinet, power supply, fan & cables	\$1600.00
DDC-88-3 Cabinet with power supply, fans & cables	\$ 275.00
DDC-88-4 Cabinet only	\$ 75.00

DISK DRIVES

8"

Shugart 801R Sgl/Sided Dbl/Den	\$ 450.00
Qume Datatrak 8" Dbl/Sided Dbl/Den	
QME-8DS (851R) compatible	\$ 650.00
Pkg of two	\$1250.00

5 1/4"

MPI-B51 MPI B-51	\$ 235.00
Sgl Sided Sgl/Dbl Den	
MPI-B52 MPI B-52	\$350.00
Sgl Sided, Dbl Den	
MPI-B91	
MPI B-91	\$ 375.00
Sgl Sided, Dbl Den, 77 tracks	
Shugart SA400 SHU-SA400	\$ 250.00
Sgl Sided, Dbl/Den	

S-100 PRODUCTS

Double Density - Cal Comp Sys
5 1/4" or 8" disk controller with free CP/M 2.2
CCS-2422A A&T \$374.95

Expando RAM II - SD Systems
4 MHz RAM board expandable from 16K to 256K
SDS-RAM216K 16K kit \$289.95
SDS-RAM216AT 16K A&T \$339.95
SDS-RAM232K 32K kit \$329.95
SDS-RAM232AT 32K A&T \$379.95

SDS-RAM248K 48K kit \$369.95
SDS-RAM248AT 48K A&T \$419.95
SDS-RAM264K 64K kit \$409.95
SDS-RAM264K 64K A&T \$459.95

PROM-100 - SD Systems
2708, 2716, 2732, 2758 & 2516 EPROM programmer
SDS-PRDM-100K kit \$220.00
SDS-PRDM-100AT A&T \$275.00

ITHACA AUDIO REV 2.0 Z-80 BD

Bare Board \$35.00 each
10 for \$300.00

SEALS ELECTRONICS 32K STATIC BD

Uses TMS-4044 or 5257L \$35.00 each

QT MEMORY EXPANSION KITS

TRS-80 • APPLE • EXIDY

4116 200 ns	8 for \$32.00
2716 (5V-450 ns)	\$ 9.00
2716 (5 & 12V-450 ns)	\$ 9.00
2732 (5V)	\$40.00
2114L 300 ns	8 for \$36.00
	100 - \$3.50 ea.

PARTS

MICROPROCESSORS

Z80 (2MHz)	\$10.95
Z80A (4MHz)	\$12.95
6502	\$11.25
6800	\$12.50
6802	\$18.00
8035	\$20.00
8080A	\$ 3.50
8085A	\$20.00
8086-4	\$60.00
8088	\$60.00
8748	\$60.00
TMS 9900 JL	\$29.95

EPROMS

1702A	\$ 4.95
2708	\$ 6.25
2516 (5V)	\$ 9.00
2716 (5V)	\$ 9.00
2716 (5 & 12V)	\$ 9.00
2758	\$19.95
2532	\$40.00
2732	\$40.00

USRT

S2350	\$ 7.95
-------	---------

MISCELLANEOUS OTHER COMPONENTS

N8T20	\$ 3.25
N8T26	\$ 2.50
N8T97	\$ 2.00
N8T98	\$ 2.00
1488	\$ 1.25
1489	\$ 1.25
D3205	\$ 3.00
D3242	\$14.00
P3404	\$ 6.75
TMS5501	\$19.00
DM8131	\$ 3.00

UARTS

TR1602B	\$ 4.50
AY5-1013A	\$ 4.50

CHARACTER GENERATORS

2513	\$10.95
UP CASE (5&12V)	\$12.00
2513	\$10.95
LWR CASE (5&12V)	\$ 9.75
2513	\$10.95
LWR CASE (5V)	\$10.95

KEYBOARD CHIPS

AY5-2376	\$13.75
AY5-3600	\$13.75

BAUD RATE GENERATORS

MC14411	\$11.00
1.8432 XTAL	\$ 4.95

DISK CONTROLLER

1771B01	\$24.95
1791B01	\$37.95

6800 PRODUCTS

6802P	\$18.00
6821P	\$ 5.25
6840P	\$18.25
6845P	\$22.00
6850P	\$ 4.80
6860P	\$11.55
6875P	\$ 7.40

QT PRODUCTS

SBC+2/4 SINGLE BOARD COMPUTER

Features: 1K RAM (which can be located at any 1K boundary) plus one each Parallel and Serial I/O parts on board • Power on jump to on-board EPROM (2708 or 2716) • EPROM addressable on any 1K or 2K boundary • Full 64K use of RAM allowed in shadow mode • Programmable Baud rate selection, 110-9600 • 2 or 4MHz switch selectable • DMA capability allows MWRT signal generation on CPU board or elsewhere in system under DMA logic or front panel control • Two programmable timers available for use by programs run with the SBC+2/4 (timer output and controls available at parallel I/O connector; parallel input and output ports available for use on CPU board).

Bare Board \$ 60.00
Kit \$190.00
A&T \$295.00

Z+80 CPU

Features: Power on jump to on-board EPROM (2708, 2716 or 2732) • EPROM addressed on any 1K or 2K boundary; also shadow mode allows full 64K use of RAM • On-board USART for Synchronous or Asynchronous RS-232 Operation (Serial I/O port) • Programmable Baud rate selection, 110-9600 • Switch selectable 2 or 4 MHz • MWRITE signal generated if used without front panel • Front panel compatible.

Bare Board \$ 50.00
Kit \$150.00
A&T \$210.00

RAM+16

Features: S-100, 16K x 8 bit static RAM • 2 or 4 MHz • Uses 2114 1K x 4 static RAM chip • 4K step addressable • 1K increment memory protection, from bottom board address up or top down • Deactivates up to six 1K board segments to create "holes" for other devices • DIP switch selectable wait states • Phantom line DIP switch • Eight bank select lines expandable to 1/2 million byte system • Data, address and control lines all input buffered • Ignores I/O commands at board address.

Bare Board \$ 35.00
4MHz Kit \$190.00
4MHz A&T \$225.00

RAM+ 65

•S-100, 16K x 8 bit static RAM •2 or 4MHz •Uses 2114L (300NS) CHIP •Addressable in 4K steps •Memory protection in 1K increments, from bottom board address up or top down • May deactivate up to six 1K segments of board to create "holes" for other devices • DIP switch selectable wait states • Phantom line DIP switch •Features bank selection by I/O instruction using any one of 256 DIP switch-selectable codes—allows up to 256 software-controlled memory banks.

Bare Board \$ 35.00
4MHz Kit \$210.00
4MHz A&T \$250.00

EXPANDABLE+ REV II ^{NEW} DYNAMIC MEMORY BOARD

Features: Runs at 4MHz • 3242 refresh controller with delay line • Four layer PC board insures quiet operation • Supports 16K, 32K, 48K or 64K of memory • 24 IEEE-specified address lines • Optional M1 wait state allows error free operation with faster processors • Optional Phantom disable • Uses Z-80 or on-board refresh signal • Bank on/off signal selected by industry standard I/O port 40 (Hex) • Convenient DIP switch selection of data bus bits determines bank in use • 3 watts low power consumption • Convenient LED indication of bank in use.

Definitely works with Cromemco and North Star

Bare Board \$ 75.00

KIT		A&T	
No RAM	\$230.00	16K	\$350.00
16K	\$280.00	32K	\$450.00
32K	\$360.00	48K	\$575.00
48K	\$480.00	64K	\$675.00
64K	\$525.00		

CLOCK/CALENDAR+ FOR APPLE II, S-100 OR TRS-80

Features: Date/Month/Year • Day of week • 24 hour time or 12 hour (a.m./p.m.) selectable • Leap year (perpetual calendar) • 4 interval interrupt timer; 1024Hz (approx. 1 millisecond), 1 sec., 1 min., 1 hr. • On-board battery backup • Simple time and date setting • Simple software interface • Time advance protection while reading.

Battery Included	
S-100 or Apple	TRS-80
A&T \$150.00	A&T Only ... \$150.00
Kit \$100.00	
Bare Bd. \$ 60.00	

WATCH FOR THE FOLLOWING NEW BDS:

- 4 Port Serial Bd (APR)
- E-PROM Programmer (MAY)
- Floppy Disk Controller (JUN)
- Hard Disk Controller (JUN)
- Color Video Bd (AUG)

I/O+

INDUSTRIAL GRADE I/O BD

Has two serial Sync/Async ports (RS-232, current loop or TTL) with individual Xtal controlled programmable baudrate generators • Four 8-bit Parallel ports; one latched Input port and other three can be programmed in combinations of input, output or bidirectional • Also, has three 16-bit Programmable Timers and an 8-level Programmable Interrupt Controller w/Auto restart (8080 / Z80) • Other features include; on-board clock divisor for timers, completely socketed, wire wrap posts for easy port configuration plus more.

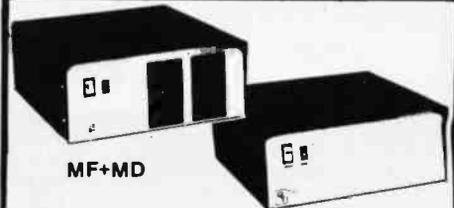
Bare Board \$ 70.00
Kit \$200.00
A&T \$375.00

SILENCE+ MOTHERBOARDS

These motherboards are among the quietest on the market. A unique grounding matrix — with each line completely surrounded by ground shielding — eliminates need for termination and gives high crosstalk rejection • They're customer-proven, without crosstalk sometimes operating at 14MHz • A LED power indicator helps eliminate zapped circuits • IEEE S-100 std. compatible, available with 6, 8, 12, 18 or 22 slots • (The 22 slot board fits Imsai chassis and has slot for front panel.)

6 Slot		12 Slot	
Bare Board ..	\$ 25.00	Bare Board ..	\$ 30.00
Kit	\$ 40.00	Kit	\$ 70.00
A&T	\$ 50.00	A&T	\$ 90.00
8 Slot		18 Slot	
Bare Board ..	\$ 27.00	Bare Board ..	\$ 50.00
Kit	\$ 55.00	Kit	\$100.00
A&T	\$ 70.00	A&T	\$140.00

QT MAINFRAMES



MF+MD

MF+

5 1/4" Disk Mainframe with 25A Pwr Sup

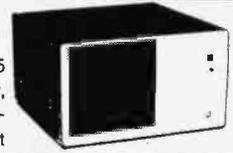
MF+MD12 (12 slot M/B) \$500.00
MF+MD8 (8 slot M/B) \$475.00
MF+MD6 (6 slot M/B) \$450.00
MF+MD w/o M/B \$400.00

Q.T. Mainframe

MF+12 (12 slot M/B) \$450.00
MF+18 (18 slot M/B) \$500.00
MF+22 (22 slot M/B) \$600.00

MAINFRAME+ DISK DRIVE

Includes cabinet, 25 amp power supply, IEEE S-100 compatible 6, 8 or 12 slot motherboard and dual 8" disk drive with disk drive power supply.



MF+DD6 \$625.00
MF+DD8 \$650.00
MF+DD12 \$675.00

DDC-8 SINGLE 8" DISK CABINET

Accepts one 8" disk drive (Shugart, Remex, PerSci, Siemens, etc.) • Fan cooled, with data cable and AC line filter to eliminate EMI • Operates from 100-125VAC/200-250VAC at 50-60Hz • Disk drive NOT included.

DDC+8 \$195.00



COMPUTER
SYSTEMS
INC.

15620 South Inglewood Avenue
Lawndale, California 90260
(213) 970-0952

PLACE ORDERS TOLL FREE
1-800-421-5150
(CONTINENTAL U.S. ONLY)
(EXCEPT CALIFORNIA)

Apple is a trademark of Apple Computer, Inc.
CP/M and MP/M are trademarks of Digital Research.
TRS-80 is a trademark of Radio Shack.

Circle 355 on inquiry card.

TERMS OF SALE: Cash, checks, money orders, credit cards accepted. Also C.O.D. orders under \$100.00. Minimum order \$10.00. California residents add 6% sales tax. Minimum shipping and handling charge \$3.00. Prices subject to change without notice. International sales in American dollars only.



BITS & PIECES

DETACH OUR CATALOG FROM THE NOV. BYTE

TRS-80/APPLE MEMORY EXPANSION KITS

4116's RAMS

from Leading Manufacturers
(16Kx1 200ns)

8 for \$29.00

ADD \$3.00 FOR PROGRAMMING JUMPERS
FOR TRS-80 KEYBOARD

4116's 100 pcs & UP \$3.00 each
1000 pcs & UP \$2.75 each

2114-3L
4096 BIT (1024x4) 300ns
LOW POWER STATIC RAM
8/\$30.00
100 + \$3.00

2716
450ns 5 Volt only
16 K EPROM
\$11.95 each
or 8/\$68.00

5257-3L
(TMS 4044)
4096x1 300ns
LOW POWER STATIC RAM
8/\$50.00
100 pcs. + \$4.75

2708
450ns 8K
EPROM
\$8.50 each
or 8/\$54.00

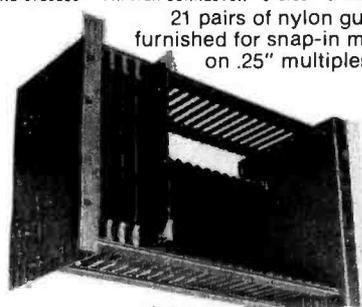
2732 \$25.00

450ns 5 Volt only
32 K EPROM 8x4K **8/\$160.00**



PART NO.	DESCRIPTION	PRICE		
		1-9	10-24	25-99
CND-DE9P	9 PIN MALE	\$ 2.10	\$ 1.90	\$ 1.70
CND-DE9S	9 PIN FEMALE	\$ 2.70	\$ 2.40	\$ 2.10
CND-DE9C	9 PIN COVER	\$ 1.50	\$ 1.25	\$ 1.10
CND-DA15P	15 PIN MALE	\$ 2.75	\$ 2.45	\$ 2.15
CND-DA15S	15 PIN FEMALE	\$ 3.95	\$ 3.60	\$ 3.20
CND-DA15C	15 PIN COVER	\$ 1.50	\$ 1.30	\$ 1.10
CND-DB25P	25 PIN MALE	\$ 3.50	\$ 3.25	\$ 3.00
CND-DB25S	25 PIN FEMALE	\$ 4.60	\$ 4.35	\$ 4.20
CND-DB51212	1 PC. GREY HOOD	\$ 1.60	\$ 1.45	\$ 1.30
CND-P25H	2 PC. GREY HOOD	\$ 1.50	\$ 1.25	\$ 1.10
CND-DB51226	2 PC. BLACK HOOD	\$ 1.90	\$ 1.65	\$ 1.45
CND-DC37P	37 PIN MALE	\$ 5.80	\$ 5.10	\$ 4.45
CND-DC37S	37 PIN FEMALE	\$ 8.70	\$ 7.70	\$ 6.70
CND-DB37C	37 PIN COVER	\$ 1.80	\$ 1.55	\$ 1.30
CND-DD50P	50 PIN MALE	\$ 8.75	\$ 7.75	\$ 6.70
CND-DD50S	50 PIN FEMALE	\$11.65	\$10.25	\$ 8.90
CND-DD50C	50 PIN COVER	\$ 2.00	\$ 1.80	\$ 1.60
CND-D2041B	HARDWARE SET 2 PR RS232, DB25P, EIA	\$ 1.00	\$.80	\$.70
CND-RS2328F	CLASS 1 CABLE 8 CON. 8 FT. CENT. 700 SERIES	\$19.95	\$17.95	\$15.95
CND-5730360	PRINTER CONNECTOR	\$ 9.00	\$ 7.50	\$ 6.00

21 pairs of nylon guides
furnished for snap-in mounting
on .25" multiples



VCT-CCK100 \$49.80

RACK MOUNTABLE CAGE

Especially designed to accommodate S100 size Plugboards, Motorola Exorcisor™ and Micromodule™ Plugboards. Cage has .081" thick anodized aluminum side walls. Will accommodate Plugboards 4.0" to 8.5" long and 10.0" to 11.5" wide by 1/16" thick. Cages assemble quickly.

CENTRONICS® 737-1 LETTER QUALITY DOT MATRIX PRINTER

LIST \$995.00
SALE

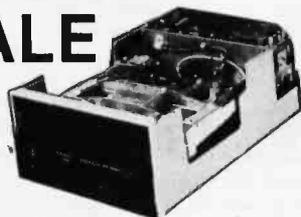
\$725.00

CEN737-1



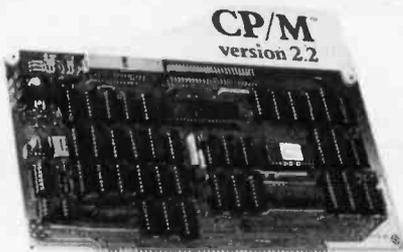
Shugart

SA801R SALE



SHU-SA801R \$410.00

2 OR MORE **\$395.00 ea.**



California Computer Systems LIST \$400.00
CCS2422A
FLOPPY DISK CONTROLLER
WITH CP/M VERSION 2.2 **SALE \$375.00**

IEEE S-100 COMPATIBLE SINGLE/DOUBLE DENSITY
5 1/4" 8" DISK DRIVES
SINGLE/DOUBLE HEADED
ASSEMBLED & TESTED

CCS-2810 Z80 CPU
2 1/4 MHZ CPU W/Serial I/O

CCS-2810 A&T List Price \$300.00 **SALE \$275.00**

BOBBOUR

S-100 MOTHERBOARDS

	LIST PRICE	OUR PRICE
GBT-153U UNKIT 6 SLOT		\$ 89.00
GBT-153A A & T 6 SLOT	\$129.00	\$119.00
GBT-154U UNKIT 12 SLOT		\$129.00
GBT-154A A & T 12 SLOT	\$169.00	\$149.00
GBT-155U UNKIT 20 SLOT		\$174.00
GBT-155A A & T 20 SLOT	\$214.00	\$189.00



PRIORITY ONE ELECTRONICS

16723 B ROSCOE BLVD. • SEPULVEDA, CA. 91343

Terms: Visa, MC, BAC, Check, Money Order, U.S. Funds Only. CA residents add 6% sales tax. Minimum order \$15.00 Prepaid U.S. orders less than \$75.00 include 5% shipping and handling. MINIMUM \$2.50. Excess refunded. Just in case... please include your phone no. Prices subject to change without notice. We will do our best to maintain prices thru April, 1981. (213) 894-8171 *SOCKET and CONNECTOR prices based on GOLD, not exceeding \$700 per oz.

*Sale Prices are for prepaid orders only. Credit card orders will be charged appropriate freight

MODEM SALE

\$129.00

THE STAR
MODEM
from LIVERMORE



FEATURE
FITS GTE HANDSETS!

2 YEAR WARRANTY

EXCLUSIVE ACOUSTIC CHAMBERS
The exclusive triple seal of Livermore's new flat mounted cups locks the handset into the acoustic chamber yielding superior acoustic isolation and mechanical cushioning. Designed to adapt to most common handsets used throughout the world, the STAR offers the utmost in flexibility and transmission reliability.

Specifications:

- Data Rate: 0 to 300 baud
- Compatibility: Bell 103 and 113; CCITT
- Frequency Stability: ±0.3 percent. Crystal controlled
- Receiver Sensitivity: -50 dBm ON, -53 dBm OFF
- Modulation: Frequency shift keyed (FSK)
- Carrier Detect Delay: 1.2 seconds ON; 120 msec OFF
- EIA Terminal Interface: Compatible with RS 232 specifications
- Teletype Interface: 20 milliampere current loop
- Optional Interfaces: IEEE 488; TTL; TTY 43
- International (CCITT) frequencies available
- Switches: Originate/Off/Answer; Full Duplex/Test/Half Duplex
- Indicators: Transmit Data, Receive Data, Carrier Ready, Test
- Power: Supplied by 24 VAC/150 MA UL/CSA listed wall-mount transformer. Input 115 VAC, 2.5 watts. (A 220 VAC, 50 Hz adaptor is available upon request.)
- Dimensions: 10" x 4" x 2"
- Weight: 1.74 lbs. (3 lbs. shipping weight including AC adaptor)
- Warranty: Two years on parts and labor, excluding the AC adaptor which carries the manufacturer's warranty

Part No.	Description	List Price	SALE PRICE
LIV-STAR	RS232, TTL Modem	\$199.00	\$129.00
LIV-STAR2UM	RS232, 20MA Current Loop	\$199.00	\$129.00
LIV-STAR-V21	CCITT European Standard	\$229.00	\$209.00
LIV-IEEE	IEEE 488 Standard	\$395.00	\$249.00
LIV-IEEE-V21	IEEE 488, CCITT Standard	\$465.00	\$388.00

Part No.	Description	Price
CND-RS2328F	RS232 8 Cond 8 ft.	\$19.95
LIV-I21	IEEE to IEEE 2 Meter	\$59.95
LIV-I2PET	IEEE to Pet 2 Meter	\$59.95

PROTECT YOUR INVESTMENT PROTECT YOUR DATA WITH



ISOBAR

GOF-IBAR46

LIST PRICE \$79.95

SALE PRICE \$39.95

GOLD S-100 CONNECTORS

PRIORITY ONE distributes the TI S-100 Card Edge Connectors at tremendous volume for prices others only wish they could duplicate.

SOLDER TAIL PRICE

Part No.	1-9	10-24	25-99	100-249
TI-S100 STG	3.20	2.90	2.50	2.20

WIRE WRAP PRICE

Part No.	1-9	10-24	25-99	100-249
TI-S100 WWG	4.00	3.75	3.50	3.25

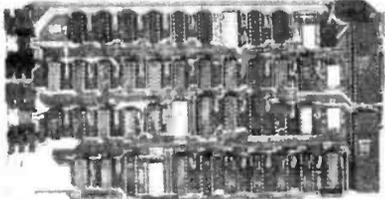
ORDER TOLL FREE 1-800-423-5633 ORDER TOLL FREE 1-800-423-5633

DETACH OUR CATALOG FROM THE NOV. BYTE

S-100 HEADQUARTERS

GODBOUT

THE DUAL PROCESSOR BOARD IS HERE!



GBT161 8085 CPU BOARD
GBT1612 8085/8088 CPU BOARD

- 8088 & 8085A CPU
- S-100 IEEE COMPATIBLE
- SWITCHABLE CPU'S
- 5 MHZ OR 2 MHZ SWITCHABLE
- POWER ON JUMP TO ANY 256 BYTE BOUNDARY
- POWER ON JUMP CAN BE DISABLED
- CPU CAN JUMP ON POWER ON ONLY OR POWER ON AND RESET.
- 24 BIT EXTENDED ADDRESSING
- IMSAI FRONT PANEL COMPATIBLE
- AVAILABLE WITH 8085A ONLY

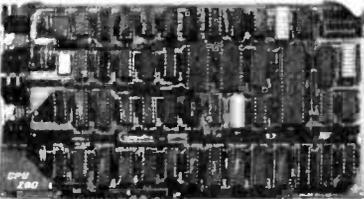
BOARD WITH 8085 ONLY

		List Price	Our Price
GBT161A	Assembled & Tested	\$325.00	\$305.00

BOARD WITH 8085 & 8088

GBT1612A	Assembled & Tested	\$425.00	\$399.00
----------	--------------------	----------	----------

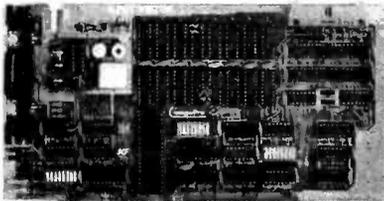
ENHANCED Z80 S-100 CPU BOARD



GBT160 Z80 CPU

- 4-6 MHz Z80 CPU
- IEEE S-100 Bus Compatible
- On Board Prom Sockets For Up To 8K Prom
- Power On Jump Start To Any 256Byte Boundary
- On Board Memory Manager For Direct Addressing For Up To 16 M-Bytes
- Fully Maskable Vectored Interrupts
- Wait State Generation For All Machine Cycles
- Bypassing Of All Supply Line To Suppress Transients
- All IC's Are Socketed

		List Price	Our Price
GBT160U	UnkIt	\$225.00	\$225.00
GBT160A	Assembled & Tested	\$295.00	\$280.00



SPECTRUM S-100 COLOR GRAPHICS BOARD

- Uses the MC6847 LSI IC
- Uses 1372 color encoded/generator
- Alphanumeric/graphics in 8 colors
- Ultra dense 256 x 192 full graphics
- 8K bytes, on-board low power RAM
- One full duplex parallel I/O port with attention, enable & strobe bits with power for running joysticks, keyboards, etc.
- A parallel port for graphics mode control
- Board may be used as a 4MHz RAM for program storage

		LIST PRICE	OUR PRICE
GBT144U	UNKIT		\$299.00
GBT144A	A&T	\$399.00	\$349.00
GBT20	SUBLOGIC UNIVERSAL GRAPHICS INTERPRETER SOFTWARE		\$35.00

GODBOUT



INTERFACER I

Our I/O board gives you unparalleled flexibility and operating convenience. We include such features as:

- 2 Independently addressable serial ports (dip switch selectable addresses)
- Real LSI Hardware UARTs for minimum CPU housekeeping
- RS232C, current loop (20mA), & TTL signals on both ports
- Precision, crystal-controlled Baud rates up to 19.1 KBaud (Individually dip switch selectable)
- Transmit & receive interrupts on both channels, jumperable to any vectored interrupt line
- Industry standard RS232 level converters with five RS232 handshaking lines per port
- Optically isolated current loop with provisions for both on-board & off-board current sources
- UART parameters, interrupt enables, & RS232 handshaking lines are software programmable with power-on hardware default to customer specified hard-wired settings for maximum flexibility
- Port connectors mate directly to ribbon cable & DB25 connectors in standard pinouts
- RS232 lines will conform to either master or slave configurations
- Board gives full feature operation with both 2 & 4 MHz systems
- Low power consumption: +8V @ 450mA; +16V @ 150mA; -16V @ 70mA max.
- No software initialization required for board operation, although board parameters may be altered by software

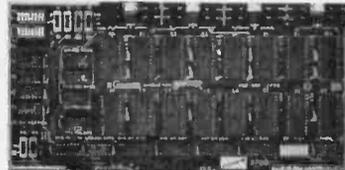
		LIST PRICE	OUR PRICE
GBT133U	UNKIT	\$199.00	\$199.00
GBT133A	A&T	\$249.00	\$219.00



INTERFACER II 3PTS

- 1 independently addressable serial port
- RS232C: 20mA current loop, & TTL signals
- Precision crystal controlled Baud rate generator
- Up to 19.2K Baud
- Transmit and receive interrupts, jumperable to and vectored interrupt line
- Five RS232 handshaking lines
- Optically isolated current loop
- 3 parallel I/O
- Utilizes LSTTL octal latches for latched I/O data with 24mA drive current
- Enable & strobe bits on each port (each with selectable polarity)
- Interrupts for each input port
- Separate 25 pin connector with power for each channel and a status port for interrupt mask & port status

		LIST PRICE	OUR PRICE
GBT150U	UNKIT	\$199.00	\$199.00
GBT150A	A&T	\$249.00	\$219.00



ECONOROM 2708

Has provisions for wait states for 4MHz operations. Configured as four 4K blocks—each independently addressable and disableable. Power-on jump. Does NOT include 2708s. Includes all support chips, sockets, regulators, heat sinks, etc. Sold in UNKIT form only. Shipping Weight 2 lbs.

GBT125U UnkIt\$85.00



* NEW! * DISK 1 HIGH PERFORMANCE FLOPPY DISK CONTROLLER

Finally, a floppy disk controller worthy of bearing the CompuPro name is now available for integration into your S-100 system. The DISK 1 floppy controller incorporates numerous features that were previously unavailable on a DMA floppy disk controller board. DISK 1 fully complies with the IEEE 696 bus standard, INCLUDING DMA ARBITRATION!

- Third generation INTEL 8272/NEC 765A LSI floppy disk controller.
- High speed cycle stealing DMA interface for processor independent data transfer between system memory and flexible disk.
- Handles up to four 8 or 5.25 inch floppy disk drives.
- Single or double density / single or double sided capability.
- Supports IBM 3740 soft sectored formats.
- 24 bit DMA addressing with data transfer across 64K boundaries for data transfer throughout the 16Mbyte memory map.
- I/O mapped Interface allows contiguous system memory. (DISK 1 occupies no memory space)
- On board Phantom boot EPROM for automatic startup.
- On board serial port for initial system startup.
- Board compatible with MP/M, OASIS, CP/M-80 and CP/M-86.
- Board supplied with BIOS for CP/M-80
- CP/M-80 and CP/M-86 available for DISK 1.
- CPU speed independent data transfer for operation up to 10MHZ.
- Fully arbitrated DMA Interface as per IEEE 696 for allowing multiple DMA devices without conflict.
- May be interrupt driven for multi-user environments.
- Up to 600K bytes per side (8 inch drive) for an on-line total of up to 4.8M bytes (4 drives - double sided -double density)

		LIST PRICE	OUR PRICE
GBT-171BA	Disk 1 A&T	\$495.00	\$445.00

SYSTEM SUPPORT 1 MULTIFUNCTION BOARD

This multi-purpose S-100 board provides your computer with the most needed system support functions at less cost than buying numerous single function boards. Includes sockets for 4K of extended address EPROM or RAM (2716 pinout), 1 socket with battery backup; crystal controlled month/day/year/time clock with BCD outputs; optional high speed math processor (9511 or 9512); full RS-232 serial port; three 16 bit interval timers (cascade or use independently); two interrupt controllers service 15 levels of interrupts; power fail indicator with provision to switch CMOS memory to battery backup; and comprehensive owner's manual with numerous software examples. Conforms fully to all IEEE 696/S-100 standards.

Want to make your S-100 system more versatile? System Support 1 is the answer.

		LIST PRICE	OUR PRICE
GBT-162U	unKit	\$295.00	\$295.00
GBT-162A	A&T	\$395.00	\$360.00
GBT-9512	Match Clip		\$195.00

Static S-100 Memory



32K ECONORAM XX

32K Bank Select. IEEE S-100 compatible. Features one 32K block that can be addressed on 4K boundaries. Compatible with the IEEE proposed standard of 24 address lines as well as all currently used bank select configurations. Any or all of the eight 4K byte blocks may be disabled to create as many windows in memory to avoid any system memory conflicts.

		List Price	Our Price
GBT164A16	16K RAM A & T	\$399.00	\$329.00
GBT164A24	24K RAM A & T	\$539.00	\$455.00
GBT164A32	32K RAM A & T	\$699.00	\$569.00



PRIORITY ONE ELECTRONICS (213) 894-8171

16723 B ROSCOE BLVD. • SEPULVEDA, CA. 91343

Terms: Visa, MC, BAC, Check, Money Order, U.S. Funds Only. CA residents add 6% sales tax. Minimum order \$15.00 Prepaid U.S. orders less than \$75.00 include 5% shipping and handling. MINIMUM \$2.50. Excess refunded. Just in case... please include your phone no. Prices subject to change without notice. We will do our best to maintain prices thru APRIL, 1981

* SOCKET and CONNECTOR prices based on GOLD, not exceeding \$700 per oz.

* Sale Prices are for prepaid orders only. Credit card orders will be charged appropriate freight

ORDER TOLL FREE 1-800-423-5633 ORDER TOLL FREE 1-800-423-5633

Circle 356 on inquiry card.

DETACH OUR CATALOG FROM THE NOV. BYTE

DETACH OUR CATALOG FROM THE NOV. BYTE

IMAGINE THE STORAGE ON AN 8 INCH FLOPPY

315K BYTES PER SIDE ON 5 1/4" - OF COURSE! Micropolis, the world's largest manufacturer of high density 5 1/4" disk drives, has been doing it for years. And reliably at that.

An ordinary 5 1/4" floppy provides just 35 tracks per side and stores only 70K bytes. This is not nearly enough for anything useful, so instead, Micropolis uses 77 tracks per side. Each track is then formatted with 16 sectors (hard) at 256 bytes per sector yielding an impressive 315K bytes per side.

Micropolis drives have a larger capacity than many 8" disk drives, though it only occupies the space of a 5 1/4" floppy. The 315K byte capacity is roughly 4 times the capacity of a standard 5 1/4" drive. This is what we call QUAD DENSITY.

To achieve the high density capability, you may think Micropolis had to sacrifice speed or reliability. NOT SO! The track to track access time is only 30ms with a high speed data transfer rate of 250,000 bits per second.

By creating this high density format, Micropolis is able to keep your initial subsystem costs to a minimum. Your cost is less than \$,002 per byte. That's a BIG VALUE in a small package.

MICROPOLIS disk subsystems are expandable to keep up with your ever increasing needs. Up to four drives/heads may be daisy-chained on one \$100 controller board. With all four drives/heads in operation, you have access to over 1.2 MEGABYTES of on-line storage.

WITH MICROPOLIS, complete means COMPLETE. Each subsystem comes complete with controller interface, cable, and software. The software includes the MDOS operating system, extended basic, assembler and editor. Everything you need to get "On Line" in one complete package.

MICROPOLIS provides total integration which means they control everything from beginning to end. The result is a better drive for you, backed by a full 120 day factory guarantee.

Anyone can cut price by cutting out capacity or valuable features. But there's no long term advantage in it. Not for the user. Or the builder.

MICROPOLIS takes a better approach, even though it's harder, using advanced design to provide more capability while also lowering cost.

For example, most 5 1/4-inch floppy disks cut costs by using a cheap, less accurate plastic cam or cam follower to position the read/write head. Most 8-inch floppy disks use a better approach, with a rolled steel lead screw for this function.

We go them one better and use an all-steel system, with a precision-ground steel lead screw and steel follower. It costs more but gives us greater storage capacity with lower cost per thousand bytes. Not so incidentally, our steel construction (compared to plastic) significantly increases reliability, too. There's even a built-in File Protect feature that prevents accidental loss of valuable data. (A file protected diskette cannot be written on.)

Heat can cause numerous read and write errors that can become hazardous to your data. The major heat producing power supply components are mounted to a large heat sink, external to the cabinet, by the power switch and fuse (located at the rear of the cabinet). This design is to assure that the drive components are kept as cool as possible to assure reliable data recovery.

MICROPOLIS has a reputation for getting along with most everybody. Compatibility is not a problem with MICROPOLIS. Their disk drives and/or subsystems can be easily integrated into systems such as Polymorphic, Cromemco, CCS, Ithica Intersystems, Godbout, Northstar, Jade Big Z, QT SBC 2/4, and many others. Many OEM manufacturers rely on MICROPOLIS to get the job done efficiently. Companies like Commodore, Exidy, Harris, and Vector Graphics to name just a few. Years from now, you can look back with a secure feeling knowing you made the best choice, MICROPOLIS.

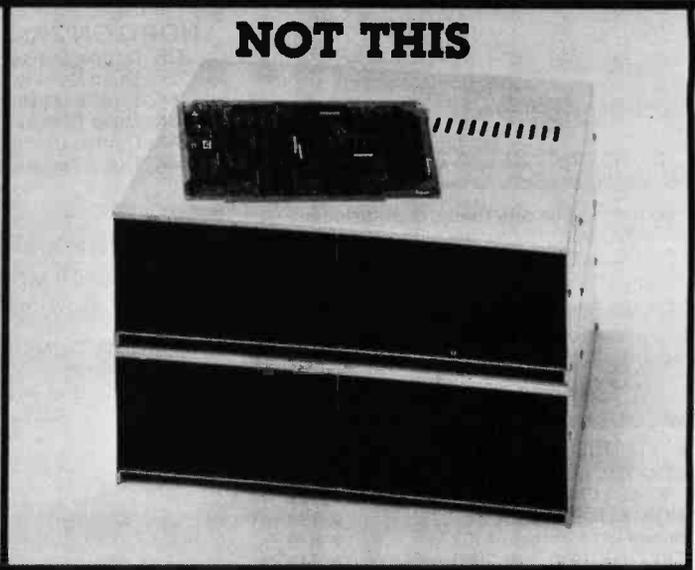


AGE CAPACITY OF IN 5 1/4" FORMAT

THIS



NOT THIS



Because of our incredible purchasing power, PRIORITY ONE ELECTRONICS is able to buy MICROPOLIS disk drives by the thousands and receive special pricing. That special pricing we receive is passed on to you in the form of tremendously discounted prices. Now all that remains is for you to take advantage of this truly incredible buy.

GOOD NEWS FOR TRS-80* OWNERS

We now have a complete line of TRS-80* Model I compatible MICROPOLIS add on drives in matching colors. These drives simply plug into the expansion interface via a disc data cable.

197K BYTES PER SIDE FOR YOUR TRS-80*, that's easy! Just order a 77 track add on drive and the New DOS-80 operating system. Among the many features of New DOS-80, is its ability to control any mix of 35, 40, or 77 track drives on the same cable.

MODEL	DESCRIPTION	LIST	SALE PRICE
S-100 SUB-SYSTEMS			
MCP-1053-4	1.2 MB 2 HEAD DUAL	\$2605.00	\$1395.00
MCP-1053-2	630 KB DUAL	\$1895.00	\$995.00
MCP-1043-2	315 KB SINGLE	\$1145.00	\$695.00
MCP-1041-2	315 KB SINGLE, NO PS	\$1045.00	\$639.00
MCP-1042-1	143 KB SINGLE	\$795.00	\$625.00
MCP-1041-1	143 KB SINGLE, NO PS	\$695.00	\$595.00

TRS-80® DISK DRIVES

MCP-1027-1	35 TRACK SINGLE	\$545.00	\$279.00
MCP-1037-1	35 TRACK DUAL	\$1195.00	\$695.00
MCP-1027-2	77 TRACK SINGLE	\$645.00	\$439.00
MCP-1037-2	77 TRACK DUAL	\$1395.00	\$795.00

ACCESSORIES

APP 395M	NEW DOS/80 TRS-80*		
	35 thru 77	SUPPLIED	ON
	TRACK OPERATING	35 TRACK	77 TRACK
	SYSTEM	\$149.00	\$159.00
PR1-34CEEE-2	Two Drive Data Cable		\$29.95
PR1-34CEEE-4	Four Drive Data Cable		\$39.95

GOOD THRU APRIL 1981

COMPLETE W/S-100 CONTROLLER, CABLES, MANUALS AND MICROPOLIS MDOS AND BASIC

ADD-ON DRIVES

MCP-1033-2	630 KB DUAL	\$1395.00	\$895.00
MCP-1023-2	315 KB SINGLE	\$645.00	\$495.00
MCP-1021-2	315 KB SINGLE, NO PS	\$545.00	\$475.00
MCP-1022-1	143 KB SINGLE	\$545.00	\$375.00
MCP-1021-1	143 KB SINGLE, NO PS	\$445.00	\$360.00

REQUIRES ACCESSORY ADD-ON CABLES

**THIS COULD BE THE START OF SOMETHING SMALL.
SEE US AT THE WEST COAST COMPUTER FAIR
AND PICK UP YOUR DRIVES.**



1-800-423-5633 PRIORITY ONE ELECTRONICS (213) 894-8171

16723 B ROSCOE BLVD. • SEPULVEDA, CA. 91343



Terms: Visa, MC, BAC, Check, Money Order, U.S. Funds Only. CA residents add 6% sales tax, Minimum order \$15.00 Prepaid U.S. orders less than \$75.00 include 5% shipping and handling. MINIMUM \$2.50. Excess refunded. Just in case ... please include your phone no. Prices subject to change without notice. We will do our best to maintain prices thru April 1981.

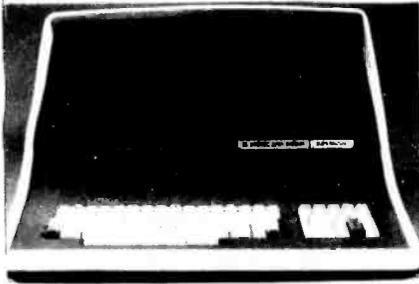
*SOCKET and CONNECTOR prices based on GOLD, not exceeding \$700 per oz.

*Sale Prices are for prepaid orders only. Credit card orders will be charged appropriate freight

*TRS-80 is a registered trademark of Tandy Corp.

Best Prices and Delivery!

SUPERBRAIN by Intertec



Self-contained computer with dual disks and two RS232C ports. Complete with CP/M 2.2 and BASIC.

- 32K Double Density, List \$2995 **\$2685**
- 64K Double Density, List \$3345 **\$2883**
- 64K Upgraded to Quad Density w/ Special MiniMicroMart Warranty **SPECIAL \$3395**

VIDEO TERMINALS

- NEW EMULATOR** (Intertec), List \$895 **\$ 749**
- NEW INTERTUBE III** List \$895 **ONLY \$ 749**
- SOROC 120**, List \$995 **SPECIAL \$ 729**
- 1Q140, List \$1495 **SPECIAL \$1149**
- PERKIN-ELMER 550**, List \$997 **\$ 799**
with anti-glare screen, \$1027 **\$ 829**
- HAZELTINE 1410**, List \$900 **\$ 749**
1420 **\$ 849**
1500, List \$1225 **\$ 879**
1510, List \$1395 **\$1089**
1520, List \$1650 **\$1389**
- LEAR SIEGLER ADM3A**, Assembled **\$ 849**
- TELEVIDEO 912C**, List \$950 **\$ 789**
920C, List \$1030 **\$ 849**
950C, List \$1195 **NEW \$1039**

PRINTERS

- ANADEX DP-8000** **\$ 849**
- DP-9500, List \$1650 **\$1399**
- DP-9501, List \$1650 **\$1399**
- PAPER TIGER IDS-445**, List \$995 **\$ 695**
w/graphics op., incl. buffer, \$1195 **\$ 789**
- PAPER TIGER IDS-460**, List **1149**
- PAPER TIGER IDS-460G** List **1199**
- NEW IDS PAPERTIGER 460** List 1295 **\$1149**
- NEW IDS PAPERTIGER 460G** List \$1394 **\$1199**
- NEC Spinwriters** Call for Price
- TELETYPE 43 KSR** **\$1087**
- CENTRONICS**
- 730-1 parallel interface **NEW LOW \$ 649**
- 737 parallel interface **SUPER VALUE \$ 829**
- 779 w/Tractor, List \$1350 **\$1049**
- 703 w/Tractor, VFU, List \$2975 **\$1695**
- 704 w/Tractor, VFU, List \$2350 **\$1595**
- TI 810 Basic**, List \$1895 **\$1695**
- 810/serial & Centronics-style parallel interface, List \$1940 **\$1735**
- 810 w/full ASCII (U/LC), Vertical Forms Control, Compressed Print **\$1895**
- TI 820 KSR**, List \$2165 **\$1895**
- TI 745 w/full ASCII**, List \$1695 **\$1399**
- COMPRINT 912 w/parallel interface** **\$ 559**
912 w/serial interface, List \$699 **\$ 589**
- AXIOM IMP I** **\$ 699**
- MICROTEK**, List \$750 **\$ 675**
- OKIDATA Microline 80**, List \$949 **\$ 599**
Tractor Feed Option **\$109**
- RS232 Serial Interface** **\$ 99**

NORTH STAR HORIZON™

- HORIZON 1 ASSEMBLED & TESTED**
- 32K, Double Density, List \$2695 **\$2279**
 - 32K, Quad Density, List \$2995 **\$2539**

- HORIZON 2 ASSEMBLED & TESTED**
- 32K, Double Density, List \$3095 **\$2619**
 - 32K, Quad Density, List \$3595 **\$3049**
 - 48K, Double Density, List \$3590 **\$3039**
 - 48K, Quad Density, List \$4090 **\$3469**
 - 64K, Double Density, List \$3830 **\$3239**
 - 64K, Quad Density, List \$4330 **\$3669**

FLOPPY DISK SYSTEMS

- NORTH STAR MDS-A**
Assembled, List \$899 **SPECIAL \$ 719**
- MORROW THINKER TOYS*** Discus 2D,
List \$1199 **OUR PRICE \$ 998***
Discus 2D, dual-drive, List \$1994 **\$1694***
Discus 2 + 2, A&T, List \$1549 **\$1319***
Dual Discus 2 + 2, A&T, List \$2748 **\$2335***
Now includes CP/M 2.2

Prom Programers

- SSM PB1 Kit List \$125 **\$106**
- SSM PB1 A&T List \$190 **\$161**
- SD Computer Prom 100 Kit \$236 **\$201**
- SD Computer Prom 100A&T List \$311 **\$264**

FLOPPY DISK CONTROLLER BOARDS

- NORTH STAR, DD**,
Assembled, List \$499 **\$399**
- MORROW Disk Jockey 1, A&T (\$213)** **\$189**
Disk Jockey 2D, A&T, List \$479 **\$429**
- SD Versafloppy 1, Kit**, List \$284 **\$239**
Versafloppy II, DD Kit, List \$413 **\$349**
Versafloppy II, DD, A&T, List \$507 **\$429**
- DELTA double density A&T (\$385)** **\$345**
- CONDUCTOR**, double density A&T **\$269**
- INTERSYSTEMS FDC-2, A&T, \$495** **\$439**
- MICROMATION Doubler, DD, A&T** **\$429**
- TARBELL Floppy Disk Interface Kit** **\$199**
double density, A&T, List \$495 **\$444**

ESCON CONVERSION FOR IBM SELECTRIC

Complete w/microprocessor controller and power supply. Factory built. User installs solenoid assembly or it can be done at Escon factory at nominal cost.

- Parallel (TRS-80, Sorcerer, etc.), \$575 **\$514**
- RS232 Standard Serial, List \$599 **534**
- IEEE-488 (for PET), List \$660 **584**
- TRS-80 Cable **25**

CALIFORNIA COMPUTER SYSTEMS

- Z80 CPU BOARDS List \$299 **\$269**
- DISK CONTROLLER 2422 List \$399 **\$359**
- 16K Static, A&T, List \$349.95 **\$259**
- 32K STATIC List \$710 **\$599**
- 64K DYNAMIC BOARD List \$699 **\$589**

CPU BOARDS

(assembled unless noted)

- NORTH STAR Z80A (ZPB-A/A)**, \$299 **\$254**
- CROMEMCO 4 MHz (ZPU-W)**, List \$395 **\$335**
4 MHz (SCC-W), List \$450 **\$382**
- INTERSYSTEMS** (formerly Ithaca Audio)
new Series II Z-80, 4 MHz, List \$395 **\$349**
- SSM CB1 8080 A&T List \$252** **\$214**
- CB1A Kit**, List \$183 **\$156**
- CB2 Z-80, A&T**, List \$344 **\$289**
- CB2 Kit**, List \$60 **\$221**
- DELTA Z-80, with I/O** **\$289**
- SD SBC-100**, List 413 **\$349**
- SBC-100 Kit**, List \$341 **\$289**
- SBC-200**, List \$471 **\$399**
- SBC-200 Kit**, List \$373 **\$317**

MEMORY BOARDS

32K SD ExpandoRAM Kit

CALL FOR PRICES

- NORTH STAR 16K Dynamic RAM Board**,
A&T (RAM-16-A/A), List \$499 **\$429**
- 32K A&T (RAM-32/A)**, List \$739 **\$629**
- CROMEMCO 16KZ-W**, List \$495 **\$419**
64KZ-W, List \$1795 **\$1269**
- MEASUREMENT SYSTEMS & CONTROLS**
(Guaranteed performance, incl. labor/parts 1 yr)
- DM6400 64K Board w/all 64K, \$795 **\$655**
 - DM4800 with 48K, List \$695 **\$650**
 - DM3200 with 32K, List \$595 **\$505**
 - DMB6400 64K Board w/all 64K **\$855**
 - DMB4800 with 48K **\$785**

- MORROW SuperRAM** — all static, all A&T
- 16K, 4 MHz or 2 MHz, List \$349 **\$299**
 - 32K, 4 MHz, List \$699 **\$629**
 - 16K Memory Master, List \$399 **\$339**
 - 24K Memory Master, List \$549 **\$465**

- INTERSYSTEMS** (formerly Ithaca Audio)
- 8K Static 2 MHz, A&T, List \$165 **\$149**
 - 8K Static 4 MHz, A&T, List \$195 **\$176**
 - 16K Static 2 MHz, A&T, List \$475 **\$427**
 - 16K Static 4 MHz, A&T, List \$495 **\$445**
 - 64K Dynamic, List \$995 **\$895**

- CALIFORNIA COMPUTER**
16K Static, A&T, List \$349.95 **\$259**

VIDEO BOARDS

- I/O Mapped**
- SD COMPUTER VDB-8024, kit**, List \$437 **\$369**
Assembled, List \$556 **\$469**
 - XITEX SCT-100K, Kit** **ONLY \$169.95**
SCT-100A Assembled **\$189.95**
 - SSM VB2 I/O, Kit**, List \$199 **\$169**
Assembled & Tested, List \$269 **\$229**
- Memory Mapped**
- SSM VB1C, 16x64, Kit**, List \$179 **\$152**
Assembled & Tested, List \$242 **\$206**
 - SSM VB3, 80-Char., 4MHz, Kit**, List \$425 **\$359**
4 MHz, A&T, List \$499 **\$424**
 - INTERSYSTEMS, 16x64, A&T**, List \$165 **\$149**

*Subject to change.

NEW CROMEMCO 16FDC DOUBLE DENSITY DISK CONTROLLER

List \$595 **OUR PRICE \$505**

SHIPPING AND INSURANCE: Add \$2.50 for boards, \$6 for Selectric Converter or Floppy Disk Drives, \$7.50 for Floppy Disk Systems, \$15 for Horizon. SHIPPED FREIGHT COLLECT: SuperBrain, Centronics and T.I. printers. Contact us for shipping information on other terminals and printers.

Above prices reflect a 2% cash discount (order prepaid prior to shipment). Add 2% to prices for credit card orders, C.O.D.'s, etc. Prices are subject to change and offers subject to withdrawal without notice.

MiniMicroMart, Inc.

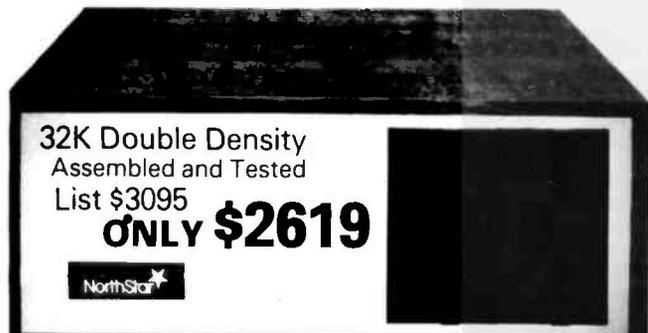
1618 James Street, Syracuse NY 13203 (315) 422-4467 TWX 710-541-0431

If North Star or Cromemco offer it . .

WE HAVE IT!!

Immediate Delivery at Discount Prices

NORTH STAR Horizon 2



ASSEMBLED

HORIZON 1, DD	\$2279	32K, QD, List \$2995	2539
HORIZON 2, 32K, DD	\$2619	48K, QD, List \$4090	3469
32K, QD, List \$3595	3049	64K, DD, List \$3830	3239
48K, DD, List \$3590	3039	64K, QD, List \$4330	3669

NORTH STAR APPLICATIONS SOFTWARE

(Exclusive for use with North Star Disk Systems — specify Double or Quad Density)

NORTHWORD, List \$399	\$339
MAILMANAGER, List \$299	249
INFOMANAGER, List \$499	419
GENERALLEDGER, List \$999	799
ACCOUNTSRECEIVABLE, List \$599	499
ACCOUNTSPAYABLE, List \$599	499

NORTH STAR HARD DISK HD-18

18 megabytes, plugs into parallel port of North Star Horizon. Utilizes tried-and-proven 14" Century Data Marksman. List \$4999.

OUR PRICE \$4199

NORTH STAR MDS-A — Double (or Quad) Density Disk System, Kit, List \$799. **OUR PRICE \$669** Assembled and Tested, List \$899 **SPECIAL \$719**

NORTH STAR MEMORY BOARDS

16K Dynamic RAM (RAM-16-A/A), Assembled. List \$499	\$420
32K (RAM-32/A), Assembled, List \$739	\$620

INTRODUCTORY SPECIALS ON ...

**PREMIUM QUALITY BASF DISKS
CERTIFIED FOR QUAD SYSTEMS**

(Box of ten)

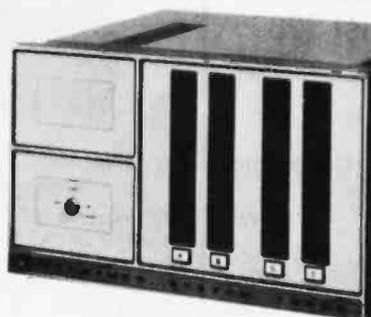
5 1/4" DOUBLE DENSITY DOUBLE SIDED List \$57.50	\$38.95
8" DOUBLE DENSITY DOUBLE SIDED List \$75.00	\$47.49

Shipping \$2.50 — Free Shipping in Multiple Or Two Box's

NEW System 3

by CROMEMCO

Now with Dual Double Sided Double Density (over 2 megabytes of Storage) 64K of RAM List \$7995



LIMITED TIME \$6395

CROMEMCO SYSTEM 2 — Now double Density with Double Sided Drives, Quad Capacity mini floppy disc drives. List \$4695 **Only \$3899**

CROMEMCO Z-2H

Full 11-megabyte Hard Disk system. Fast Z-80A 4 MHz processor, two floppy disk drives, 64K RAM memory, RS232 special interface, printer interface, and extensive software available. List \$9995



OUR PRICE \$8489

NEW DOUBLE DENSITY CONTROLLER BOARD

From Cromemco

With built-in diagnostics — 16 FDC Controller

List \$595	OUR PRICE \$505
----------------------	------------------------

Z-2 COMPUTER SYSTEM List \$995	\$845
SINGLE CARD COMPUTER — SCC-W 4 MHz. List \$450	\$382
NEW COLOR GRAPHICS INTERFACE — SOI List \$595	OUR PRICE \$505
CROMEMCO HDD — 11/22-megabyte Hard Disk for use with existing systems. DMA controller. Transfer rate of 5.6 megabytes/second. HDD-11, List \$6995	OUR PRICE ONLY \$5939
HDD-22, List \$11,995	\$10,189

SHIPPING AND INSURANCE: Add \$15 or Horizons, \$2.50 for Boards and Software. Hard Disk Systems and Cromemco systems shipped freight collect. Advertised prices are for prepaid orders. Credit card and C.O.D. 2% higher. Deposit may be required on C.O.D. All prices subject to change and offers subject to withdrawal without notice.

— WRITE FOR FREE CATALOG —

MiniMicroMart, Inc.

1618 James Street, Syracuse, NY 13203 (315) 422-4467 TWX 710-541-0431

Circle 358 on Inquiry card.



Computers, Disk Systems

ZENITH

data systems



Z89-FA
List \$2895

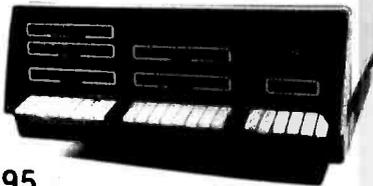
OUR PRICE \$2395

- Z-89GA
List \$2595 \$2149
- A-87 Two Drive
Minifloppy System List \$1195. **\$989**
- Z-47DA. **\$3695**
- 8" Two Megabyte List \$3695. **\$3059**

INTERSYSTEMS

formerly ITHACA AUDIO

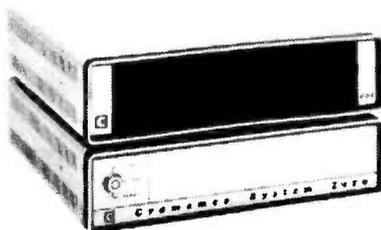
The new Series II CPU Board features a 4 MHz Z-80A CPU and a full-feature front panel. 20-slot actively terminated motherboard, with 25 amp power supply (50/60 Hz operation, incl. 68 cfm fan).
DPS-1, List \$1795



\$1495

COMPLETE SYSTEM with InterSystem 64K RAM, I/O Board w/priority interrupt and double density disk controller board. Full 1-year warranty, List \$3595

\$2995



NEW! CROMEMCO SYSTEM ZERO

List \$995 **OUR PRICE \$849**

NEW! CROMEMCO SYSTEM ZERO/D

A complete 64K Computer with Double Density Disk Controller List \$2995

OUR PRICE \$2545

Companion Disk drive for above —
Quad Density — Total of 780 Kilobytes of storage on the two drives. List \$1295

OUR PRICE \$1099

Only \$3644 for a complete 64K Disk System

SUPERBRAIN

By INTERTEC



64K Double or Quad Density units available. Uses two Z-80 CPU's. Commercial-type terminal with 12" monitor. Dual double density minifloppies. Over 350 kilobytes of storage (twice that with quad density drives). Two serial RS232 ports, I/O ports standard. Expandable with optional S-100 S-100 interface. Comes with CP/MTM 2.2 operating system. MiniMicroMart can supply a wide range of CP/M development and application software.

w/64K Double Density, List \$3495 .. **\$2869**
w/64K Quad Density, List \$3995. **\$3395**

HP HEWLETT PACKARD HP-41CV



HP-41 System I—\$399.

(The HP-41CV and HP 82104A Card Reader) List \$495.

HP-41 System II—\$679.

(The HP-41CV and HP 82104A Card Reader, HP 82143A Printer/Plotter) List \$840.

HEWLETT-PACKARD

HP-85A

Desk-Top Computer



List \$3250

\$2749

MORROW THINKER TOYS® DISCUS M26™

26 megabytes of formatted storage
List \$4,995

\$4,199



THINKER TOYS® DISK SYSTEMS

Now includes CP/M® 2.2

Discus 2D, List \$1199. **\$1019**

Discus 2D, dual-drive, List \$1994 **\$1694**

Discus 2 + 2, Assem., List \$1549. **\$1319**

Dual Discus 2 + 2, Assem., \$2748. **\$2335**

All Morrow systems now include CP/M® 2.2

MORROW Discus 2D's IN STOCK

NEW! CROMIX FROM CROMEMCO

A New UNIX Like Disk Operating System.

With true multi-user, multi-tasking capabilities

List \$295 **OUR PRICE \$249**

NEW! DOUBLE DENSITY CONTROLLER BOARD FROM CROMEMCO

With built-in diagnostics

16 FDC Controller, List \$595 **OUR PRICE \$505**

RADIO SHACK TRS-80™

10% OFF!



Terminals and Printers

Intertec EMULATOR

Software compatible with a Soroc IQ-120, Hazeltine 1500, ADM-3A or DEC VT-52. Features block mode transmission and printer port; 12" anti-glare screen; 18-key numeric keypad; full cursor control. List \$895

OUR PRICE \$749



NEW INTERTUBE III

List \$995 **ONLY \$749**

12" display, 24 x 80 format, 18-key numeric keypad, 128 upper/lower case ASCII characters. Reverse video, blinking, complete cursor addressing and control. Special user-defined control function keys, protected and unprotected fields. Line insert/delete and character insert/delete editing, eleven special line drawing symbols.

TELEVIDEO TVI-912C



Upper and lower case, 15 baud rates: 75 to 19,000 baud, dual intensity, 24 x 80 character display, 12 x 10 resolution. Numeric pad. Programmable reversible video, auxiliary port, self-test mode, protect mode, block mode, tabbing, addressable cursor. Microprocessor controlled, programmable underline, line and character insert/delete. "C" version features typewriter-style keyboard. List \$950

OUR PRICE \$789

920C (with 11 function keys, 6 edit keys and 2 transmission mode keys, List \$1030

ONLY \$849

HAZELTINE

1500

ONLY \$879



1410 w/numeric keypad, List \$900 \$749
1420 w/lower case and numeric pad 849
1510, List \$1395 1089
1520, List \$1650 1389

SOROC



IQ-120

List \$995

SPECIAL \$729

IQ-140 List \$1495
SPECIAL \$1149

CENTRONICS PRINTERS

NEW 730, parallel, friction, tractor ... **\$679**
NEW 737 parallel, friction, tractor ... **\$849**
779-2 w/tractor (same as TRS-80 Line
Printer I), List \$1350 1049
702 120 cps, bi-direct., tractor, VFU 1995
703 185 cps, bi-direct., tractor, VFU 2395
704 RS232 serial version of 703, \$2350 ... **\$1995**

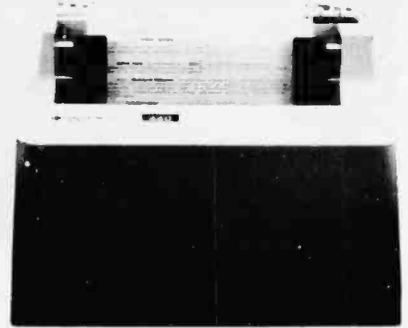
NEC SPINWRITER™



Terminal/Keyboard as well as
RO Printer Only models available.

CALL FOR PRICES!

PAPER TIGER®



IDS 455 Paper Tiger, List \$995 **\$895**
w/graphics option, incl. buffer, \$1194 ... **\$989**
TRS-80 cable 45

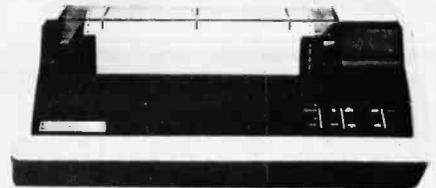
NEW IDS 460

**QUALITY PRINTING AT MATRIX
SPEED—LOGIC SEEKING
PROPORTIONAL SPACING**

w/auto text justification

NEW IDS PAPERTIGER 460 List \$1295 **\$1099**
NEW IDS PAPERTIGER 460G List \$1394 **\$1149**

TI-810



TI-810 Basic Unit, \$1895 **ONLY \$1595**
TI-810 w/full ASCII (Lower case), vertical
forms control, and compressed print ... **\$1795**
TI-745 Complete printing terminal
with acoustic coupler, List \$1695 ... **\$1399**

ANADEX

DP9500 / DP9501 PRINTERS

DP-9500, List \$1650 **\$1349**
DP-9501, List \$1650 **\$1349**
ANADEX 80-Col. Dot Matrix. **\$849**

OKIDATA

Microline 80 ONLY \$599

Tractor Feed Option \$109
Serial interface \$ 99

AXIOM IMP I \$699

COMPRINT 912 w/parallel interf. \$559

912 w/serial interface, List \$699 **\$589**

MICROTEK, List \$750 \$675

MiniMicroMart, Inc.

1618 James Street, Syracuse NY 13203 (315) 422-4467 TWX 710-541-0431

Circle 359 on Inquiry card.



Unclassified Ads

UNCLASSIFIED POLICY: Readers who are soliciting or giving advice, or who have equipment to buy, sell or swap should send in a clearly typed notice to that effect. To be considered for publication, an advertisement must be clearly noncommercial, typed double spaced on plain white paper, contain 75 words or less, and include complete name and address information.

These notices are free of charge and will be printed one time only on a space available basis. Notices can be accepted from individuals or bona fide computer users clubs only. We can engage in no correspondence on these and your confirmation of placement is appearance in an issue of BYTE.

Please note that it may take three or four months for an ad to appear in the magazine.

FOR SALE: Apple Pascal language system. Neyer used, still in original packing with factory warranty for \$400. M Antonovich, Box 6020, Wyomissing PA 19610.

FOR SALE: Moving, must sell; complete Texas Instruments 9900 minicomputer. Processor board with operating system in prom, 2K cache programmable memory, 9900 processor, and I/O interface. Memory board with 32 K bytes of programmable memory and complete buffering. Cassette interface and 9600 bps digital cassette player/recorder. Complete system software: Assembler, Linking Loader, Text Editor, Super BASIC, and lots of games. All contained in a fan-cooled chassis. Total price for entire hardware/software computer system is \$1800. Bernard H Penney, 31 Wheeler Dr, Peekskill NY 10566, (914) 945-1044 day/(914) 528-1612 night.

FOR SALE OR TRADE: Kenwood amateur radio equipment: TS520S transceiver, frequency readout, AT200 tuner, 6- and 2-meter transverters, and variable frequency oscillator. All service manuals and cables included. Will sell or trade for Heath H-89 or H-8 computer system. Edward H Hill Sr, 3046 Stuart St, Indianapolis IN 46218, (317) 545-8886.

FOR SALE: PDP-11. DEC PDP-11/05 processor boards with 4 K core memory, 16 to 64 K programmable memory, and parity controller. All working. Also, TI Silent 743 (new) with full ASCII keyboard. Sell all, separately, or trade for line printer or what have you. Make offer. Jack Kreska, 1429 Warwick St, Garland TX 75042, (214) 495-2680.

FOR SALE: Microcomputer magazine collections. BYTE 10/76 (#14) to 12/80 (51 issues) for \$50. *Kilobaud Microcomputing* 1/77 (#1) to 12/80 (all 48 Issues published) for \$70. *Interface Age* 7/76 (#8) to 8/80 (48 issues plus several original SCCS journals) for \$35. All plus book rate postage. John Cameron, POB 1517, Palo Alto CA 94301, (415) 327-0341.

HELP: I need any information at all about a CompuCORD 1210 digital cassette tape transport made by CompuCORD Inc of Waltham, Massachusetts. The company no longer exists, at least in Waltham. Any information regarding this device, the manufacturer, or any source of documentation is eagerly sought. I will be happy to pay for copying, or copy and return all material by return mail. Fred Goldberg, 29 Clearview Rd, E Brunswick NJ 08816, (201) 257-8753.

MUST SELL: One slightly used Gray-1—too big for my apartment. Hardware included: light-dimmer interface, toaster interface, one homebrew 64-bit parallel I/O port with Nixle-tube indicators, coat hangers, extra buffing powder for instruction buffers, one box of bootstraps. Software included: CAL assembler on thirteen cassette tapes in Kansas City format, Morse-code trainer, tic-tac-toe game, 8080 emulator. Price is negotiable. A Pifful, POB 463, Peanutbutter NH 03458.

FOR SALE: TI-59, PC-100A (in perfect working condition), three modules (Master, Statistics, Mathematics and Utilities), eight specialty packettes (Engineering, Science, Securities, Marketing, etc), 20-roll paper for PC-100A, and many finance utility programs. If brand new, you would pay \$640. Now all can be yours if you send a cashier's check for \$460. C M Chen, 120 Columbus Pl, Stamford CT 06907, (203) 322-7857.

WANTED: MMD-1 microprocessor trainer in operating condition. Please state asking price in first offer. D C Shoemaker, 2000 A Foxridge, Blacksburg VA 24060, (703) 552-5764.

FOR SALE: 48 K Apple II plus complete with two paddles, some programs, and cassette recorder with interface jack. Only three months old and in great condition. \$1300. Eric Podell, 14949 Wellwood Rd, Silver Spring MD 20904.

FOR SALE: Sold system, must sell software at super reduced prices. Dozens of CPM, languages, business s/w (G/L, A/R, A/P, etc). Send SASE for complete list and prices. Dee B Moser, Box 638, Great Bend KS 67530.

WANTED: June 1977 and October 1980 issues of BYTE. Will pay cash or trade March 1978, July 1980, August 1980, September 1980 issues. Also, I have for sale a Godbout 8 K S-100 4 MHz programmable memory board, assembled and working; \$50. Thomas Kryst, 5242 E 24th St Apt D, Anchorage AK 99504.

HICKOK DIGITAL MULTIMETERS

DMM +Vari-Pitch +Logi-Trax MX-333 \$210.

Model LX303 \$6950

Model LX304 \$7950

VIZ Tech DMM 3 1/2-Digit LCD Readout Model WD 747 \$7995

BK PRECISION 15 MHz Miniscope Model 1420

- Rise time 11.7 nS or less
- Bull-in signal delay line
- Flat response

Dual Trace 5" 30 MHz Triggered Scope Model 1479A

Autorangeing DMM Model 2845

Digital Pulsar Probe Model DP-100

50 MHz Pulsar Probe Model DP-50

ESR 3 1/2-Digit 0.1% Digital Capacitance Meter Model 3001 \$23375

Function Generator Model 2001 \$15795

Proto Boards Model PB-104 Fully assembled \$5995

Logic Monitor Model LM-1 Works with DTL, HTL, TTL, and CMOS \$5995

NLS Touch/Test 20 Multimeter Model TT20 A portable/bench-type meter

15 MHz Dual Trace Triggered Miniscope Model MS-215

30 MHz Dual Trace Triggered Miniscope Model MS-230

Beckman DIGITAL MULTIMETERS

Model TECH 300 \$10995

Model TECH 310 \$14000

Model TECH 330 \$19995

BSR X-10

PK 400 4 Pc Standard Starter Kit • One (1) Standard Command Console • Two (2) Lamp Modules • One (1) Appliance Module \$7499

PK500 5 Pc Ultrasonic Starter Kit • One (1) Deluxe Ultrasonic Command Console • One (1) Hand Held Remote Unit • Two (2) Lamp Modules • One (1) Appliance Unit \$9995

LM501 Lamp Module \$13.95

AM601 Appliance Module \$13.95

WS701 Wall Switch Module \$13.95

WS711 Wall Switch Module with independent On/Off power buttons \$15.95

The Timer Model TC201 \$5995

YOU NAME IT... WE GOT IT. AND AT DISCOUNT PRICES.

SEND FOR FREE 180 PAGE CATALOG.

Simpson DIGITAL MULTIMETERS

Model 462 \$19995

Model 463 \$16995

260 Meter Model 260-7 \$96.

Complete with nickel-cadmium batteries, AC charger/adaptor, test leads

MURAPHONE Cordless Telephone System Model 300 \$110.

Miniature High Fidelity 3-Way Stereo Speakers Model HF-9 \$5995

In-Dash Car Stereos

8-Track AM/FM \$5250 Model JCS 420

Cassette AM/FM \$5750 Model JCS 505

Digital Cassette AM/FM with Clock Model JCS 607 \$8995

Graphic Equalizer Model GE 5000 \$3995

LUXO Magnifier Lamp Model LFM-1A \$65.

Precision ground and polished magnification lens

FIDELITY Chess Challenger 7 Model BBC \$7995

Sensory Chess Challenger \$110.

Voice Sensory Challenger \$24995

Weller WTCPN Controlled Output Soldering Station Model WTCPN \$5750

Soldering Station Model EC 2000 \$10950

6x9 3-Way Speakers • 20 oz. magnet Model BP2000-69 TRD \$1295 ea.

WAHL Cordless Soldering Iron Model 7800 \$2995

Thermal-Spot Circuit Tester Finds faulty components quickly and easily Model 5800 \$2995

Service Master Tool Kit Model 99-SM \$4995

VACO Super Case Model 70260 \$24995

Casio Calculator Calendar Watch Model C-80 \$4250

FORDHAM

855 Conklin St. Farmingdale, N.Y. 11735

- Master Charge
- BankAmericard
- VISA • C.O.D.
- Money Order
- Check
- N.Y. State residents add appropriate sales tax.

ADD FOR SHIPPING AND INSURANCE

to \$ 250.00	\$ 3.50
\$251.00 to 500.00	5.00
\$501.00 to 750.00	7.50
\$751.00 to 1000.00	10.00
over 1000.00	12.50

TOLL FREE (800)645-9518

In N.Y. State call (516) 752-0050

Circle 289 on inquiry card.

FOR SALE: Speak & Spell with Speak-2-Me-2 installed by Percom Data. 230-word vocabulary plus program to form words from parts of vocabulary words. Complete with modified printer interface cable, user's manual, and driver programs. Set up for TRS-80 Level II with 16 K. Instructions for other computers. Worth \$200, sell for \$150. Joseph Wear, Rt 1 Box 83A, New Egypt NJ 08533, (609) 758-7193.

FOR SALE: Okidata Model CP-110 friction-feed line printer, with RS-232 serial interface and uppercase/lowercase character set. Prints 80 columns bidirectional at 110 cps. Uses 8 1/2-inch roll paper. Excellent condition. Cost \$1349, asking \$650. Virgilio DeCarvalho, Columbia-Princeton Electronic Music Center, 632 W 125th St, Room 318, New York NY 10027, (212) 260-3050.

FOR SALE: H-8, serial I/O board, 20 K programmable memory, cassette, Extended BASIC. Up and running, all documentation included. First \$600 takes. 1 ship. M H Endres, Box 8, Spirit Lake ID 83869, (208) 623-5911.

FOR SALE: Magic Wand for TRS-80 Model II. Original disk and manual; \$200. A A Schwartz, 6454 Camino Teatro, La Jolla CA 92037.

FOR SALE: Burroughs Series B9352 video terminal. Has printer output, uppercase, and full cursor control. \$300 plus freight. Steve Nelson, Box 150, Webster MN 55088.

FOR SALE: PET 8 K computer with Soundware sound for PET, five tapes with programs including Microchess 2.0, and COMPUTE magazine for the PET. Original PET cost over \$800, will settle for \$675. Also, have ELF II computer complete with documentation and newsletters. Cost over \$200, would like to trade for HP-41C card reader. Am interested in HP-41C equipment, willing to negotiate with PET and ELF II. Shaji Jacob, 827 Lincoln, Fort Morgan CO 80701, (303) 867-8162.

FOR SALE: TI #751 Silent 700 type printer. 10, 15, 30 cps, thermal, Baudot code, receive-only. Complete, but needs electrical work. With five rolls of paper and complete documentation. \$100, you pay shipping, or trade for Heath H-9 terminal. Tom Hamilton, 1405 Washington, Birmingham MI 48009, (313) 647-5420 after 5 PM ET.

FOR SALE: OSI Superboard with expansion, 18 K programmable memory, 8 A power, 9-inch Sanyo monitor, and full enclosure; \$650. 12-slot S-100 motherboard with 15 A power supply and termination; \$150. Microdivisions Screensplitter 46 by 80 video display for S-100, brand new; \$350. Plus much used equipment. Glenn Barnas, 280 Carmita Ave, Rutherford NJ 07070, (201) 935-0271.

FOR SALE: SwTPC CT-64 terminal; \$300 or best. AC-30 cassette interface, works on any 300 bps RS-232 line; \$80 or best. MP-A2 6800 processor card with SWTBUG; \$120 or best. All assembled and tested. USR-310 modem; \$130. Keyboard; \$50. Must sell soon. Charles Duff, 7007 N Sheridan #317, Chicago IL 60626, (312) 386-0311 leave message.

FOR SALE: Multiterm printer Model T-4000: 55 cps, Diablo Hyltype mechanism, tractor feed, ribbons, print wheels, many additional features, auto-underline, etc. \$1700 or offer. Also, two Centronics 306C printers. \$1200 each or offer. Michael Sloot, POB 982, Loma Linda CA 92354, (714) 796-2757.

FOR SALE: PET owners, I have sixteen 4108 programmable memory circuits guaranteed good. Will sell for \$2.50 each or the entire lot for \$35. Also, if your PET uses 4108s and they are in sockets, and you would like to upgrade to 32 K inexpensively, send \$1 plus SASE for guaranteed instructions. I am also looking for an inexpensive printer with 40/80 lines and Centronics-type parallel input. Harry E Leggans, Box 1179, APO New York 09023.

FOR SALE: Alpha 16 mainframe includes processor, clock/controller, teletypewriter interface, 4 K memory, floppy-disk controller, and power supply. Also, much software and all manuals. \$500 or offer. Edwin Karlow, Department of Physics, Loma Linda University, Riverside CA 92515, (714) 785-2143.

FOR SALE: Siemens FD100 mini floppy-disk drives with manuals, power supplies, and cases. \$250 each or best offer. Western Digital 1771 floppy-disk controller circuits. \$8 each. Marcy Durkee, 10265 Meadowwood Ln, Overland MO 63114.

WANTED: Used computer-science books. Reasonably priced, in good condition; for personal use—only one copy of a title wanted. Examples: programming languages, Knuth (volume 2), programming techniques, compiler design, applications, etc. J R Berman, 494 Forest Ave, Teaneck NJ 07666.

FOR SALE: TRS-80 Model I, Level I, 4 K. Like new, hardly used. \$500. Also, Apple games for trade—Invader, Asteroids, Sargon, etc. Randy Strouth, RR 5 Box 63, Fairbault MN 55021, (507) 334-6585.

FOR SALE: Digital Group Z80, Diskmon, Business BASIC, 64-character, 26 K dynamic; \$1200. Two 8-inch disk drives and Digital Group controller; \$1600. Keyboard (needs repair) and 9-inch monitor; \$250. Whole system for \$2800. Wayne Dirks, 801 E 10th, Hutchinson KS 67501, (316) 663-3998 days.

FOR SALE: TRS-80 Model III computer with 48 K programmable memory, brand-new condition. Complete documentation plus several TRS-80 books. \$950. Also, HP-41C programmable calculator with card reader plus blank cards, four memory modules, and MATH and STAT modules. \$500. Alan J Grant, 530 44th St, Brooklyn NY 11220, (212) 436-1714 weekends or after 6 PM weekdays.

FOR SALE: Commodore PET 2001 computer with 8 K programmable memory and new 2.0 read-only memories. Has on-board cassette and small keyboard. \$50 deposit for shipping by UPS collect, balance due of \$475. Dan Rubis, 19713 Alger, St Clair Shores MI 48080, (313) 771-1392.

WANTED: User's manual for Processor Technology 32KRA memory board. Steve Grant, 6055 E Washington Blvd, Suite 1035, Commerce CA 90040, (213) 725-1563.

FOR SALE: Heath H-8, dual-drive H-17, H-9 video terminal, three 8 K programmable memory cards, serial/cassette interface. Entire system for \$1500 or sell in parts. Richard Berhain, 142 Jefferson Ave, Hasbrouck Heights NJ 07604, (201) 288-1693.

FOR SALE: North Star 2 system. Double-density, 48 K, with D C Hayes modem. Two serial and one parallel ports, SOROC IQ 140 terminal, and Centronics 779 tractor printer. Includes \$2000 in business software. Six months old, in original boxes. \$4895 or best offer. Also, D C Hayes modem 100; \$325. Don, (615) 526-7651.

FOR SALE: Heath H-9 terminal; Heath H-10A reader/punch; TI 9900 single-board 16-bit microcomputer. Complete manuals and software included. Best offer. D Montgomery, Box 27, Oakland FL 32760, (305) 656-4293.

FOR SALE: Super ELF with expansion board, 4 K static programmable memory, two I/O ports, Super Monitor, ASCII keyboard, 4-slot expansion case, power supply, RF modulator, Tiny BASIC cassette, and manuals; \$250. Electric Crayon I/O-driven color graphics unit with 2 K memory, graphics firmware, manual, and built-in RF modulator. Alphanumerics and graphics expandable to 256 by 192. \$200. Brent Elder, 7422 N Campus #7, Cornell University, Ithaca NY 14853, (607) 256-6750.

FOR SALE: Model 33 ASR teletypewriter with manuals, paper-tape reader and punch, and stand. Mint condition, less than 100 hours on usage meter. \$595 plus shipping. Automatic motor control installed and tested is \$30 extra. Ken Brand, 421 Fairview Ave, Winchester VA 22601, (703) 662-0665 after 6 PM.

WANTED: January and May 1979 BYTE. May and June 1978 *Creative Computing*. January, May, July, and December 1978 *Kilobaud Microcomputing*. Name your price. Robert Lansdale Jr, 18 Ashfield Dr, Etobicoke Ontario, M9C 4T6 Canada.

January BOMB Results: Hand-Held Computers

Readers responded to our January theme by voting top honors for "The Panasonic and Quasar Hand-Held Computers: Beginning a New Generation of Consumer Computers" by Gregg Williams and Rick Meyer (January 1981 BYTE, page 34). Because Gregg is an employee of BYTE, the \$100 prize will go to Rick.

Steve Ciarcia captured second place for his article "Electromagnetic Interference," page 48 and receives \$50.

Third place was taken by Teri Li for his article "Whose BASIC Does What?" Fourth place went to Michael Keith and C P Kocher for their article "The NEC PC-8001: A New Japanese Personal Computer."

With the January issue, we began to collect votes for the BOMB (BYTE's Ongoing Monitor Box) through responses on one of the reader-service cards. This resulted in an increased number of votes and many favorable comments from readers. ■

BOMB

BYTE's Ongoing Monitor Box

Article #	Page	Article	Author(s)
1	20	Recurrence in Numerical Analysis	Davidson
2	36	Build a Low-Cost Logic Analyzer	Ciarcia
3	46	The MicroAce Computer	Searls
4	66	Digital Minicassette Controller	Kahn
5	94	A Reformatter for CPIM and IBM Floppy Disks	Lehman
6	102	Programming the Game of Go	Millen
7	122	Build Your Own Turing Machine	Willis
8	150	A Closer Look at the TI Speak & Spell	Vernon
9	188	Three Versions of APL	Williams
10	218	An Introduction to Data Compression	Corbin
11	252	Build An Intercomputer Data Link	Wingfield
12	290	Three-Dimensional Computer Graphics, Part 2	Crow
13	348	PADDLES: Interfacing with Modular Breadboards	Combs and Field

Reader Service

Inquiry No.	Page No.	
311		AB Computers 387
189		ABM Products 292
293		Abrams Creative 384
56		Ackerman Digital 82
*		Action Computer 137
18		Adaptive Data & Energy Sys 23
336		Addmaster 392
49		Advanced Access 72
354		Advanced Comp Prod 402, 403
206		Advanced Micro Sys 312
108		Adventure Int'l 160
*		ALF Products 78
40		Alpha Byte Storage 59
297		ALL Electronics 384
332		Alpha Omega Systems 392
308		American Busn Comp 386
172		American Square Comp 273
275		Ancrona 370, 371
276		Ancrona 372, 372
218		Anderson Jacobson 319
63		Anderson Peripherals 94
237		Apparat 330
10		Apple Computer 13
198		ASAP 303
226		ASAP 323
202		Ashton-Tate 307
188		Automated Equip Inc 291
*		Avocet Sys Inc 294
156		Axlom 245
159		BASF 249
*		Basis Microcomputer GMBH 177
285		John Bell Engineering 379
*		Beta Comp Devices 315
295		BIS Inc 384
300		Bit Bucket, The 384
13		BIZCOMP 16
82		BMC 119
124		Bower-Stewart & Assoc 182
*		BYTE Back Issues 246
135		BYTE Books 201
152		BYTE Books 233
181		BYTE Books 283
205		BYTE Books 311
17		Callf Comp Systems 21
353		Callf Digital 400, 401
243		Cambridge Learning Inc 333
93		Cavri Systems 136
173		Central Data 275
143		Chrislin Industries 219
301		Clev Con Comp & Compts 385
32		Colonial Data 50
248		Computer Age Inc 337
210		Computer Case Co 315
314		Computer City 398
20		Computer City Canada Inc 25
256		Computer Disc of Am 340
*		Computer Factory, The 247
261		Computer Furn & Access 342
176		Computer Mail Order 278
104		Computer Markcng Corp 152
307		Computer Mart Inc 386
322		Computer Shopper 390
57		Computer Specialties 84, 85
271		Computer Tech Assoc 355
*		Computer Warehouse 93
51		Computers R Us 74, 75
342		Computers Plus Inc 382
52		CompuMart 76, 77
80		CompuServe 116, 117
269		Computerware 345
183		CompuText 286
249		COMPUTIME 337
45		Compuview Products Inc 67
278		Concord Comp Components 374
51		Consumer Computers 74, 75
107		Corvus Systems 159
130		Coval 192
235		Cover Craft 328
*		CPM User's Group 60
321		CPU Chop, The 389
1		Cromemco 1, 2
118		Crystal Computer 173
323		Custom Business Comp 390
298		Cyber Innovations 384
*		Cybernetics Inc 138
242		Data Access 333
*		Data Discount Center 146
346		Data Hardware 382
64		Datasouth Computer Corp 95
85		Datasouth Computer Corp 126
178		Dattek 280
84		Delta Products 123
89		Denver Software Co, The 131
113		Designers Software 167
146		Diablo (Div of Xerox) 223
266		Diglac Corp 343
75		Digicom 110
*		Digital Equipmt Corp 241
87		Digital Graphic Systems 129
141		Digital Marketing 213
163		Digital Pathways 255
109		Digital Research 161
*		Digital Research Computers 367
201		Discount Sftw Grp, The 306
65		DMA 346
168		Dual System Control Corp 265
258		Dymarc Ind 341
361		Dyna Byte C III
154		Dynacom 239
317		DWP 388
252		Ecosoft 339
*		Electravalue Industrial 342
74		Elron Computers Ltd 108
*		Efficient Mngmt Sys 327
286		Electronic Center 380
22		Electronic Control Tech 28
339		Electronic Equip Unltd 392
270		Electronic Specialists 345
241		Ellis Computing 333
123		Epson 181
236		ER Hardins Mltry Madness 329
244		Escon 334
121		Essex Publishing Co 176
227		Essex Publishing 324
36		Exatron Inc 55
29		Eyring Research Inst 45
98		Faircom 144
213		Farnsworth Comp Center 317
289		Fordham Radio Supply 414
225		Forethought 323
25		Frederick Comp Prod 32
294		Fredericktowne Comp 384
*		General Peripherals 388
111		Godbout Electronics 163
140		Godbout Electronics 210, 211
70		Mark Gordon Computers 104
138		GR Electronics Ltd 208
132		H & E Computronics 195
133		H & E Computronics 197
134		H & E Computronics 199
291		Hanley Engineering 383
207		Hayden Book Co Inc 313
48		Hayes Microcomp Prod Inc 71
31		Heath Company 49
27		High Technology Inc 34
39		Hobbyworld Electronics 58
299		Horizons Inc 384
53		Houston Instrument 79
54		Houston Instrument 79
15		IMS International 17
*		Info Unltd Software 347
190		Innovative Sftw Appl 293
58		Integral Data Sys 87
59		Integral Data Sys 89
212		Integrand 317
259		Intelligent Control Sys 341
34		Intertec Data Systems 53
14		Intertec Data Systems 185
345		Intrnl Corp 382
335		Ipxex Int'l Inc 392
5		Ithaca Intersystems 8
6		Ithaca Intersystems 9
351		Jade Computer Prod 396, 397
352		Jameco Electronics 388, 399
230		JDR MICRODEVICES 325
331		Jim-pak 391
283		JR Inventory 378
105		Kern Publishing 48
105		Key Tronic 153
125		Konan Corp 81
341		Lab Microsystems 382
284		Lanier 27
*		Lax Computer 378
*		Leading Edge 237
257		Leapac Services 341
310		Leapac Services 386
232		Lee Products Co 317
86		Leo Electronics 130
101		Lifefloat 141
102		Lifelines 149
325		Linma 390
106		Livermore Data Sys Inc 154
222		LNW Research 321
99		Lobo Drives Int'l 145
137		Logo Computer Systems 205
305		Lyban Comp 386
348		McHenry & Assoc 382
*		McMillan Book Club 193
296		Macrotronics Inc 384
319		Magnolia Microsystems 388
103		Mailbu Electronics 151
164		Mark of the Unicorn 257
144		Marot Software Systems Inc 221
174		Marymac Industries Inc 276
77		Mauro Engineering 112
100		Maxell Data 147
*		Mediamix 388
*		Meas Sys & Controls 29, 121
221		Memtech 321
228		Meta Research 325
273		Meta Technologies Corp 358
169		MFJ Enterprises Inc 268
204		Micro Ace 309
38		Micro Age Computer Store 57
199		Micro Business World 304
20v		Microbyte 305
*		Micro Comp Discount Co 114
73		Micro Data Base Sys 107
312		Micro Flash 388
*		Micro Focus 109
119		Micro House 174
175		Micro Management Sys 277
*		Micro Mint 392
160		Micro Pro International 251
47		Micro Works, The 70
287		MicroCompEquip 380
153		Microcomputer Store 340
33		MicroDaSys 51
114		Micromall 168
214		MICROMATE 317
78		MICRO-SCI 113
*		Microsetta 357
86		Microsoft (Cons Prod Div) 127
254		MicroTech Exports 339
223		Microware 322
165		Mikos 259
83		Miller Microcomputer Serv 120
255		Mini Computer Suppliers 339
306		Mini Computer Suppliers 386
358		Mini Micro Mart 410
358		Mini Micro Mart 411
359		Mini Micro Mart 412
359		Mini Micro Mart 413
50		Morrow Designs 73
16		Mountain Computer Inc 19
217		Mountain View Press 319
161		mpl 253
*		MT Micro SYSTEMS 83
171		MTI Inc 271
196		MTI Inc 300
192		Multi Business Comp Sys 296
158		MUSYS 248
203		Nautilus Systems 308
182		NCC '81 285
216		NCE Supply Corp 319
231		NEBS 326
12		NEC America Inc 15
165		NECO 259
90		National Computer Show 133
240		National Multiplex 333
195		Nestar Systems Inc 299
*		Netronics 207, 254, 258, 260
*		Northern Tech Books 183
220		Ohio Data Products Corp 321
332		Ohio Scientific Instr C IV
368		Oliver Advanced Eng 392
68		Olympic Sales Co 100
9		Omega Micro Computers 12
61		Omega Sales Co 156, 157
62		Omikron 92
194		Omnibyte 298
*		onComputing 96, 209
250		Optimal Technology 337
127		Orange Micro 187
95		Osborne/McGraw-Hill 139
187		OSM 263
330		OSM 390
*		Oswens Associates 18, 178, 179
187		Pacific Exchanges 289
347		Pacific Exchanges 382
327		Pacific Exchanges 390
263		Pacific Exchanges 342
288		Page Digital 381
184		Palomar Computers 287
277		Pan American Elec 374
*		Pan American Airlines 267
91		Passport Designs 134
3		PCD Systems Inc 6
4		Percom Data 7
28		Percom Data 7
363		Percom Data 35
364		Percom Data 91
365		Percom Data 91
366		Percom Data 91
367		Percom Data 91
368		Percom Data 91
193		Personal Microcomputers 297
24		Phase One Software 31
191		Phase One Systems 295
239		Pickles & Trout 332
79		Pilcon 115
117		Power One Inc 171
290		Priority One 393
356		Priority One 406, 407
357		Priority One 408, 409
340		Professional Comp Store 392
116		Prometheus 170
329		P & S Electronics 390
185		Purchasing Agent, The 288
355		QT Comp Systems 404, 405
343		Quality Computer Parts 382
215		Quality Software 318
142		Quasar Data Products 215
148		Qantex 225
96		Quay 191
282		Quest 377
251		R & B Computer Systems 338
208		RKS Enterprises 314
81		Racet Computes 118
41		Radio Shack 61
*		Random House 338
43		RCA Solid State 64
128		RCA Solid State 189
122		RNB Enterprises 180
7		Rochester Data 10
238		Roland's Song Sftwr 331
234		S & M Systems 327
*		S-100 Inc 341
55		Howard W Sams Co 80
247		SC Digital 337
129		Scientific Engineering 190
2		SciCon Corp 5
60		SciTronics Inc 90
246		SciTronics Inc 336
315		Scotia Software 388
*		Scottsdale Systems 62
115		SD Systems 169
304		SKP Electric 386
344		Sluder 382
11		Small Business Applications 14
136		Softech Microsystems 203
211		Softech Microsystems 316
328		Soft Tools 390
131		Software-To-Go 194
110		SoHo Group, The 162
130		Solid State Sales 172
302		Solid State Surplus 386
179		Source EDP 281
138		Sorrento Valley Assoc 206
209		Sorrento Valley Assoc 315
120		Southern Semiconductors 175
360		Southwest Tech Prod Corp CII
166		Spectrum Software 261
8		SSM 11
176		Stereo House 278
180		SubLOGIC 282
280		Sunny Int'l 376
*		SuperSoft 155, 216, 217, 224, 320
37		Super Star Int'l Corp 56
97		Sybox 143
*		Syncho Sound 69
224		Synergetic Solutions 323
170		SZ Systems 269
334		SZ Software 392
155		Tab Books 242, 243
197		Tarbell Electronics 301
149		Tarco 226
71		Tech Sys Consultants (TSC) 105
177		TecMar Inc 279
44		Televideo 65
267		Terco Medlo 343
253		Texas Comp Sys 339
36		3G Company 196
76		3M Company 111

THE DYNABYTE DIFFERENCE.

No one has a broader line of micro-based business computers than Dynabyte. Memory to 400KB. Mini-floppies, eight inch floppies, Winchesters and cartridge module hard disks; capacity from 630KB to 96MB. Satisfy all your clients' needs with Dynabyte. Start small, expand the system as computing needs grow, with modular add-ons from Dynabyte. With complete software and hardware compatibility across the entire line.

But expandable memory and the broad range of storage capacities are only part of the DYNABYTE DIFFERENCE. How about multiple terminals? Foreground/background? With Dynabyte you can have up to eight partitions, driven from up to eight terminals. And each terminal can have its own spooler; or all can share a system spooler. How about up to sixteen printers, and they don't require any partition space either. The DYNABYTE DIFFERENCE.

Our operating systems are the standard CP/M™ for single user sites and Dynabyte-enhanced MP/M™ for multiple user sites. As a seller of business systems you already have a whole library of applications

software. So to help protect your software investment we offer COBOL and BASIC and FORTRAN and PASCAL and PL/1.

Or you can use BUSINESS MANAGER™, Dynabyte's fully integrated accounting system. Menu driven, well documented, easy to install; it fits the needs of most wholesalers and distributors as is.

With no direct sales outlets, we are totally committed to our resellers. We don't compete with them. We support them with full service others only promise. Another DYNABYTE DIFFERENCE.

If you're tired of only promises from your computer suppliers; if you're losing sales because of price or limited storage capacity, or lack of modular expansion capability, call Dynabyte. Ask about the DYNABYTE DIFFERENCE. Ask about our advertising and lead referral programs. Ask about our warranty program. You'll be surprised.

Call our toll-free hotline: (800) 227-8300. In California (415) 329-8021. Dynabyte, 115 Independence Drive, Menlo Park, California 94025. Call or write today for the DYNABYTE DIFFERENCE.

DYNABYTE
Business Computers

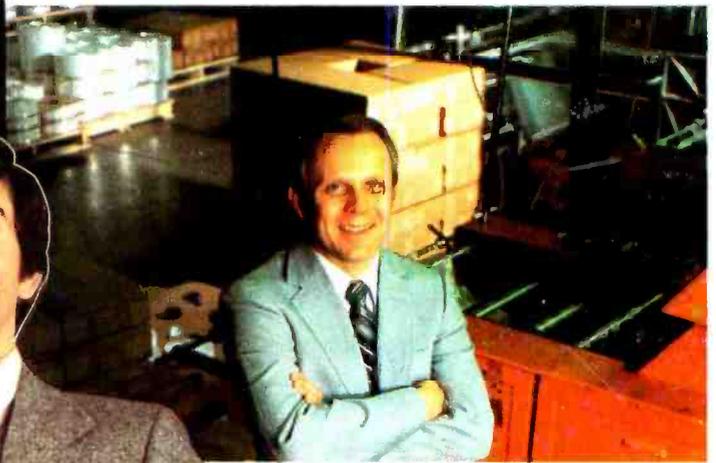
"It's beautiful what your bucks will buy from Ohio Scientific."



Ohio Scientific was first to add Winchester hard disk drives to microcomputers. This advanced technology allows low cost microcomputers to store over 100 times as much information on line as they could before.

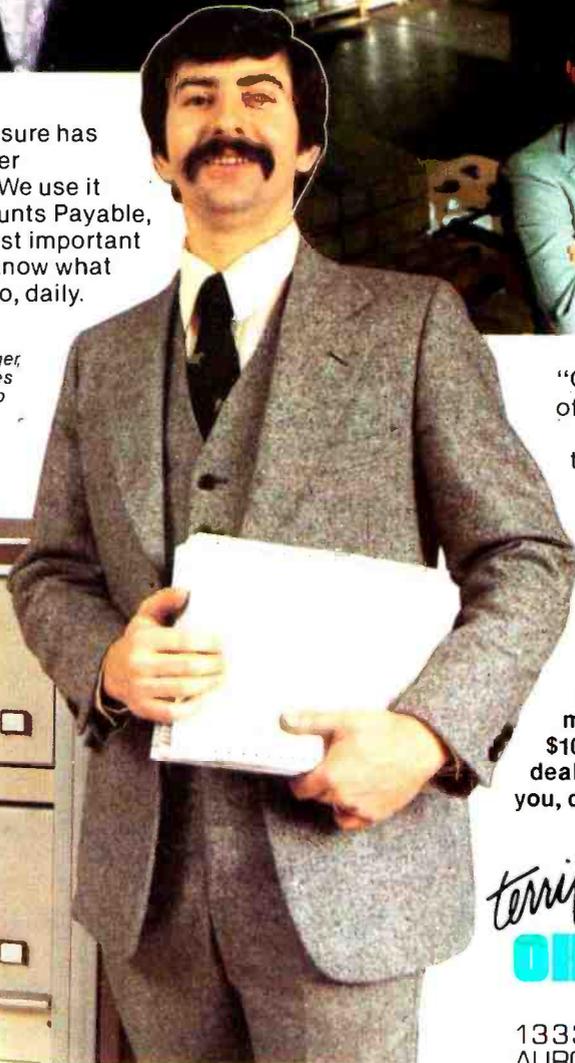
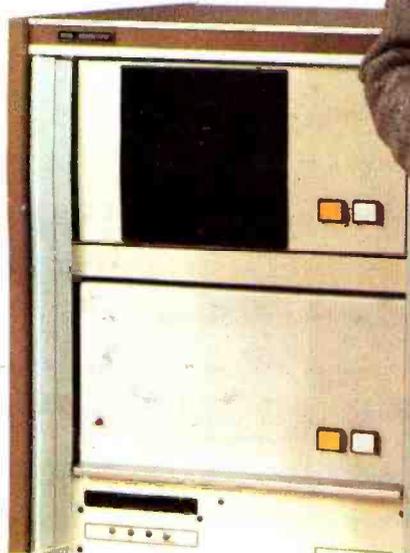
"Our Challenger C3-B has been running almost 24 hours a day for the last 18 months keeping track of countless details of our business. The Challenger's real time clock allows repetitive jobs to be scheduled months in advance, and runs them without operator intervention when the time comes. For example, every morning at 3 AM our Challenger knows it is time to update all the day's accounting records including the P&L, General Ledger, and Payables. It knows when it is time to file a tax return, and it makes out the quarterly reports. When it is through with all of this, it writes the checks. Periodically it does a comprehensive advertising analysis and updates any other files that are necessary."

*Holly Quarles, President, Commonwealth Capital Corp.
Charlottesville, Virginia*



"Running our retail stores sure has been easier since our Challenger computer came to work for us. We use it for Accounts Receivable, Accounts Payable, Payroll, General Ledger. It's most important in Inventory Control. We must know what we have and haven't. Now we do, daily. Terrific! Ohio Scientific!"

*Henry Felkey, Division Manager
Schwartz-Klines
New Philadelphia, Ohio*



"Our Challenger gives us more control of scrap from our blown film extrusion operation. By putting shift reports through the computer, we spot waste immediately. Whether the problem is the extruder or the operator it's corrected fast. Wasted material is wasted money!"

*Wayne Johnson, Controller, Wyard
Industries, Cambridge, Minnesota*

Ohio Scientific hard disk based microcomputers start at less than \$10,000. And are sold by more than 400 dealers nationwide. For the one nearest you, call 1-800-321-6850, TOLL FREE.

terrific!

Circle 362 on inquiry card.

OHIO SCIENTIFIC

a **MACOM** Company

1333 SOUTH CHILLICOTHE ROAD
AURORA, OH 44202 • [216] 831-5600